



BRNO UNIVERSITY OF TECHNOLOGY

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

FACULTY OF BUSINESS AND MANAGEMENT

FAKULTA PODNIKATELSKÁ

INSTITUTE OF MANAGEMENT

ÚSTAV MANAGEMENTU

APPLICATION OF MULTI-CRITERIA DECISION MAKING METHODS IN A SELECTED COMPANY

APLIKACE METOD VÍCEKRITERIÁLNÍHO ROZHODOVÁNÍ VE VYBRANÉ FIRMĚ

MASTER'S THESIS

DIPLOMOVÁ PRÁCE

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BRNO 2024

Assignment Master's Thesis

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Academic year: 2023/24
Study programme: International Business and Management

Garantka studijního programu Vám v souladu se zákonem č. 111/1998 Sb., o vysokých školách ve znění pozdějších předpisů a se Studijním a zkušebním řádem VUT v Brně zadává Master's Thesis s názvem:

Application of Multi–Criteria Decision Making Methods in a Selected Company

Characteristics of thesis dilemmas:

Introduction
Aims of the thesis and methodology
Theoretical background
Analysis of current state
Solution proposals and benefits
Conclusion
References
Attachments

Objectives which should be achieve:

The main objective of the thesis is to solve a selected decision making problem using appropriate methods of multi–criteria decision making.

Basic sources of information:

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Deadline for submission Master's Thesis is given by the Schedule of the Academic year 2023/24

In Brno dated 4.2.2024

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Abstract

This thesis applies selected Multi-Criteria Decision-Making methods to select the optimal country for business expansion of a Slovak company situated in the tissue and hygiene market. Through a focused comparative analysis, it ranks selected countries based on critical criteria such as market size, regulatory environment, logistics capabilities, and labor costs. The findings provide strategic recommendations to guide the company in making an informed, data-driven decision for its international expansion.

Keywords

multi-criteria decision-making (MCDM), weighted sum model (WSM), analytical hierarchy process (AHP), technique for order of preference by similarity to ideal solution (TOPSIS), business expansion, strategic decision-making, comparative analysis

Abstrakt

Tato diplomová práce aplikuje vybrané metody multikriteriálního rozhodování k výběru optimální země pro expanzi slovenské společnosti situované na trhu hygienických a papírenských výrobků. Prostřednictvím zaměřené komparativní analýzy se hodnotí vybrané země na základě kritických kritérií, jako jsou velikost trhu, regulační prostředí, logistické schopnosti a náklady na práci. Výsledky poskytují strategická doporučení, která mají společnosti pomoci učinit informované a na datech založené rozhodnutí o mezinárodní expanzi.

Klíčová slova

multikriteriální rozhodování (MCDM), vážený součtový model (WSM), analytický hierarchický proces (AHP), technika pro uspořádání preferencí podle podobnosti s ideálním řešením (TOPSIS), expanze podnikání, strategické rozhodování, komparativní analýza

Bibliographic citation

BABELA, Viliam Igor. *Application of Multi-Criteria Decision Making Methods in a Selected Company* [online]. Brno, 2024 [cit. 2024-05-17]. Available at: <https://www.vutbr.cz/studenti/zav-prace/detail/159425>. Master's Thesis. Brno University of Technology, Fakulta podnikatelská, Ústav managementu. Supervisor doc. Ing. Radek Doskočil, Ph.D., MSc.

Affidavit

I declare that the present master project is an original work that I have written myself. I declare that the citations of the sources used are complete, that I have not infringed upon any copyright (pursuant to Act. no 121/2000 Coll.).

Brno dated 20th May 2024

Bc. Viliam Igor Babela

author's signature

Acknowledgments

I would like to express immense gratitude to the supervisor of my thesis, Associate Professor Ing. Radek Doskočil, Ph.D., MSc, for his excellent guidance, willingness to help, valuable advice and insights which he provided during the writing of my diploma thesis. And mainly for the extraordinary patience he expressed when working with me on this thesis.

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Introduction

In order to expand its business, Scandi s.r.o., a firm in the Slovak Hygiene & Tissue Paper industry, is looking into prospective new markets, the focus of this diploma thesis is to guide Scandi s.r.o. in its global expansion through the utilisation of multi-criteria decision-making (MCDM) methods. My prior involvement with the firm and my understanding of its operations enables me to deliver practical insights from this research.

There are three primary components to the thesis. I'll begin by providing a general overview of decision-making processes and outlining basic terms related to global expansion in the theoretical foundation section of the thesis. A review of several multi-criteria decision-making methods will be covered as well as overview of selected software which will be used to tackle the decision making problem.

A short summary of Scandi s.r.o and its business as well as identification and overview of chosen variables and criteria which will be used to evaluate them will be provided in the following analysis of current state section. The results of the criteria and variable analysis will be utilized by incorporating them into the MCDM methods in the final solution proposal phase. The analysis will start with simpler methods like Weighted Sum Method (WSM) and proceed with more sophisticated approaches such as the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and the Analytic Hierarchy Process (AHP). This stage will conclude with a comparative evaluation of the outcomes from each method, leading to a knowledgeable suggestion on the market that would be best for Scandi s.r.o. to expand into.

Aims of the Thesis and Methodology

The primary aim of this thesis is to enhance the decision-making process for a Slovak company in the Hygiene & Tissue Paper industry, by employing multi-criteria decision-making (MCDM) methodologies. The goal is to systematically and objectively evaluate set of variables/countries and select the best option for international expansion. Partial aims include: Analyzing theoretical foundations and key terms for evaluating country feasibility and understanding MCDM techniques. Defining and ranking critical decision-making criteria, such as market size, regulatory environment, logistics capabilities, and labor costs. Identifying potential countries and applying MCDM methodologies to evaluate them. Synthesizing findings and formulating strategic recommendations to identify the most suitable market for expansion.

Methodology

This thesis employs a comprehensive approach combining standard research methods with advanced MCDM techniques. Key steps include:

Theoretical Analysis:

Review theoretical foundations of MCDM techniques and outline key terms related to evaluating countries for expansion and the tissue & hygiene goods markets.

Criteria and Weight Establishment:

Define and rank critical decision-making criteria using Saaty's matrix to assign weights.

Variable Evaluation:

Identify potential countries and apply AHP, WSM, and TOPSIS methodologies to evaluate them against the criteria.

Synthesis and Recommendations:

Synthesize findings from AHP, WSM, and TOPSIS to provide a clear analysis.

Formulate strategic recommendations for the most suitable country for the company's international expansion based on the aggregated assessments.

1 Theoretical Background

This part of the thesis focuses on introducing the theory of concepts that fall under the topic of **business decision making** as well as explaining basic terms regarding **international expansion** of businesses and economical metrics used to evaluate viability of a country for expansion purposes. In this section we will also describe the **analytical software** we have chosen to conduct the **MCDM methods**. The concepts mentioned in the theoretical foundation section should be perceived as a bedrock for the analysis and therefore also the actual solution proposals.

1.1 Business Decision Making

Evaluating choices and selecting the best course of action necessary to accomplish organisational goals is an important step in business decision-making. Businesses need to go through this process in order to succeed and flourish, and it calls for a combination of analytical evaluation and often also intuitive judgement. In order to make decisions that are both effective and impactful on the organisation and its stakeholders, a methodical approach to issue identification, information collection, alternative assessment, and solution implementation shall be taken. (1)

1.2 Problem Solving and Decision Making Processes

Problem solving is essentially an act of **recognising a discrepancy between the current and intended situation**, whether in personal or in business context, and then taking steps to **address and rectify this discrepancy**. The problem-solving method consists of **seven phases**, which are undertaken for problems that are deemed significant enough to warrant thorough investigation. (2, p. 3)

1. Determine and articulate the decision making problem.
2. Identify the range of possible solutions/variables.
3. Establish the criteria which will be used to assess the different solutions/variables.
4. Assess the different solutions/variables.
5. Select an solution/variable.
6. Carry out the chosen solution/variable.

7. Assess the outcomes to see whether a suitable resolution has been achieved.(2, p. 3)

Generally, the **first five phases** of problem solving are attributed to **decision making**. The decision making process begins by **identifying and defining** the issue at hand and concludes with the act of **selecting an alternative/variable** . (2, p. 4) The depiction of both processes can be seen in the chart below.

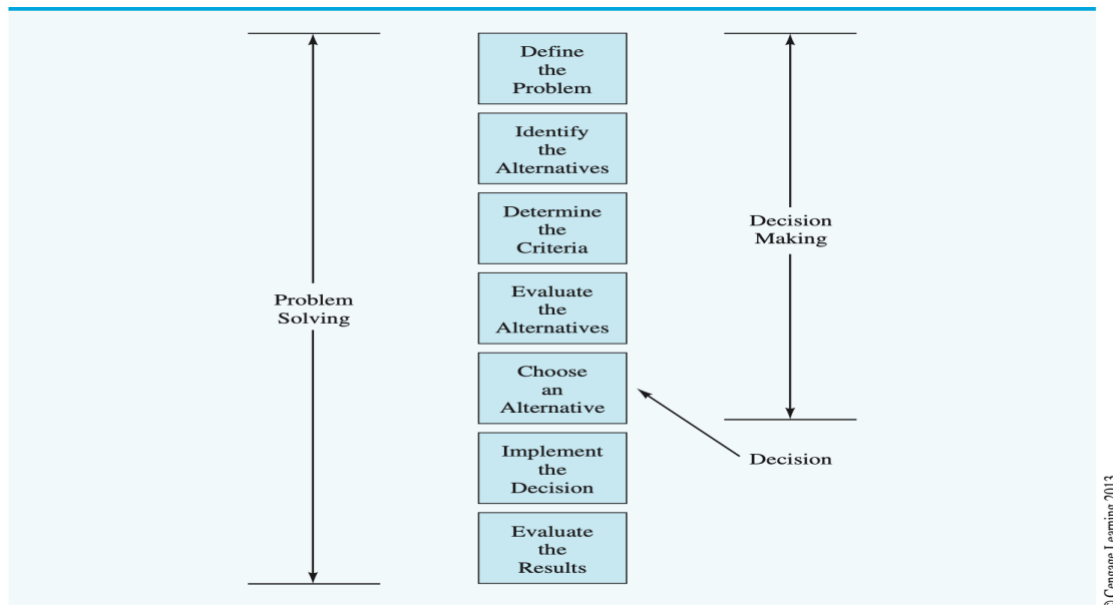


Chart 1 Steps of Problem Solving/Decision Making (Source: 2, p. 5)

A more detailed description of the decision-making process, which is often referred to as analytical model of decision-making according to Fotr and colleagues (3, p. 19-20), further delves into following sub-processes (phases):

1. **Identification of decision problems.** This sub-process involves the collection, analysis and evaluation of information about the organisation and its environment, resulting in the identification of situations that require resolution.
2. **Analysis and formulation of decision problems.** This sub-process involves determining the basic principles of the problem, determining the causes of its occurrence and the objectives of solving the problem. The result is then a unified and comprehensible formulation of the decision problem.
3. **Determining the criteria** against which the variables for solving the decision problem will be assessed and evaluated.
4. **Formation of variables** for solving the decision problem, which involves finding and formulating the actions leading to the solution.

5. **Determination of rankings** of the individual variables (actions) in terms of the selected criteria.
6. **Evaluating the ranking** of the **variables** and selecting the **variable** to be implemented (optimal) or the preferred arrangement of variables.
7. **Implementation** of the selected option/variable, representing its practical implementation.
8. **Evaluate** the results of the implemented variant. This step focuses on determining deviations with respect to the set objectives, preparation and implementation of corrective measures, correction of objectives if they were not set realistically.

In this case the first 6 steps represent the decision making process.(3, p. 19-20)

1.2.1 Elements of the Decision Making Processes

The fundamental components that form the basis of the decision-making process are integral to understanding its framework and functionality. These components include: the **objective** of the decision, which sets the goal or purpose, the **evaluation criteria**, that guide how different options are assessed, the **subject** of the decision, referring to the individual or group making the decision, the **decision** object, which identifies what is being decided upon, and the decision **variables** along with their **consequences** and associated **states of the world**, such as scenarios and risk situations.(4, p. 14)

1.2.1.1 Objective of the decision

The **objective** of decision-making is to solve a problem and obtain the desired outcome. There are frequently many objectives, which might be **mutually supportive** and complementing (complementary objectives) or **cannot be attained concurrently** (conflicting objectives). Objectives can be expressed quantitatively or qualitatively. The time frame for setting objectives determines whether they are long-term, medium-term, or short-term. (4, p. 15)

1.2.1.2 Evaluation criteria

The evaluation criteria are used to **assess the overall merits** of each decision variable. They are mostly drawn from the objective and may be **quantitative or qualitative**. **Quantitative** criteria are expressed **numerically**. **Qualitative** criteria are presented

verbally. There are two **types of quantitative criteria**: **yield** (more is better, maximalization) and **cost** (less is better, minimalization). (4, p. 15)

1.2.1.3 Subject of the decision

Depending on the number of actors involved, decision-making events can include one or numerous decision makers – **subjects of the decision**. Decision-makers can be **rational or indifferent**. The rational participant, often known as the decision maker, actively impacts the decision-making process to maximise benefits and minimise costs. (4, p. 16)

1.2.1.4 Object of the decision ,its variables and their consequences

The decision object indicates what the decision maker is **deciding on**, such as a production programme, new technology, or a region for expansion. The decision's object, is therefore an **actual or potential decision problem**. (4, p. 16)

1.2.1.5 Variables of the decision and their consequences

Variables can be a **range of options** which can be **compared and evaluated against each other** or, in a limited context, are considered for selection in a specific decision-making process. (5, p. 10) For example, when making a purchase or any other kind of strategic decision, a person in a position of a decision maker within a company needs to make a **choice between multiple options**. The consequences of these choices represent **the impacts of the decision options** on the **organizational unit** where the decision-making occurs and its external environment, including competitors, suppliers, customers, etc. (4, p. 16)

1.2.1.6 States of the world

States of the world represent various **scenarios or risk situations** that can occur **after the implementation** of a chosen variant, suggesting **possible future conditions**. These states are mutually exclusive possible situations that may arise as a **result of the decision-making process**. These states are beyond the control of the decision-maker, thereby introducing risk or uncertainty. (4, p. 16)

1.2.2 Quality of the Decision Making Process

The quality of decision-making has an **significant impact** on **effectiveness** and often **determines** the **future outlook** of organizations, particularly the quality of decisions made at the top management level. Poor **decision-making** can , and **often leads** , to poor business outcomes or even **total failure**. The importance of decision-making is not solely based on the resources involved, but also the risk and uncertainty factors. (4, p. 21)

Several factors influence the quality of the decision-making process, such as :

- **Stated Objectives and Criteria Formulation:**
 - Transformation of the decision problem's objectives into evaluation criteria.
 - Formulation of these criteria for evaluating and selecting options.
 - Degree of alignment between the selected options and the objectives of the organizational unit where the decision-making occurs.
- **Information Utilization:**
 - Quantity and quality of available information and its utilization in solving the decision problem.
- **Application of Decision Making Theory :**
 - Extent of usage of decision theory methods and knowledge, especially model-based and graphical tools, in addressing the decision problem.
- **Quality of the Problem-Solving Process:**
 - Rationality of the approach in solving the decision problem.
 - Comprehensive implementation of all sub-processes within the decision-making process.
- **Quantity and Conceptual Distinction of Decision-Making Variables:**
 - Distinctiveness and conceptual clarity of the processed decision-making variants.
 - Accuracy and reliability of information regarding the outcomes of these variants.

- **Overall Quality of the Decision-Making Process:**
 - Assessment of the effectiveness and efficiency of the decision-making process as a whole. (4, p. 21-22)

1.3 Multi-Criteria Decision Making Methods

Multi-criteria decision making deals with the choice of **one or more variants** from a set of **permissible variants** and recommending them for implementation. A decision-maker should proceed with **maximum objectivity** when selecting a variable, utilizing suitable procedures and methods for analyzing options.

In the models of multicriteria analysis a **finite** (discrete) set of **m variants** is given, which are evaluated based on **n criteria**. The goal is to either choose a variable which is perceived the most suitable based on ranking across selected criteria, a compromise solution, or alternatively, to rank the variants from best to worst or eliminate inefficient variants.

Decision variables should be carefully examined and selected in order to be feasible, logical, and able to provide a suitable solution to the decision-making problem. These variants are then evaluated based on individual criteria. (6, p. 150)

The primary **advantages of multi-criteria decision making** methods are:

- **Ability to Evaluate Using a Broad Set of Criteria:** These methods allow for the assessment of variants relative to a comprehensive array of criteria.
- **Necessity for Explicit, Formalized Expression:** Unlike merely intuitive approaches, these methods require a formalized articulation of the significance (weight) of each criterion by the respective decision-making entities.
- **Transparency and Reproducibility:** The entire subprocess of evaluating variants is transparent and reproducible, even for parties not directly responsible for the decision-making process but whose interests are significantly affected by the choice of variant. (4, p. 82)

Most multi-criteria evaluation methods initially require the decision maker to establish the weight of each evaluation criterion. The **weights** of the criteria **are numerical representations** of their **importance** or relevance to **the goals being pursued**. The more significant a criterion is considered by the decision-making entity, the higher is its weight. Conversely, less significant criteria are assigned lower weights. (4, p. 82)

1.4 Methods for Setting the Weights of the Criteria

When conducting an analysis of variables based on multiple criteria it is necessary to determine whether the criteria are considered **indifferent or differentiated**. If they hold **different levels of significance**, it is implied that within the set of criteria, **some are preferred over others**. For instance, the quality and price of a provided course are likely more significant to potential participants than its location. (4, p. 82) This variance in significance arises from analysing a set of **heterogeneous** criteria. For example, the criteria of quality, price, and location are **disparate and expressed in different units of measurement**. (4, p. 82)

The significance of a criterion is determined using its weight according to the preferences of the decision-maker. **The sum of all criteria weights should always equal 1.**(4, p. 82)

The weight assigned to a criterion reflects its importance and complexity relative to the other evaluated criteria. It is expressed numerically so that a criterion of higher importance receives a higher weight.(7, p. 262)

When classifying decision making methods, it is possible to differentiate them based on the kind or amount of information regarding the preferences between criteria and variants which is available:

- **No Information:** In some cases, there may be **absolutely no information available** about **preferences**. This situation **only allows for establishing preference of the criteria**. In case of complete absence of information regarding the preference of both the variables and criteria , it wouldn't be possible to solve the decision making proble. (6, p. 155)
- **Nominal Information:** This category **pertains to information** that is valid **solely through criteria**. It assists in **pinpointing desired or target levels** and **classifies variants** into **either acceptable or unacceptable, based solely on the criteria**. (6, p. 155)
- **Ordinal Information:** This type of information **provides a ranking system**. It **organizes criteria** based on their **importance or arranges variables** according to **how well they meet the criteria**. (6, p. 155)
- **Cardinal Information:** Containing both **quantitative and qualitative elements**, this information helps to determine **preference of one evaluation** compared to

another and in case of **criteria preference** , represents their **weights** which are usually **expressed numerically**. It becomes particularly **vital** when the chosen decision making method **requires cardinal information** and for **expressing verbally defined criteria assesment in a quantitative way**, a process that isn't strictly reliant on direct comparisons between variants. (6, p. 155)

1.4.1 Methods Establishing Weights from Cardinal Information on Preferences

Methods to determine the weights of criteria based on cardinal information about preferences **assume that the user can and is willing to specify not only the order of importance of the criteria but also the relative importance between all pairs of criteria**. The most commonly used methods in this area are the scoring method, which transforms the point evaluations of importance into a vector of weights, and the **Saaty's method** of quantitative **pairwise comparison**, which derives a weight vector from estimates of the relative importance provided by the user.(6, p .160) For the purposes of this thesis we will delve into Saaty's method.

1.4.1.1 Saaty's Method

Saaty's method is designed for **determining the weights of criteria** and is particularly effective when evaluations are performed by a single expert.

This method involves **quantitative pairwise comparisons of criteria**.(6 , p. 160) Evaluator uses an **integer scale with values of 1-9** in order **denote levels of preference between pairs of criteria**:

- **1**: Equal importance between criteria
- **3**: Moderate preference for one criterion over another
- **5**: Strong preference for one criterion over another
- **7**: Very strong preference for one criterion over another
- **9**: Absolute preference for one criterion over another

Additionally 2, 4, 6, and 8 can be used to **denote levels of preference** between pairs of criteria, which are **inbetween the main levels of preference**.

Each criterion pair is compared, and the magnitude of preference for one criterion relative to another is recorded in a Saaty matrix. (6, p. 160)

$$S = \begin{pmatrix} 1 & s_{12} & \dots & s_{1n} \\ 1/s_{12} & 1 & \dots & s_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ 1/s_{1n} & 1/s_{2n} & \dots & 1 \end{pmatrix}$$

Equation 1 Saaty's matrix (Source: 6, p. 160)

Saaty's matrix, a square matrix of order $n \times n$, is **used to express the reciprocal nature of criteria weights.**

Specifically: $s_{ij} = \frac{1}{s_{ji}}$, **reflecting the relative importance between the i -th and j -th** criteria. On the **diagonal scale** of Saaty's matrix, the **values are always one**, indicating that **each criterion is equally important to itself**. The elements of this matrix are **not always perfectly consistent**. Consistency is measured using the **Consistency Index (CI)**, defined by Saaty as: $I_s = \frac{l_{\max} - n}{n - 1}$ where **l_{\max} is the largest eigenvalue of the matrix**, and n is the number of criteria. A Saaty matrix is **considered sufficiently consistent if $I_s < 0,1$** . In cases where the Saaty matrix is inconsistent, which can be common in complex tasks, **the inconsistency can result from errors in ratio estimation** which happens when **decision maker does not verify his judgments properly**. Therefore, it is essential to reassess the estimates to ensure the matrix meets the required consistency. (6, p. 161)

The output of the Saaty's matrix should be an integer on a scale of 0-1 ($0 = 0\%$, $1 = 100\%$) for each criterion representing the weight of the criterion as a percentage out of 1 or 100% , i.e. $0,33 = 33\%$, the sum of all weights should be equal to 1 or 100%.

1.5 Methods for Ranking of the Variables

In this section we will delve into the MCDM methods which were utilized in solving the decision making problem of this thesis. The first 2 methods – WSM and AHP fall under the umbrella of methods which require cardinal information. The third method – TOPSIS

1.5.1 Weighted Sum Method

The weighted sum method requires cardinal information and a weight vector for criteria in the matrix Y . This method constructs a total score for each variant, allowing for the identification of the most advantageous variable or for ranking variables from the most preferable to the least.

This method is a specialized case of the utility function method and is based on the principle of maximizing utility. When a variant a satisfies criterion j to a degree y_{ij} , it provides the user utility which can be expressed through a linear function of utility.

(6, p .171)

The total utility of a variant is expressed as the weighted sum of the utility values of different criteria:

$$u(a_i) = \sum_{j=1}^m v_j \cdot u_j(y_{ij})$$

Equation 2 Calculation of total utility of a variable according to WSM Method (Source: Own processing based on source 6, p. 171)

where u_j are individual utility functions for each criterion j , and v_j are the weights of the criteria.

Algorithm for the Weighted Sum Method:

We should firstly determine the ideal variant H with ratings h_1, \dots, h_n and the baseline variant D with ratings d_1, \dots, d_n . (6)

Further we create a standardized criteria matrix R , where its elements are obtained using the formula:

$$r_{ij} = \frac{y_{ij} - d_j}{h_j - d_j}$$

Equation 3 Formula for calculation of standardized criteria matrix R in WSM Method Source: Own processing based on source 6, p. 171)

Matrix R now represents the utility function scores of the i -th variant for criterion j because its elements are transformed criteria values scaled between 0 and 1. The baseline variant corresponds to a score of zero, and the ideal variant to one.

For individual variants, we calculate the aggregated utility function:

$$u(a_i) = \sum_{j=1}^n v_j \cdot r_{ij}$$

Equation 4 Formula for calculating the aggregated utility function for individual variables in WSM Method (Source: Own processing based on source 6, p. 171)

We sort the variants according to the values of $u(a_i)$ and the necessary number of variants with the highest utility values are considered for solving the problem. This method effectively normalizes the varying scales of criteria to a common scale where evaluations are directly comparable and can be aggregated to derive a comprehensive utility measure. (6, p. 172)

1.5.2 Analytical Hierarchy Process

The AHP method, designed by Professor Saaty in 1980, simplifies and accelerates decision-making by **structuring unstructured decisions into hierarchical components**. It breaks down problems into a hierarchy of interrelated elements, from goals and criteria to the options available. (6, p. 173)

Steps and Elements of AHP method are

Hierarchy Construction: The problem is broken down into a hierarchy of interconnected levels:

- **Goal:** The objective of the analysis.
- **Criteria:** Factors considered in evaluating the options.
- **Sub-criteria:** Additional layers of criteria, if necessary.
- **Variables:** The options being evaluated.

Pairwise Comparisons: Each variable at a particular level is compared pairwise for its importance or preference relative to other elements at the same level, typically using Saaty's scale (1-9, where 1 indicates equal importance and 9 indicates extreme importance of one over another). The pairwise comparison matrix which we can see in the table below can be used both to assess the preference of the criteria and the preference of variables in terms of their performance against each other within the criteria.

Table 1 AHP Comparison Matrix (Source: 8, p. 18)

	Visibility	Competition	Frequency	Rental costs
Visibility	1	1/4	1/5	2
Competition	4	1	1/2	1
Frequency	5	2	1	4
Rental costs	1/2	1	1/4	1

Similar to what we already stated when discussing the Saaty's matrix method which is basically just an element of AHP. When a criterion/variable is **being compared with itself**, the comparisons on the major diagonal **always amount to one**. As we can see in the table above, visibility is one-fourth as essential as competition, and competition is four times as important as visibility. This suggests that the matrix is reciprocal due to the fact that the top triangle is the opposite of the lower triangle. (8, p. 17)

Hierarchical Structures:

- **Simple Hierarchies:** Consist of a single goal, multiple criteria, and alternatives.

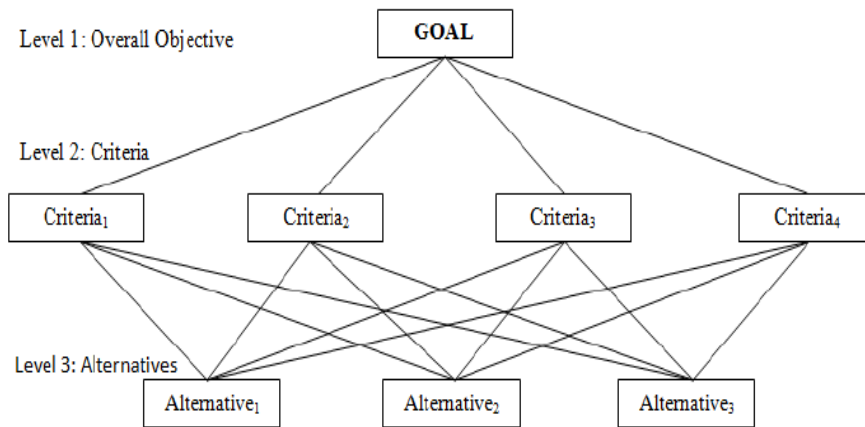


Chart 2 AHP Simple Hierarchy (Source: 11, p. 22)

- **Complex Hierarchies:** Involve multiple levels of criteria and sub-criteria, reflecting more detailed aspects of the decision problem.

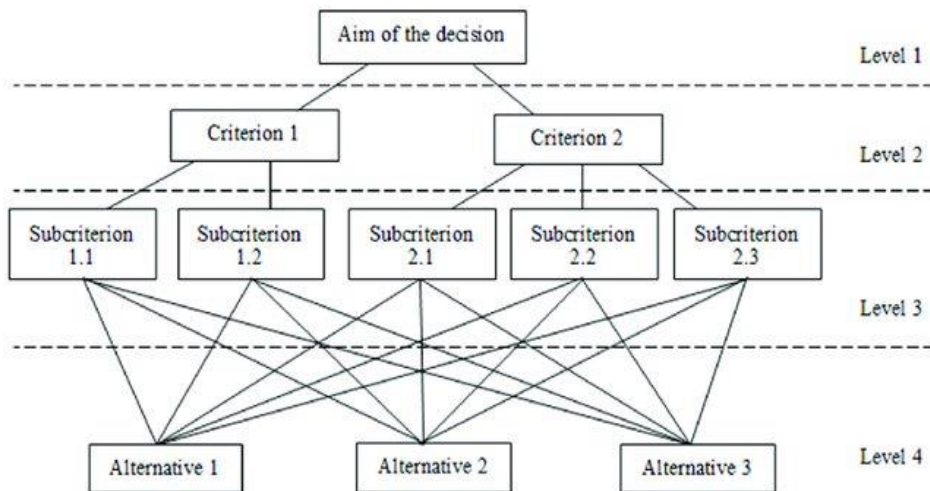


Chart 3 AHP Complex Hierachy (Source: 27, p. 10)

Preference Synthesis: Local preferences are integrated to establish global priorities across the hierarchy, leading to a ranking of the alternatives based on the criteria.

Consistency check: Again same as we discussed when elaborating on Saaty's matrix, one may run a consistency check on the finished matrix to **look for any inconsistencies in the entries**. Numerous pairwise comparisons made one after the other **could contradict one another**. These inconsistencies could be caused, for instance, by poorly defined issues, restricted rationality, a lack of sufficient information or having uncertain information and also inattention. (8, p.18) Assume for instance that the decision maker makes the pairwise comparisons listed below:

- The mall is visited by two times more visitors than the city centre.
- Three times more visitors visit the city centre than the industrial zone.
- Four times more visitors visit the industrial zone than the mall.

The **third statement contradicts the first two**. First two comparisons show that the **industrial zone** should be visited by **6 times less people than the retail mall**.

The third comparison however states that the industrial area is being visited by four times more visitors than the mall, which doesn't add up. (8, p.19)

Same as the Saaty's matrix, The Analytic Hierarchy Process (AHP) **allows some variance in decision-making**. Specifically, a **10% difference is permitted**. This tolerance is calculated by comparing 500 randomly filled matrices' average inconsistency. Again, **if a matrix surpasses this inconsistency threshold**, decision-making process should be **reconsidered**. (8, p.19)

The chart below represents the steps of the AHP process.

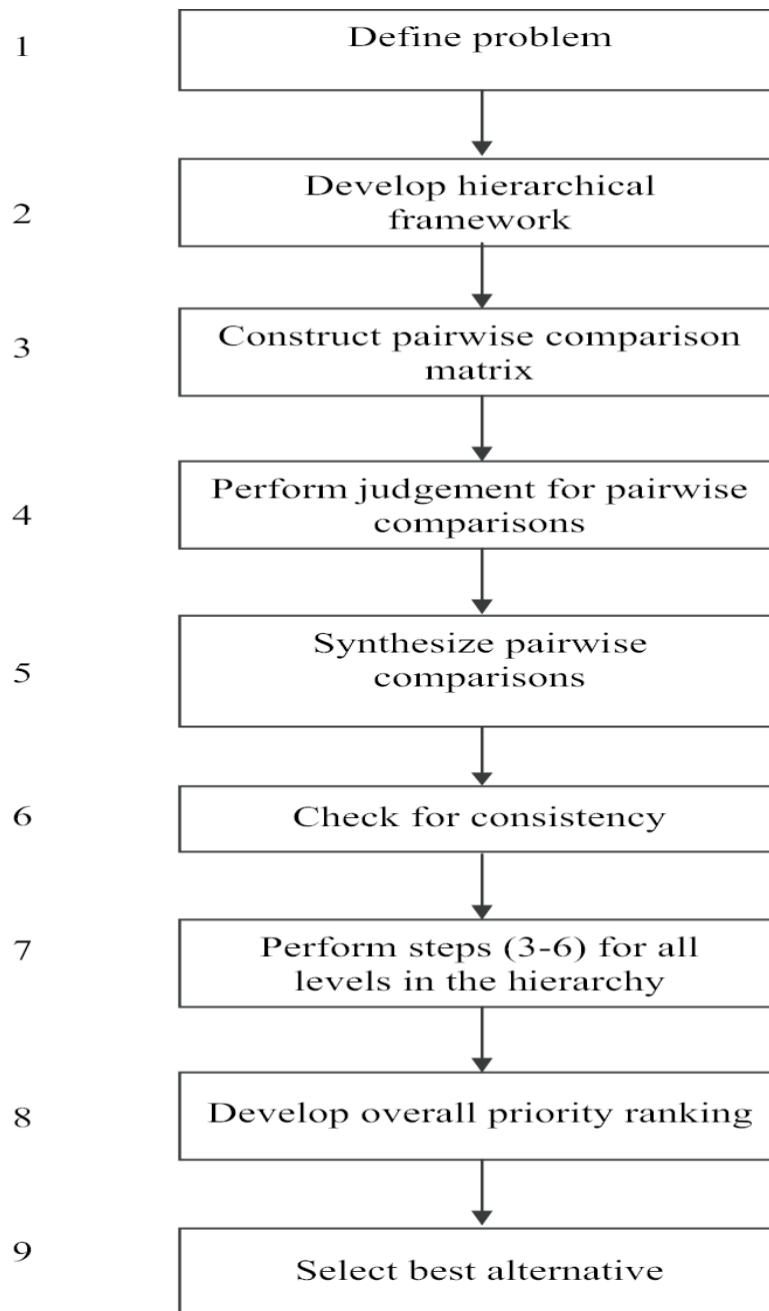


Chart 4 Steps of AHP Process (Source : 10)

AHP is used for **diverse decision-making scenarios**, including business strategy, resource allocation, and more, due to its **flexibility** and **ability to incorporate both quantitative and qualitative data**. The essence of AHP lies in its **structured approach to decomposing decision problems into a systematic hierarchy**, facilitating clear, organized decision-making processes.

1.5.3 TOPSIS

The acronym TOPSIS, stands for ‘Technique of Order Preference Similarity to the Ideal Solution’ . The TOPSIS approach has **an easily understandable output and very few inputs from the user**. The **weights** connected to the criterion are the **sole subjective properties**. **Five computational phases** form the foundation of the TOPSIS approach. **Getting together the performances of the variables** according to the various criteria is the first **stage**. In the **second stage**, these performances have to be **normalised**. We **normalize** the variables performance in connection to the criteria as it **allows for comparisons across different units** (e.g., population, GDP etc.). One of the approaches used for normalization is the **ideal normalization** which goes as: If the criterion needs to be **maximised**, we need to **divide each variable performance by the highest value in each column**. Similarly, each variable performance is divided by the **lowest value in each column** if the criterion needs to be **minimised**. After that, the **normalised scores** are **weighted** by **multiplying the normalised scores by the respective weights of the criteria** which are then **used to compare each variable to positive ideal and negative ideal** values. **Establishing** the positive ideal and negative ideal values can be done by using the **highest performance value** on each criterion for the **positive ideal** option. And similarly by using the **lowest performance value** on each criterion for **negative ideal** option. To **measure the overall performance of the variables**, we need to first calculate the **distance of each variable to both the positive ideal and negative ideal values**. This calculation is usually done using the **Euclidean distance**. The Euclidean distance involves **summing the squared differences between the scores of each variable and the positive ideal value, and taking the square root of this sum**. The **same process** is repeated for the **negative ideal value**. The **relative proximity coefficient** for each variable is then calculated. This coefficient, **which runs from 0 to 1**, is computed by **dividing the distance to the negative ideal by the total of the distances to the positive ideal and negative ideal**. A **proximity coefficient nearer to one suggests that the action/variable is preferred** since it is closer to the positive ideal. In contrast, a coefficient closer to zero suggests that the action is closer to the negative ideal and therefore less preferable. (8, p. 217-219).

The chart below offers a visualisation of TOPSIS method and shows a **two-dimensional decision space with two criteria, 1 and 2**. It compares **variables A and B** to the **positive ideal and negative ideal solutions**. The **positive ideal** solution **maximizes** both criteria in the **top right corner**, whereas the **negative ideal solution minimizes** both criteria in the **bottom left corner**. The variables A and B are shown in this space, **demonstrating their relative distances to the positive ideal and negative ideal** value and their performance on both criteria.

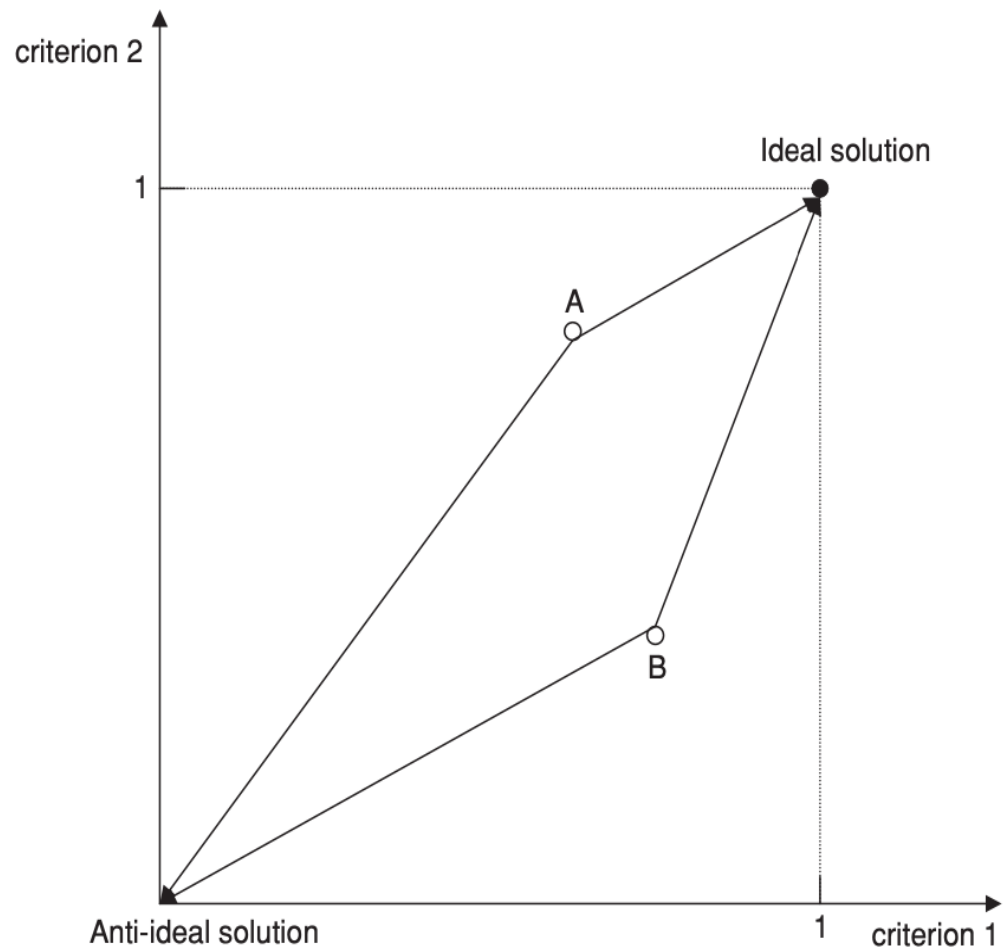


Chart 5 Visualization of TOPSIS Approach (Source: 8, p. 217)

The TOPSIS method is founded on the premise that the chosen alternative should have the shortest geometric distance from the ideal positive solution and the farthest from the negative ideal solution. It uses cardinal ratings for variables across different criteria and weights for these criteria.

This methodology effectively combines the assessments across multiple criteria into a single framework, guiding decision-makers toward the most beneficial outcomes by comparing each option's proximity to the ideal solution (positive ideal) while laso taking into account its proximity to the worst possible solution(negative ideal) .

1.6 Software Used for the Analyses

Multi Criteria Decision Making (MCDM) encompasses a broad spectrum of decision-making challenges encountered across various domains. The complexity of MCDM methods and their intricate calculations necessitate robust software tools to ensure both efficiency and accuracy in analyses. The website <https://mcdmaker-software.web.app/index.html> offers a comprehensive platform tailored for addressing these needs. It provides users with a suite of tools designed to facilitate the application of MCDM methodologies such as AHP/Saaty's matrix, the Weighted Sum Model (WSM), and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). These methods are pivotal in systematically evaluating alternatives against multiple criteria, enabling informed decision-making processes. Additionally, for the Analytic Hierarchy Process (AHP), another widely used MCDM technique, we utilized the online calculator available at <https://bpmsg.com/ahp-online-calculator/>. This calculator streamlines the AHP process, allowing for efficient pairwise comparisons and the derivation of priority scales essential for decision-making. Incorporating these software resources into our thesis not only ensures methodological rigor but also enhances the reliability and robustness of our analysis in tackling real-world decision-making challenges.

1.7 Outlining of Basic Terms Connected to the Decision Making Problem

In this section we will outline and explain the basic terms in connection to the decision making problem of international expansion.

1.7.1 International Business Expansion

Global expansion refers to a company starting operations in a foreign country to capitalize on favorable market conditions or opportunities to increase profits or reduce costs. Here are the key points summarizing global expansion:

- **Market Access:** Enables entry into foreign markets, potentially boosting sales and revenue.
- **Diversification:** Helps diversify revenue sources, reducing dependence on one market and mitigating risks from local economic downturns.
- **Talent Acquisition:** Offers access to a broader talent pool, which is beneficial for industries with specific workforce needs.
- **Economies of Scale:** Achieves cost advantages by increasing efficiency in production and distribution.
- **Innovation Promotion:** Facilitates the exchange of ideas, technology, and best practices, enhancing innovation and business operations.
- **Risk Diversification:** Spreads activities across countries to reduce risks from geopolitical, economic, or regulatory changes.
- **Brand Recognition:** Boosts global and local brand exposure and strengthens reputation.
- **Resource Access:** Provides access to new raw materials, suppliers, and distribution channels, strengthening the supply chain.
- **Learning and Adaptation:** Necessitates adjustment to diverse cultural, legislative, and economic environments, enhancing organizational flexibility.
- **Profit Potential:** Opens opportunities in emerging economies with growing middle classes.
- **Strategic Alliances:** Creates opportunities for partnerships with local businesses.

- **Tax Benefits:** Some countries offer tax incentives to foreign investors, potentially reducing overall tax burdens. (9)

1.7.2 Population of the Country

The population of a country has a direct influence on market size as it defines the quantity of potential consumers.

1.7.3 GDP Of the Country

Gross Domestic Product (GDP) is a **fundamental economic measure** that reflects the **size of a country's market** and its overall **economic well-being**. A strong GDP indicates **more customer buying power** and a more prosperous market, which are crucial factors for the success of any organisation. This economic indicator assists organisations in planning possible market expansion and devising appropriate strategies.

1.7.4 Ease of Business Operations Index

The **regulatory environment** of a country has a **considerable impact** on the **ease of business operations**. This includes the **complexity and efficiency** of processes such as **starting a business, acquiring relevant permissions, and dealing with government regulations**. The World Bank's **Doing Business Index** shows how nations rank globally in terms of **regulatory efficiency** and ease of doing business. These rankings are based on a **variety of criteria**, including the **procedural requirements**, time and costs necessary for starting and managing a firm. Countries with **higher rankings** often have streamlined procedures that **reduce bureaucracy** and **lower barriers to entrepreneurial activity**, resulting in **smoother corporate operations** and increased investment.(12)These rankings are an important tool for governments to evaluate and alter business regulations in order to create a more business-friendly climate that promotes economic growth.As well for businesses when considering a potential countries for expansion.

1.7.5 Tax Rates

Tax and especially corporate rates **affect a company's financial health** as a regulatory factor. They vary considerably by location and can affect where companies locate. **Competitive tax rates** can attract **cost-conscious enterprises**, while **high tax rates discourage investment and growth**. Tax rate and compliance complexity matter. Businesses prefer lower taxes and simplified tax regimes that reduce compliance costs and ambiguity.

1.7.6 Logistic Performance Index

The LPI is an **interactive benchmarking tool** created to help countries and businesses to identify the **challenges and opportunities** they face in their **performance on trade logistics** and what they can do to improve their performance. (13)

A summary assessment of the performance of the logistics industry, the worldwide LPI combines information on six essential performance elements into a single overall figure.

The six core components are:

- The efficiency of customs and border management clearance, rated from very low (1) to very high (5)
- **The quality of trade and transport infrastructure**, rated from very low (1) to very high (5)
- The ease of arranging competitively priced shipments, rated from very difficult (1) to very easy (5)
- **The competence and quality of logistics services**, rated from very low (1) to very high (5)
- The ability to track and trace consignments, rated from very low (1) to very high (5)
- The frequency with which shipments reach consignees within scheduled or expected delivery times, rated from hardly ever (1) to nearly always (5). (14)

1.7.6.1 Infrastructure Quality

A **key factor** influencing accessibility and logistics as well as a region's general appeal for commercial operations is **infrastructure quality**. Reliability of energy and

telecommunications, together with **transportation networks** including roads, trains, ports, and airports, **make up quality infrastructure** that promotes productive corporate operations. **Better suited to meet the demands of international trade**, draw in foreign investment, and promote long-term economic growth are **regions with well-developed infrastructure**. On the other hand, insufficient infrastructure could provide serious difficulties for companies, resulting in higher expenses and delays.(14)

1.7.6.2 Logistics Quality and Competence

Logistics quality and competence depend on **how well countries** handle internal as well as cross-border **goods flows**. **High logistics quality streamlines transportation, warehousing, and cargo handling**, minimising delays and costs in getting goods from suppliers to consumers. **However, logistics competence means the systems' capacity to execute orders, handle goods carefully, and manage logistics operations** to avoid losses or damages. These aspects **improve a nation's trade competitiveness**. Strong logistics provides swift market reactions, domestic and international trade, and supply chain reliability. Logistics competence and quality help countries engage in and benefit from global commerce by reducing risk and improving trading system reliability, attracting more business and investment.(14)

1.7.7 Labor Costs

Labour expenses typically **determine where businesses invest and operate**. **Wages, benefits, taxes, and other employment-related costs are included**. **High** labour costs can **deter corporations** from investing in high-wage countries unless they have high productivity or unique skills. In the same way, **lower labour costs** in emerging countries **might attract labor-intensive sectors**, boosting economic growth and employment. When it comes to the ability of businesses and nations to compete with one another, the cost of labour is an essential component. There is a correlation between the cost of labour and the competitiveness of produced goods in international commerce when the manufacturing sector is specifically considered. For this reason, governments, social partners, researchers, and organisations at both the national and international levels are interested in information regarding labour costs that can be compared between different industries and nations.(15)

2 Analysis of Current State

This section provides a comprehensive overview of the existing conditions relevant to the Scandi s.r.o. business expansion. It begins with a short overview of the company, proceeds with explaining the criteria used to evaluate the potential expansion countries. Furthermore each of the selected variables is analyzed and evaluated in regards to the criteria. A conclusion summarises the findings, preparing for application of Multi-Criteria Decision-Making methods in later sections.

2.1 Company Overview

Located in the tiny town of **Lieskovec**, close to Zvolen in central Slovakia which is regarded as a **regional logistics hub**, Scandi s.r.o. is a contemporary company with ambitions to transition from local prominence to a global participant. When the company was **founded in the late 1990s**, its goal was to meet the growing demand in the Slovak market for premium hygiene products. The **initial focus** of Scandi s.r.o. was on a limited number of products; however, the company has **gradually expanded** its offerings to encompass a **comprehensive suite of hygiene solutions** that are geared to meet the stringent standards of **end users** as well as the retail, hospitality, and healthcare industries. This expansion was not only in terms of the variety of products offered, but also in terms of the extent to which the market was penetrated and the quality of the operations. Scandi s.r.o. has developed **strong ties** with **important manufacturers/distributors** over the last 20 years, and it is today **Slovakia's largest distributor of Essity products**, including brands like Tork. Scandi s.r.o. has successfully streamlined its supply chain to guarantee dependability and customers satisfaction. Thanks to these strategic measures, the company has grown its revenues annually at a remarkable pace of about **6% (CAGR)** with the revenue for 2023 reaching **4,45 million EUR**, which is a credit to its resilient market strategy and flexible corporate procedures. The dynamics of growth in the Slovak market present both opportunities and problems as the company enters its third decade, which forces a strategic reevaluation of its future course. In the next page we will look at the company financials in more detail.

Here we can see the charts depicting the company's financial performance sourced from FinStat.sk (16).

Tržby

Scandi s.r.o.

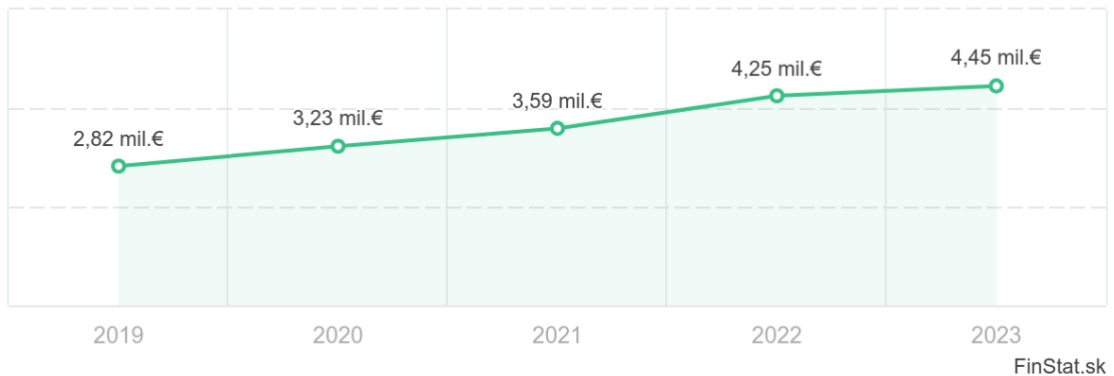


Chart 6 Revenues of Scandi s.r.o. (Source :16)

The chart above depicts Scandi s.r.o.'s 2019–2023 revenue chart. Revenue **has increased** over the **past five years**. Revenue rises annually from €2.82 million in 2019 to €3.23 million in 2020, €3.59 million in 2021, €4.25 million in 2022, and €4.45 million in 2023 which show a quite significant slowdown in growth inbetween years 2022 and 2023 compared to annual growth between the previous years which indicates Scandi s.r.o. might be reaching the limits of Slovak Market

Zisk

Scandi s.r.o.

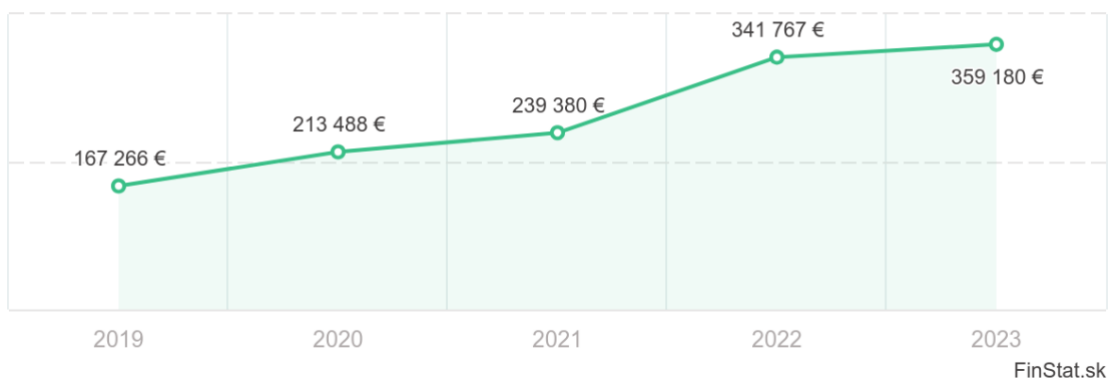


Chart 7 Net income of Scandi s.r.o. (Source :16)

As per the net income chart , Scandi s.r.o.'s net profit chart from 2019 to 2023 **indicates** a quite **favourable trend**. The company's net profit was €167,266 in 2019 and grew each year. Net profit reached €213,488 in 2020 and €239,380 in 2021, reflecting financial

soundness. There was a significant increase to €341,767 in 2022 and a **modest increase** to €359,180 in 2023. This continuous net profit growth and sales patterns show cost control and operational effectiveness. However along with the revenue the profit growth **slowed from 2022 to 2023**, suggesting Scandi s.r.o. may be **reaching market saturation in Slovak market**. To **maintain growth**, this situation suggests **exploring new markets** or expanding product offers.

Top Selling Products

Table 2 Best Selling Products of Scandi s.r.o. (Source: Scandi s.r.o.)

Skup. kariet a služieb	Produkt	Σ Množstvo	Σ Suma bez DPH
TORK	Tork Reflex papierové utierky v kotúči, Advanced, biele, 1 vrstva, dĺžka 300m, 6 ks v kartóne, 40 kartónov paleta, systém M4	8 623,00	301 543,54
TORK	Tork SmartOne toaletný papier v kotúči, Advanced, biely, 2 vrstvy, dĺžka 207m, 6 ks v kartóne, 64 kartónov paleta, systém T8	9 715,00	295 866,08
TORK	Tork PeakServe nadväzujúce papierové utierky, Universal, biele, 1 vrstva, 4920 ks v kartóne, 12 balíkov po 410ks, 45 kartónov paleta, systém H5	4 683,00	229 158,76
TORK	Tork Matic papierové utierky v kotúči, Advanced, zelené, 2 vrstvy, dĺžka 150m, 6 ks v kartóne, 28 kartónov paleta, systém H1	5 320,00	240 883,23
TORK	Tork jemná mydlivá pena 1000 ml, 6 ks v kartóne, 80 kartónov paleta, systém S4	15 069,00	129 335,73
TORK	Tork SmartOne mini toaletný papier v kotúči, Advanced, biely, 2 vrstvy, dĺžka 111,6m, 12 ks v kartóne, 48 kartónov paleta, systém T9	5 622,00	190 773,04
TORK	Tork Matic papierové utierky v kotúči, Universal, extra dlhý, biele, 1 vrstva, dĺžka 280m, 6 ks v kartóne, 28 kartónov paleta, systém H1	2 124,00	129 244,48
TORK	Tork Puroilin priemyselná čistiaca utierka z netkanej textilie malý kotúč, nevláknitá, Premium, biela, 1 vrstva, dĺžka 114 m, 1 kotúč v boxe, 72 kartónov paleta, systém W1,W2,W3	2 244,00	108 711,08
TORK	Tork Matic papierové utierky v kotúči, Advanced, jemné, biele, 2 vrstvy, dĺžka 150m, 6 ks v kartóne, 28 kartónov paleta, systém H1	2 874,00	135 862,91
SHP	SHP Harmony Professional papierové utierky MĎI v kotúči so stredovým odvíjaním, biela, 2 vrstvy, dĺžka 125m, 6 ks v kartóne, 44 kartónov paleta, systém M2	4 647,00	75 733,61
TORK	Tork Mini Jumbo toaletný papier v kotúči, Advanced, biely, 2 vrstvy, dĺžka 170m, 12 ks v kartóne, 36 kartónov paleta, systém T2	1 908,00	50 110,53
SHP	SHP Harmony Professional Mini Jumbo toaletný papier v kotúči, Premium, biely, 2 vrstvy, dĺžka 117,5m, 12 ks v kartóne, 48 kartónov paleta, systém T2	3 876,00	51 132,27
TORK	Tork Heavy-Duty priemyselná papierová utierka veľký kotúč, Premium, modrá, 2 vrstvy, dĺžka 340 m, 1 kotúč v kartóne, 30 kartónov paleta, systém W1	1 288,00	45 598,86
PLUM	Plum Profi čistiaca abrazívna pasta na ruky 1400 ml bag in box, 8 ks v kartóne	3 342,00	37 156,62
TORK	Tork Heavy-Duty priemyselná papierová utierka malý kotúč, Premium, biela, 2 vrstvy, dĺžka 170 m, 2 kotúče v kartóne, 48 kartónov paleta, systém W1,W2	2 038,00	47 223,48
SHP	SHP Harmony Professional skládané papierové utierky ZZ, biela, 2 vrstvy, 4000 ks v kartóne, 20 balíkov po 200ks, 32 kartónov paleta, systém H3	2 071,00	48 070,83

From the table above we can see that the **top selling products** for Scandi s.r.o. are **paper tissues** both for personal and professional use as well as other related products such as toilet paper. From the brand perspective Tork dominates the best selling products as Scandi is currently the biggest distributor of the brand in Slovakia.

2.2 Identification of Criteria

Within this section, we shall **explore the reasoning behind the selection** of the particular **criteria** employed throughout our analysis and how they are measured. Every criterion has been **meticulously chosen in a cooperation with CEO** and the head of sales of Scandi s.r.o. for its significance and influence on the goals of their business expansion.

In this analysis, we will delve into the **significance of these specific metrics** and their role in providing a more **comprehensive understanding of the variables** at hand. This investigation aims to provide transparency and offer a clear understanding of how our conclusions are derived from the collected data. As the other criteria are quite straightforward we decided to explain in further detail our choice behind choosing the **Infrastructure Quality and Logistics Quality and Competence** components of the

Logistic Performance Index (LPI) and not the others. We decided to chose these particular components after a conversation with head of sales and CEO of Scandi s.r.o. as they agreed they are the **most relevant LPI components for the purposes of expansion of Scandi s.r.o.** due to other components such as customs , international shipments being more focused on international trade while the intention behind the company's expansion is intranational trade within the selected country and all of the countries/variables are members of Schengen or European Union and therefore have a free trade agreements with Slovakia. We further dismissed timeliness as the company generally makes infrequent large shipments to its customers with goods worth at least of couple months of value and tracking & tracing for the same reasons as well as the shipments being insured. The chosen components directly affect supply chain efficiency and dependability, making them crucial to evaluate a country's logistical architecture. These characteristics allow us to analyse how successfully nations utilize their infrastructure to facilitate commerce and manage logistics, which affects their economic competitiveness and therefore the viability of our expansion. As components of LPI both are rated on scale 1-5 with 5 being the highest possible score.

2.2.1 Population of the Country - Max

We chose population as a variable because it **directly correlates with the potential market size for goods and services.** A larger population generally means a greater number of individuals who could potentially buy products, thereby driving demand. By considering the population, we should be able to estimate the scale of market opportunities. For the purpose of our thesis we will use the total population of a selected variable/country as a decision making criterion. Intuitively , the higher the population the more preferable the variable will be, therefore will look at is maximalisation criterion.

2.2.2 GDP Of the Country - Max

We included GDP as a variable because it is a **key indicator of economic health and market potential.** A higher GDP suggests greater economic activity, higher incomes, and increased consumer spending capacity. This economic prosperity translates into a more robust market environment where businesses can thrive. For the purposes or our thesis, we will evaluate variables/countries use **nominal GDP** figures in current prices

measured in US Dollars to rank the variables/countries, ranking ones with higher GDP figures as the more preferable, therefore will look at it as a maximalisation criterion.

2.2.3 Tissue & Hygiene Paper Market Revenue - Max

For the purposes of our thesis we will measure and evaluate the size of particular country/variable tissue & hygiene paper market in **nominal USD**, ranking countries/variables with larger tissue & hygiene markets as more preferable in our decision making processes , therefore will look at it as a maximalisation criterion.

2.2.4 Ease of Doing Business Index - Max

We used the regulatory environment quantified in the form of Ease of Doing Business Index as a criterion simply because it impacts the ease and efficiency of conducting business. Which is crucial for any company as countries with favorable regulations reduce bureaucratic hurdles, making it easier to start and run businesses. For the purposes of our thesis we will rank countries based on the aforementioned **World Bank's Ease of Doing Business index** score which is measured on a **scale of 1-190 with** countries/variables with higher scores being perceived as more preferable in our decision making, therefore it would be a maximalisation criterion.

2.2.5 Corporate Tax Rates - Min

We included tax rates as a variable because they significantly affect business costs and profitability. For the purpose of our thesis we will evaluate countries based on **current corporate tax rate expressed in percentages** as we believe it is the most relevant tax metric for the purposes of the company expansion. Again intuitively we will rank countries/variables with lower corporate tax rates higher in our evaluation than the ones with high corporate tax rates, therefore it is a minimalisation criterion.

2.2.6 Infrastructure Quality Index - Max

Infrastructure quality measures trade-related facilities and transport networks, which enable efficient and cost-effective products transportation. Will be evaluated as an index **score on scale of 1-5** and is a maximalisation criterion

2.2.7 Logistics Quality and Competence Index - Max

Logistics Quality and Competence assesses logistics providers' expertise and simplicity of shipment, which are essential for logistical integrity and punctuality. Will again be **evaluated as an index score on scale of 1-5**, with 1 being the least favourable and 5 being the most, therefore it is a maximalisation criterion.

2.2.8 Labor Costs - Min

In the analytical section of this thesis, we excluded other commonly used labour market metrics such as employment rates, workforce productivity, and demographic trends from our evaluation framework. Both CEO and head of sales agreed that although these metrics offer a comprehensive perspective on the labour market's overall condition and trends, they do not provide specific information on the immediate cost implications that are crucial for the purposes of their business expansion. Instead they agreed we should chose measurable cost factors that have a direct impact on operational budgets and profitability. The consensus was that employment rates and demographic trends, while often perceived crucial for long-term strategic planning, do not offer the precise financial insights needed for their expansion investment considerations. They both agreed that understanding the direct financial impact of labour costs is more essential in this situation.

Further based on this reasoning, we decided to use labour costs expressed in nominal USD figures, as the sole metric for assessing labour market conditions in the selected countries. The decision was made based on the requirement for a reliable and simple financial measure that will help us evaluate and compare direct labour costs across the selected countries/variables. Using nominal USD figures guarantees that the data can be compared consistently, without being influenced by the variations in local economic

conditions that PPP adjustments could bring. This approach streamlines the comparison of labour costs of the selected countries/variables based on the economic benefit they could bring to the company. Intuitively this is a minimalization criterion so the countries with lower labor costs will be seen as more preferable.

2.3 Identification of Decision Variables

Within this section, we shall delve into the rationale behind our choice of Hungary, Poland, Austria, and Czechia as the primary countries/variables for our analysis. With Scandi s.r.o. being based in Slovakia, this choice was strategically motivated by the geographic and economic proximity of these nations. The consensus between the CEO and the head of sales was that the international expansion of Scandi s.r.o. should by all means **begin in a country which shares a border with Slovakia** which after extracting the selected countries **leaves out Ukraine as the only other option**, which they deemed was **completely out of question** due to the political and economical instability derived from the ongoing war. They both agreed that expanding into a **country which shares a border with Slovakia** will lead to to important economic and **logistical synergies** between the parent company and the newly formed one. This close proximity not only makes it easier for Scandi s.r.o. to enter the market and save on transportation expenses, but it also supports the company's goal of expanding its influence in Central Europe. In addition, the **economic structures and market dynamics** in these countries are **similar to those in Slovakia**. We all agreed that this similarity will allow the company to effectively analyse and react to regional trends, as well as potential opportunities, and challenges.

2.3.1 Hungary

In this section we will explore how Hungary fares in context of the identified criteria.

2.3.1.1 Population

The chart depicted in Attachment 1 depicts the estimated population of selected European countries in 2023 including that of Hungary. According to Statista Hungary's 2023 population is estimated at **10.1 million**. This demographic information helps compare Hungary to Czechia, Poland, and Austria in terms of market size and economic potential.

Hungary's population is equivalent to Czechia's 10.5 million and slightly above Austria's which currently has 8.9 million inhabitants. Consumer marketplaces and workforces may be similar in the respective nations due to their population numbers. However, Poland, with 41 million people, has a larger labour pool and consumer base, which may attract more business and investment. These demographic data are essential for economic strategy, especially for enterprises and investors interested in Central European markets. Hungary's population over 10 million people implies a significant consumer and labour market. We believe this data is crucial for assessing regional competitive dynamics and designing economic, investment, and development strategies.

2.3.1.2 GDP

As per the table below the GDP of Hungary was **212,61 Billion USD** in 2023 and is projected to reach 223,41 Billion USD in 2024



Chart 8 GDP of Hungary (Source: 19)

The chart showing Hungary's GDP from 1989 to 2029 also shows its economic trend over four decades. Hungary's GDP grew modestly from 1989 to the early 2000s. These trends are interrupted by the 2008–2009 global financial crisis, which affected several economies. After a rebound, GDP growth increased from 2010, indicating economic stabilisation and expansion. The 2020–2029 GDP predictions include current and

predicted economic policies, investments, and market circumstances in Hungary and predict stable and hopeful growth.

2.3.1.3 Revenue of Tissue & Hygiene Paper Market

According to estimates, Hungary's tissue and hygiene paper industry brought in **USD 1,08 billion** in sales by 2023. With a little rise to USD 1.11 billion projected for 2024, this industry is expected to have steady demand. This information emphasises, in spite of fluctuating economic circumstances, the tissue and hygiene paper business in Hungary's tenacity and consistent growth. Such a tendency not only emphasises how necessary these items are in day-to-day consumer life but also points to a steady customer base that encourages the sector to expand.

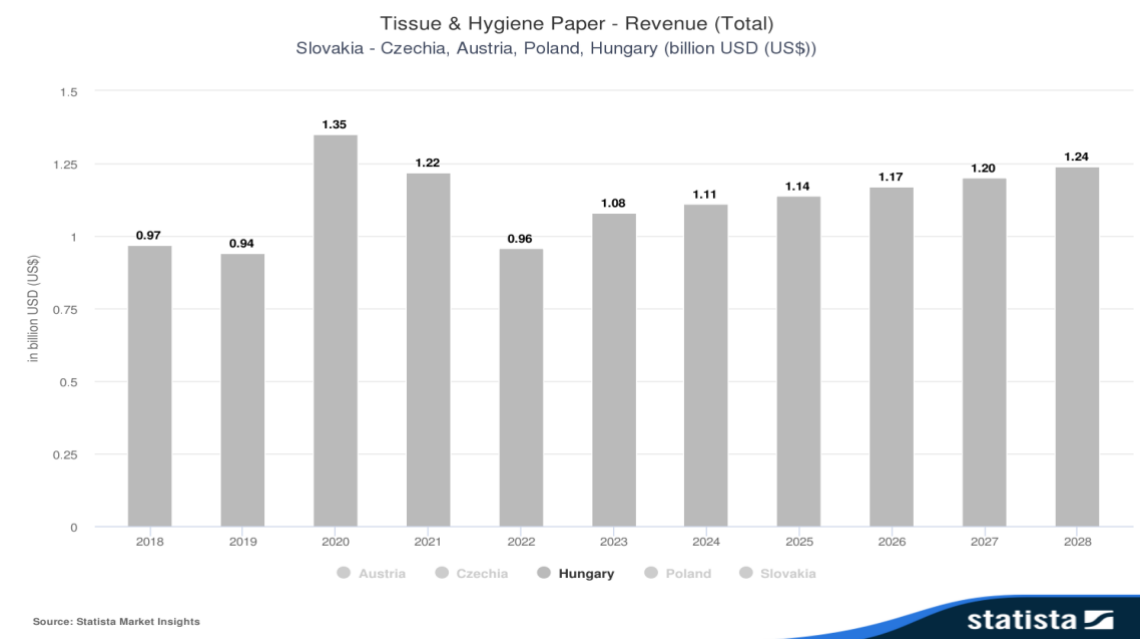


Chart 9 Revenue of Tissue & Hygiene Paper Market in Hungary (Source: 20)

2.3.1.4 Ease of Doing Business Index Score

The Ease of Doing Business Index from the World Bank (depicted in Attachment 2) is an important standard for evaluating Hungary's business climate particularly the efficacy of its regulatory structure in conducting business activity. **Hungary's 2020 score of 73.40** places it behind its peers. Austria tops the group with 78.70, suggesting a better business climate, followed by Poland and Czechia with 76.40 and 76.30 respectively. This

comparison helps explain Hungary's Central European issues and opportunities. The lower score means that Hungary may have more bureaucratic obstacles or less efficient procedures than its neighbours, which might hinder investment attractiveness and operational efficiency.

2.3.1.5 Corporate Tax Rate

As per the table in Attachment 3, Hungary has the lowest **corporate tax rate of 9%**, which has been stable throughout years. This figure is far lower than Slovakia (21%), Poland (21%), Austria (25%), and Czechia (19%). These steady tax rates in Hungary, especially corporate taxes, imply a more business-friendly tax climate than its neighbours and make it attractive for international direct investment and corporate growth.

2.3.1.6 Infrastructure Score

As per the table seen in Attachment 4, Hungary is an interesting example of infrastructure quality and economic performance. The country ranked 52nd globally with a **3.1 infrastructure score**. This puts Hungary slightly ahead of the Czech Republic, which scored 3.0 and placed 55th, but behind Poland and Austria, which scored 3.5 and 3.9 and ranked 39 and 16, respectively. This implies that Hungary's infrastructure is competitive in the region. The infrastructure score, which measures the quality and readiness of the transport, utility, and highway network, is vital to economic activity and investment.

2.3.1.7 Logistic Competence and Quality Score

As per the data seen in the table in Attachment 5, Hungary **scores 3.1** and ranks 57th internationally in logistic competence and quality, indicating logistics sector issues compared to regional counterparts. For example, Austria's score of 4.0, placed 11th, is far higher and Poland and the Czech Republic's 3.6, which are tied for 33rd place also surpass Hungary. Logistics competence and quality include logistics providers, customs brokers, and transportation operators' capacity to properly organise and execute cargo operations that satisfy current supply chain expectations. Hungary's lower rating implies necessity for logistical training, service quality, and operations management improvements.

2.3.1.8 Labour Costs

Table 3 Labour Costs in Hungary (Source:15)



As per the table above, Hungary's hourly labour expenses in 2022 were measured in PPP and US dollars. In PPP dollars, labour cost \$22.48 per hour, adjusting for the country's cost of living and economic conditions to compare local buying power. Without adjusting for buying power, the hourly labour cost **was \$11.26 in US dollars**. This low labor cost is significant for businesses considering expansion, as it indicates a more affordable workforce compared to countries with higher nominal labor costs.

2.3.2 Czechia

In this section we will explore Czechia's performance in context of the identified criteria.

2.3.2.1 Population

Population of Czechia

The chart seen in Attachment 1 depicts the estimated population of selected European countries in 2023 including that of Czechia. For the purposes of this thesis the graphic compares Czechia, with **10.5 million people**, to Poland, Austria, and Hungary in terms of regional trends and market sizes. Czechia's population is between Austria's 8.9 million and Hungary's 10.1 million. Poland, with 41 million inhabitants, is a more populated and larger Central European market. Austria's slightly lower population may affect market capacity, especially in labor-intensive or consumer-driven businesses. Hungary's equal population size predicts similar market dynamics, but economic, cultural, and political

issues may affect business settings differently. Poland's higher population may draw more investments and companies.

2.3.2.2 GDP

The chart below depicts Czech Republic's GDP from 2009 to 2029 according to IMF and shows a quite steep rise in economic output reaching a figure of **USD 332,02 Billion** in 2023. While the economic forecast anticipates growth in 2024 and 2025, driven by improved financial conditions and decreasing inflation, this optimistic scenario may reflect the broader upward trajectory in the GDP projections shown in the chart. The discrepancies highlight the uncertain nature of economic forecasting and the impact of fluctuating global and domestic factors on real economic performance. Despite the slump in 2023, the chart forecasts a strong, long-term resurgence in the Czech economy, which paints a more cheerful image than recent economic difficulties may imply. As GDP is predicted to expand considerably beginning in 2024, this may signal that factors such as improved financing conditions and inflation stabilisation may have a more long-term and favourable influence than first witnessed in 2023. The forecasted values in the graphic indicate a recovery and development phase that outpaces recent patterns, highlighting the Czech economy's latent resilience.

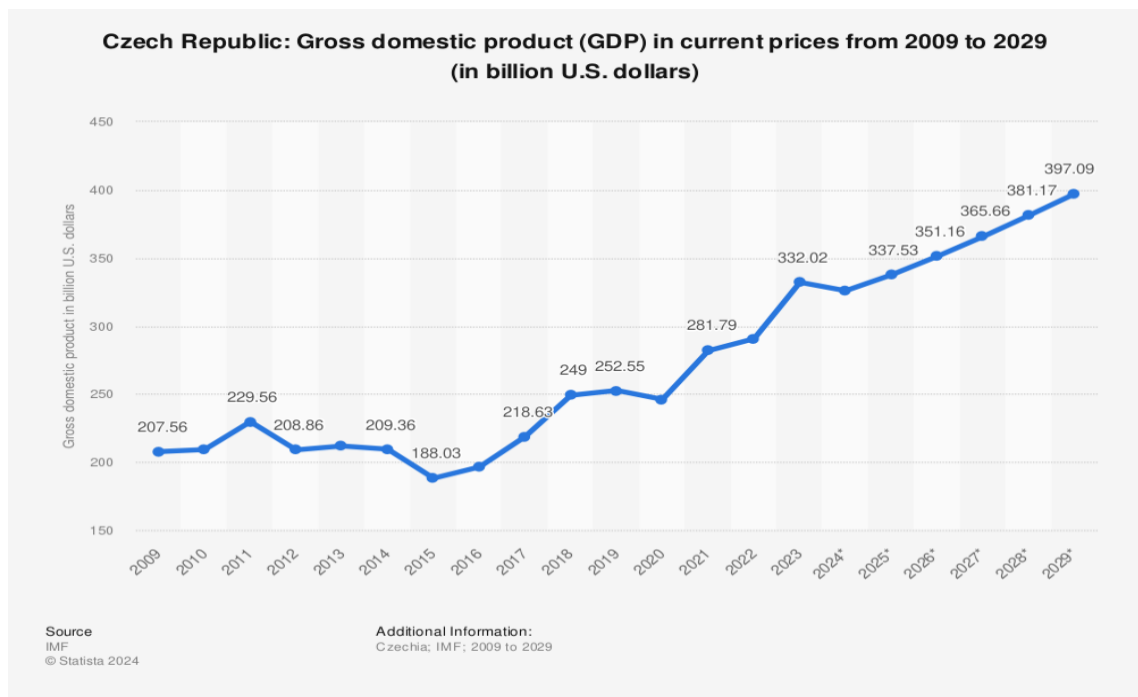


Chart 10 GDP of Czechia (Source: 23)

2.3.2.3 Revenue of Tissue & Hygiene Paper Market

As per the chart below the Czech Republic's tissue and hygiene paper industry recorded sales of **USD 1.09 billion** in 2023, indicating that there was a strong demand in the market from consumers. The sector is expected to have more expansion, with a rise in revenue that is anticipated to reach 1.12 billion USD by the year 2024..

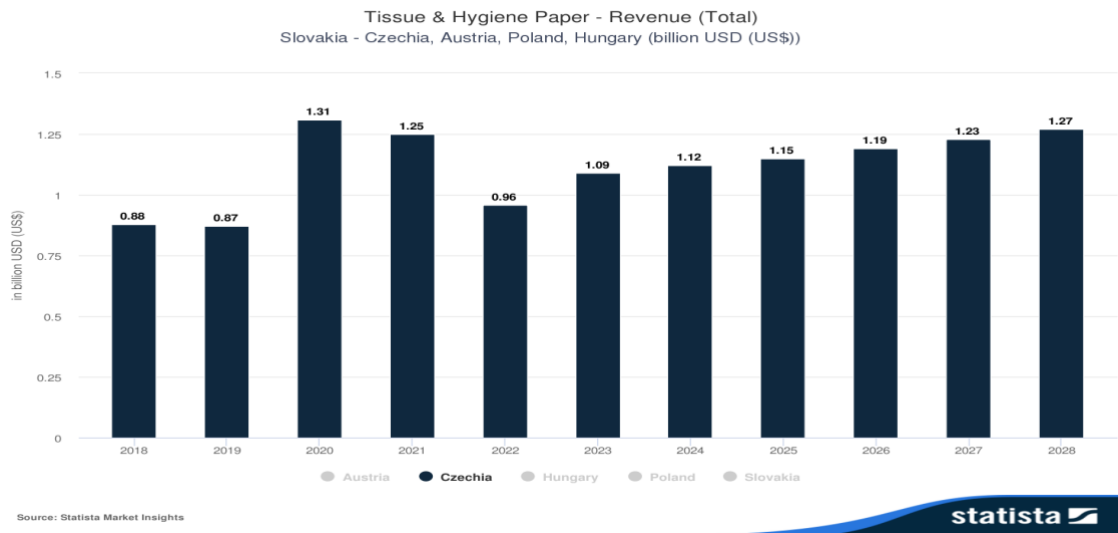


Chart 11 Tissue & Hygiene Paper Market Revenue in Czechia (Source: 20)

2.3.2.4 Ease of Doing Business Index score

As per the table in the Attachment 2, Czechia recorded an Ease of **Doing Business index score of 76.30** in 2020, positioning it competitively among its peers like Austria, Poland, and Hungary. While Austria leads with a score of 78.70, Czechia closely trails, demonstrating its relatively favorable business environment. This score, which is indicative of less bureaucratic hurdles and a supportive administrative framework, is slightly higher than Hungary's 73.40 and aligns closely with Poland's 76.40. This comparison underscores Czechia's robust position for business operations within Central Europe, which is vital for understanding its economic dynamics in the region.

2.3.2.5 Corporate Tax Rate

As per the table in Attachment 3, in terms of corporate tax rates, both Czechia and Poland keep a **consistent rate of 19.0%**, which is relatively moderate compared to Hungary's notably low 9.0% and Austria's steady 25.0%.

2.3.2.6 Infrastructure Score

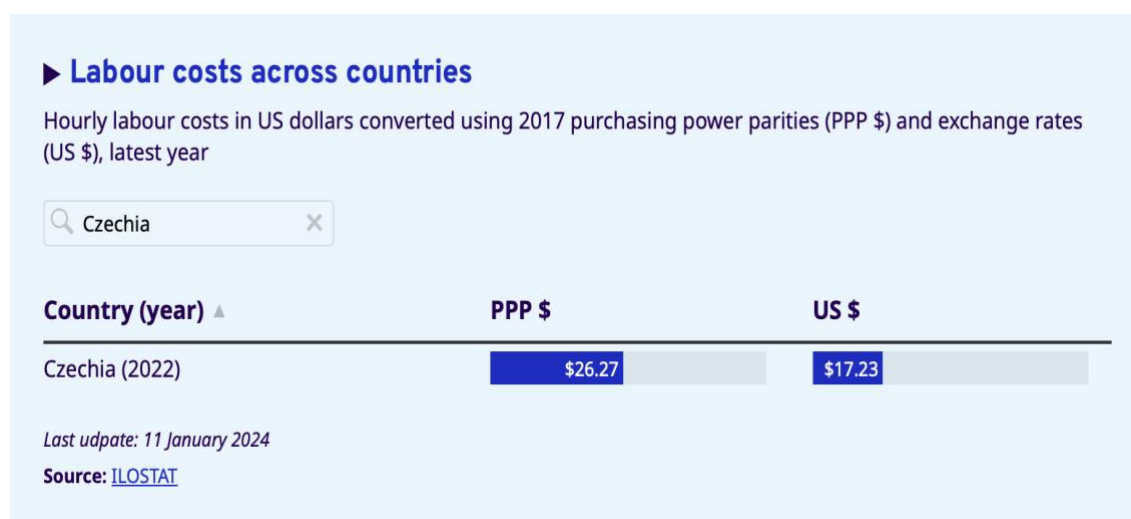
As per the table in Attachment 4, Czech Republic with a **score of 3,0** ranks 55th in global infrastructure quality, **below** Hungary's 52nd as well as below Poland and Austria. This shows that, despite its strong industrial foundation, the Czech Republic may confront infrastructural issues that might slow economic development and efficiency.

2.3.2.7 Logistic Competence and Quality Score

At 33rd, the Czech Republic and Poland have a **logistic competence and quality score of 3.6** according to the table in Attachment 5. Despite infrastructure issues, Czech logistics companies are efficient and capable, as shown by their high score. Logistics expertise supports the Czech Republic's strong industrial and export-oriented economy by effectively moving products and services across borders and inside the country. This however places Czechia and Poland behind Austria, illustrating a competitive but unequal logistical situation in Central Europe.

2.3.2.8 Labor Costs

Table 4 Labour Costs in Czechia (Source:15)



The table above shows Czechia's hourly labour expenses in 2022, calculated in two ways: \$26.27 when adjusted for purchasing power parity (PPP) at 2017 prices, and **\$17.23 in direct U.S. dollar terms**. These numbers demonstrate the comparative cost of labour in Czechia from two viewpoints, one indicating cost equivalence in terms of US buying

power and the other in terms of simple currency translation. Since we will focus primarily on the nominal value, the figure of \$17.23 per hour is notably low, making Czechia an attractive option for expansion due to its moderately affordable labor costs.

2.3.3 Poland

In this section we will explore Poland's performance in context of the identified criteria.

2.3.3.1 Population

According to data from Statista depicted in the chart in the Attachment 1, the population of Poland currently stands at **41,026,068** million inhabitants which is much higher than its neighbours Czechia, Austria, and Hungary. This vast population base provides a greater labour market and a possibly larger consumer base, in contrast to Hungary Czechia and Austria all of which have populations of around 10 million. This demographic advantage positions Poland as a favorable option for business expansion, providing numerous opportunities for market growth and workforce availability

2.3.3.2 GDP

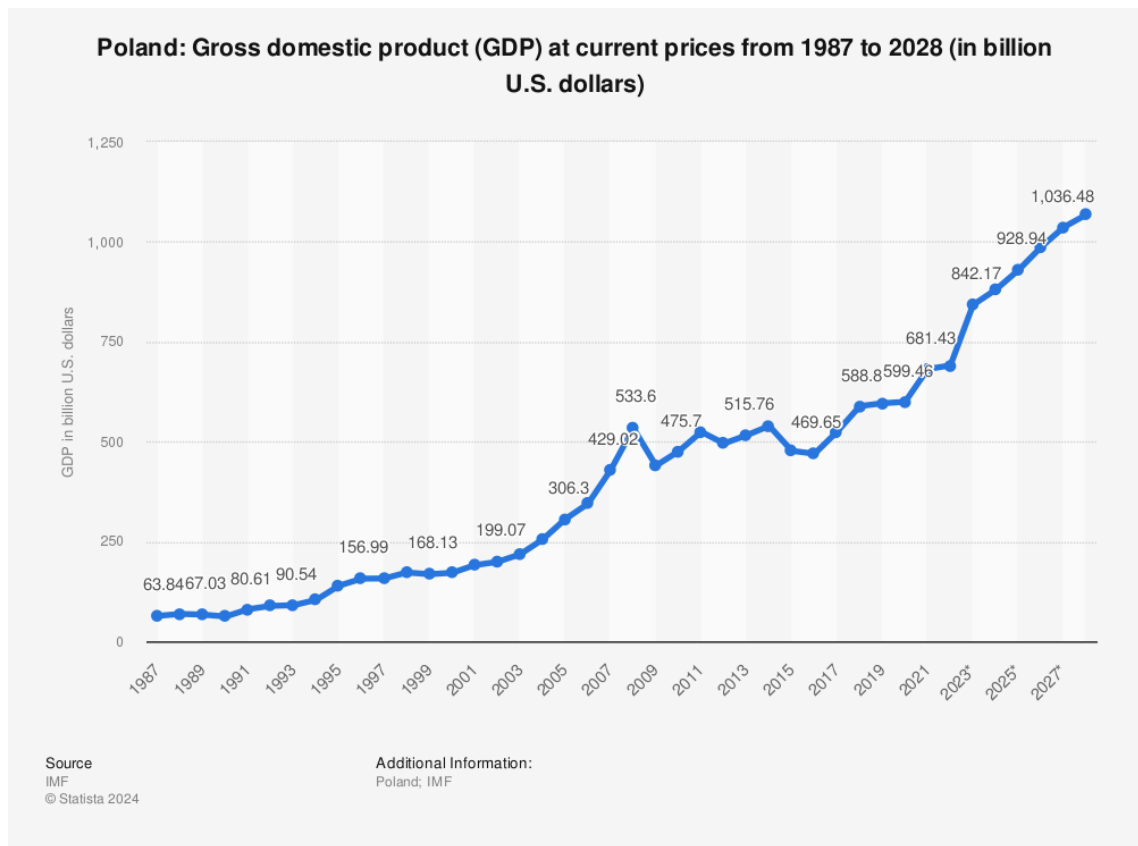


Chart 12 GDP of Poland (Source: 24)

The chart above depicts the rise of Poland's Gross Domestic Product (GDP) in US dollars from 1987 to 2028, demonstrating a strong economic growth over this time. Starting from a \$63.467 billion in 1987, Poland's GDP has steadily increased, notably since entering the European Union in 2004 and in 2023 amounted to **681,43 Billion \$USD**. The estimate predicts that the current growth trend will continue, with GDP exceeding \$1 trillion by 2028. This trend illustrates Poland's successful economic reforms and inclusion into global markets, which have greatly increased its economic production over the past several decades.

2.3.3.3 Tissue & Hygiene Paper Market Revenue

As per the Statista market insight report ,the revenue of Poland's tissue and hygiene paper market amounted to **USD 3.29 billion in 2023**, based on estimates. Projected to reach USD 3.45 billion by 2024, this industry is anticipated to maintain a consistent level of

demand. The consistent market performance implies that Poland's T & H market is quite stable. This analysis sheds light on the industry's ability to generate stable income for its participants.

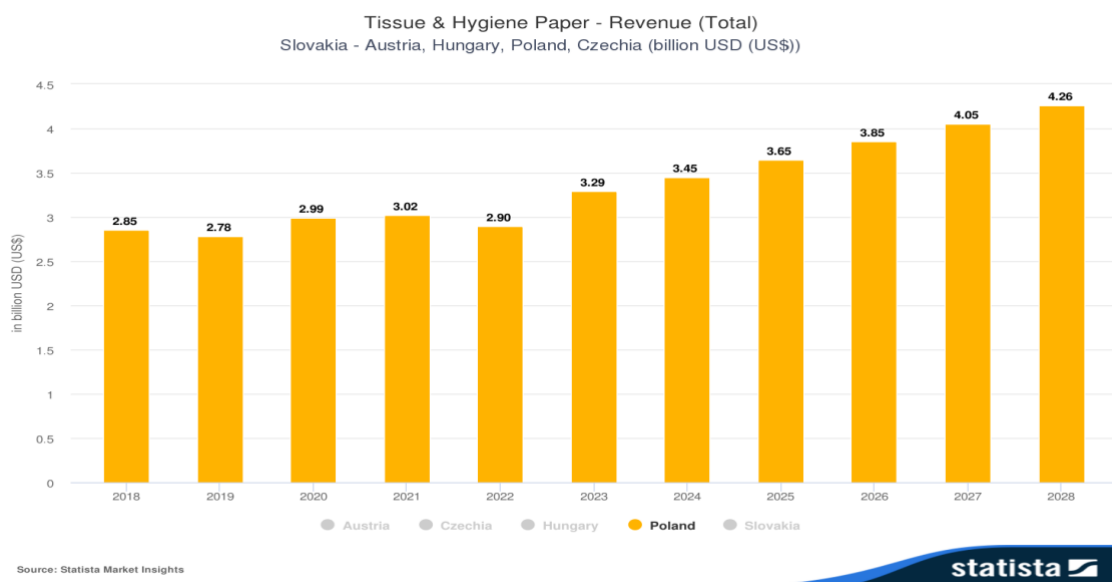


Chart 13 Tissue & Hygiene Paper Market Revenue in Poland (Source: 20)

2.3.3.4 Ease of Doing Business Index Score

For the purposes of evaluating Poland for potential business expansion, the Ease of Doing Business Index from the World Bank is a crucial benchmark for assessing the country's business environment. As shown in the table in Attachment 2, **Poland's score of 76.40** in 2020 reflects the effectiveness of its regulatory structure in fostering business activity. This score is instrumental in understanding how economic policies impact business operations in Poland, providing a measure of the business-friendliness of its legal and regulatory environments.

2.3.3.5 Corporate Tax Rate

As indicated in the table in Attachment 3, **Poland's 19.0% corporate tax rate** being at same level as Czechia's is competitive among observed nations, and remained consistent during the last decade and based on predictions is expected to continue unchanged up to 2030. This implies a stable corporate tax environment in Poland which is in line with other European nations.

2.3.3.6 Infrastructure Score

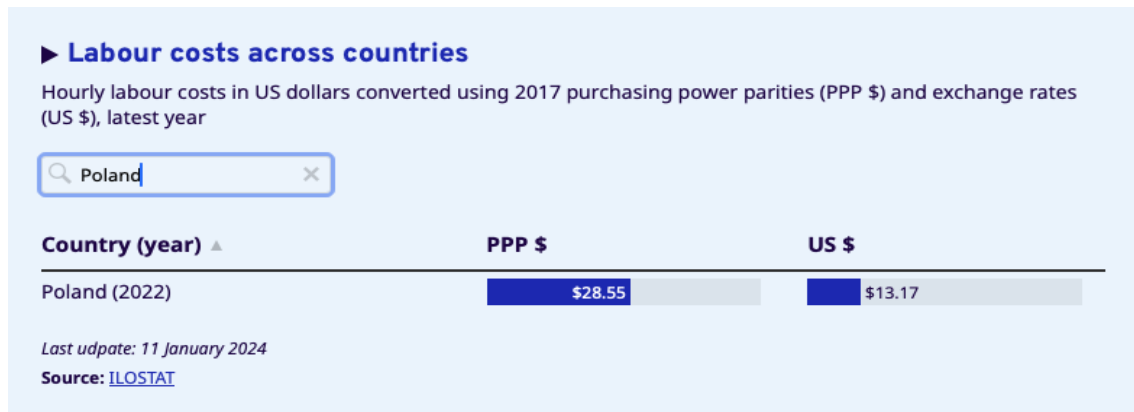
In the context of evaluating Poland for potential business expansion, infrastructure quality is a significant factor to consider. According to the data in Attachment 4, Poland ranks 39th globally with an **infrastructure score of 3.5**. This ranking ranks Poland ahead of Hungary and Czechia but below Austria. This suggests that, despite Poland's strong industrial capabilities and its sheer size in terms of population and GDP figures there may still be infrastructure issues persisting and potentially impeding its potential for business expansion.

2.3.3.7 Logistic Competence and Quality Score

As per the table in Attachment 5, Poland ranks 33rd in the worldwide logistics competence and quality score, tied with the Czech Republic and having a **score of 3.6**. This placement demonstrates that, despite possible infrastructure challenges, Polish logistics are positioned well. This logistics expertise helps Poland's potential by implying efficient movement of goods both domestically and internationally. Such a score places.

2.3.3.8 Labor Costs

Table 5 Labour Costs in Poland (Source: ILOSTAT)



For the purposes of evaluating Poland as a potential country for business expansion, understanding its labor costs is essential. The table above shows that in 2022, Poland's hourly labor costs were \$28.55 when adjusted for purchasing power parity (PPP) at 2017 prices, and \$13.17 in direct U.S. dollar terms. The remarkably low **nominal labor cost**

of **\$13.17 per hour** highlights Poland's favourable labor market conditions by indicating affordable labor.

2.3.4 Austria

In this section we will explore Austria's performance in context of the identified criteria.

2.3.4.1 Population

As per the table in Attachment 1, Austria's **population of 8.9** million situates it behind Czechia (10.5 million) and Hungary (10.156 million), and well behind Poland (41 million). In Central Europe, Austria's smaller population footprint may indicate a more constricted market potential, particularly in industries that rely significantly on consumer engagement or a large labour pool. Despite its smaller population, Austria's demographic structure necessitates careful consideration when assessing the potential for consumer market expansion and total economic activity.

2.3.4.2 GDP

Austria recorded Gross Domestic Product (GDP) of **USD 519,71 Billion** in 2023 , according to the chart below which is based on data from IMF. This figure demonstrates a consistent rising trend in Austria's economic performance, particularly from 2020 onward.

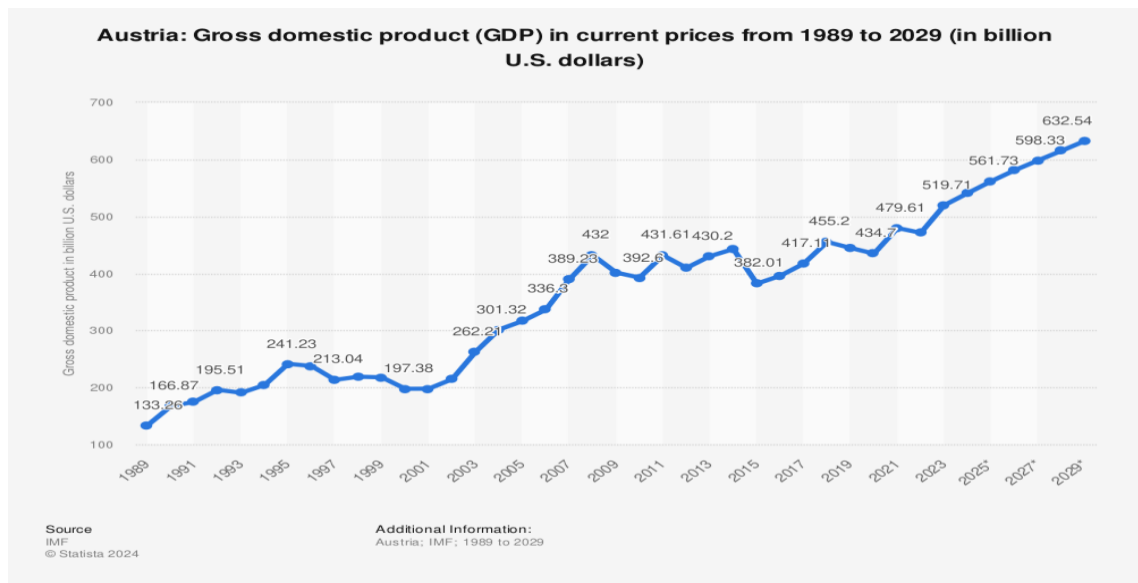


Chart 14 GDP of Austria (Source: 25)

This steady development demonstrates the strength of Austria's economic policies, competitive market environment, and successful global economic integration. GDP growth is expected to continue through 2029, implying that the economy will expand steadily. This continuous economic rise not only illustrates Austria's economic endurance, but also forecasts future progress, establishing Austria as a model for economic stability and strategic planning in Europe.

2.3.4.3 Tissue & Hygiene Paper Market Revenue

In 2023, Austria's tissue and hygiene paper market generated roughly **\$0.95 billion** in revenue, with predictions for 2024 showing a modest increase to around \$0.97 billion. This progressive rise, as shown in the chart, represents a stable expansion within the industry. The trend demonstrates a strong consumer base that has maintained consistent demand for tissue and hygiene goods over the years, notwithstanding slight changes. The market's projected growth through 2024 shows that it may profit from reasons such as increased hygiene awareness, product innovation, and maybe an increase in health-related consumer behaviours following the pandemic.

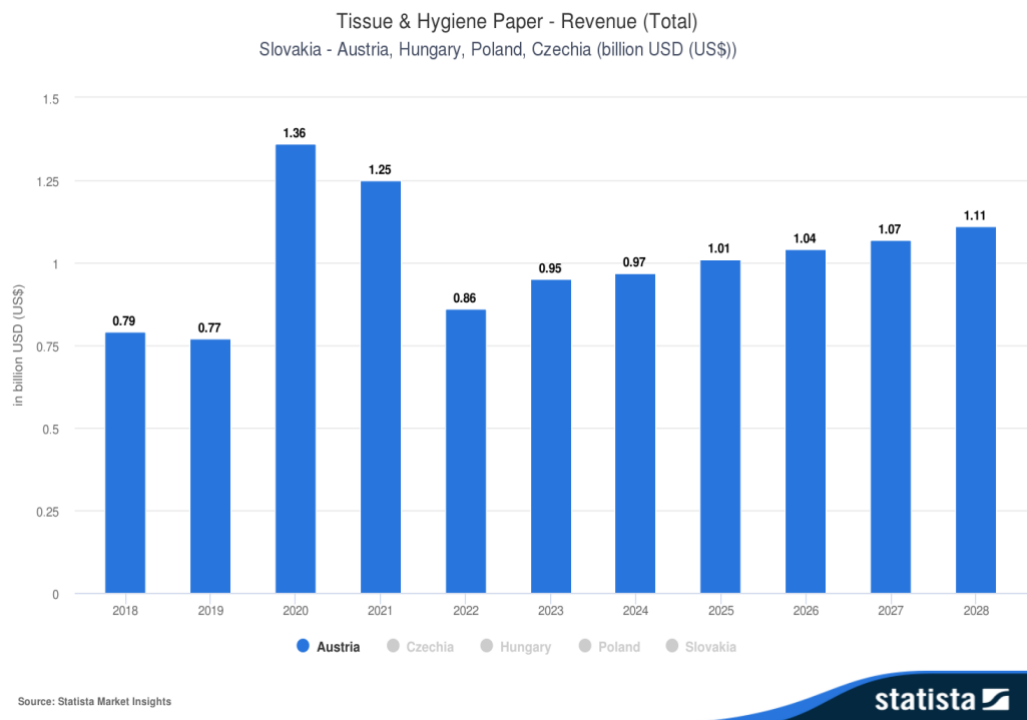


Chart 15 Tissue & Hygiene Paper Market Revenue in Austria (Source: 20)

2.3.4.4 Ease Doing Business Index Score

As seen in the table in Attachment 2, Austria had the highest **Ease of Doing Business index score of 78.70** in 2020, ahead of its Central European neighbours Poland, Czechia, and Hungary analyzed in this thesis. This score puts Austria at the top, suggesting a highly efficient regulatory system that enables company activity with minimal bureaucratic barriers. The score demonstrates Austria's top position in offering a favourable environment for business initiatives, beating Hungary's score of 73.40 and nearly coinciding with but still exceeding Poland's 76.40. Austria's top ranking in this category demonstrates its competitive advantage in creating a favourable business environment, which is critical for attracting investments and driving economic growth in the region.

2.3.4.5 Corporate Tax Rate

As seen in the table in Attachment 3 ,for the past 10 years , Austria has consistently maintained a constant corporate **tax rate of 25.0%** which was also the case in year 2023 and currently in 2024 and according to the data is projected to be the case up until 2030. This rate makes Austria the country with the highest corporate tax rate among the analyzed countries.

2.3.4.6 Infrastructure Score

As per the table in Attachment 4, Austria's **3.9 infrastructure score** and 16 categorised rank reflect a well-developed infrastructure that supports economic activity and quality of life. Austria invests in and maintains transport, utilities, and digital connections, ranking ahead of Poland, the Czech Republic, and Hungary. Infrastructure strength helps Austria attract international investment and maintain economic stability therefore making it also more favourable as a target for business expansion.

2.3.4.7 Logistic Competence and Quality Score

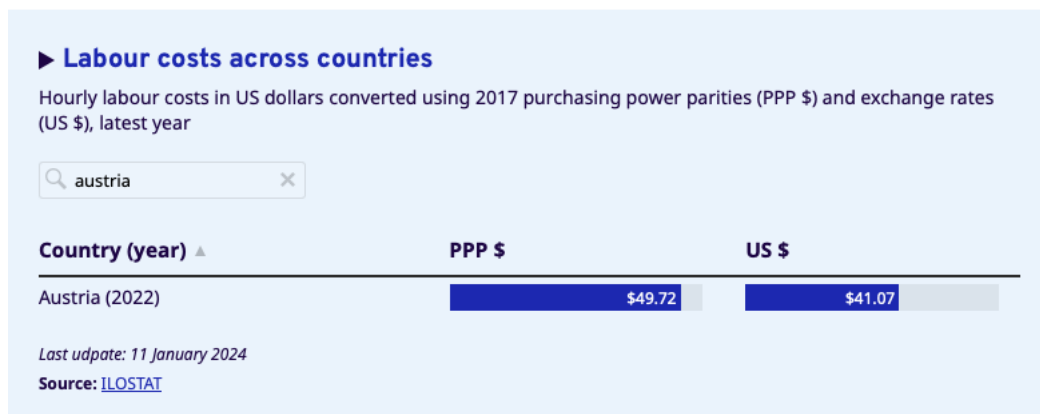
At 4.0, Austria again **excels** in logistic competence and quality, ranking 11 internationally as per the data in the table in Attachment 5. This shows a strong logistics industry that can manage complicated supply chains and offer dependable, efficient services. Given its significance in international trade and business, Austria's competitiveness in European

and worldwide markets depends on such skill. Austrian logistics companies' quality, operating efficiency, and capacity to innovate and meet market demands are reflected in their high position which puts Austria in a favourable spot when considering as a potential expansion target.

2.3.4.8 Labor Costs

As per the table below, in 2022, Austria's hourly labour costs reached \$49.72 when adjusted for purchasing power parity (PPP), and **\$41.07 in nominal US dollars**. These numbers demonstrate Austria's unusually high labour expenses when compared to global averages, reflecting the country's mature economy and high living standards. Austria's high labour cost structure implies that, while the country provides a stable and predictable market for business operations, greater labour costs may negatively impact the expansion plans.

Table 6 Labour Costs in Austria (Source:15)



2.4 Summary of Decision Making Input Data

The table below represents the summary of the data collected on the chosen criteria of selected countries/variables.

Table 7 Summary of data collected on the chosen criteria of selected countries/variables (Source: Own Processing)

Country	Max - GDP 2023 (In Billions \$USD)	Max - Population 2023 (In Millions)	Max - Tissue & Hygiene Market Revenue 2023 (In Billions \$USD)	Max - Ease of Business Index 2020 (0-100)	Min - Corporate Tax Rate 2024 (In %)	Max - Infrastructure Quality index Index 2023 (1-5)	Max - Logistics Quality and Competence Index 2023 (1-5)	Min- Average Hourly Labor Costs (In nominal \$USD)
Austria	519,71	9	0,95	78,7	25	3,9	4	41,07
Czechia	332,02	10,5	1,09	76,3	19	3	3,6	17,23
Hungary	212,61	10,2	1,08	73,4	9	3,1	3,1	11,26
Poland	681,43	41	3,02	76,4	19	3,5	3,6	13,17

The data presented in the table offers an economic and operational snapshot of Austria, Czechia, Hungary, and Poland for the year 2023, highlighting several key indicators. **Austria** reports a **GDP of \$519.71 billion** with a relatively **smaller population of close to 9 million**. It achieves a **Tissue and Hygiene Market revenue of \$0.95 billion** and an **Ease of Business Index score of 78.7**. The **minimum corporate tax rate** for 2024 is set at **25%**, and it has the highest labor costs among the compared nations at \$41.07 per hour. Additionally Austria boasts a high **Infrastructure Quality Index score of 3.9**, reflecting its well-developed infrastructure. This robust infrastructure supports efficient transportation, communication, and utility services. Austria also achieves the highest score of **4 in the Logistics Quality and Competence Index**, indicating superior logistics capabilities. This suggests that Austria has excellent logistics services, infrastructure, and international shipping connections, as well as favourable business environment making it a highly efficient country for business operations.

Poland, with the highest **GDP at \$681.43 billion** and the **largest population of 41 million**, significantly leads in the **Tissue and Hygiene Market**, generating **\$3.02 billion** in revenue. This economic size is complemented by a competitive Ease of Business Index score of 76.4. Poland has an Infrastructure **Quality Index score of 3.5**, indicating a fairly well-developed infrastructure system. This score reflects the country's ability to support economic growth and daily activities through its infrastructure. Poland also scores **3.6 on the Logistics Quality and Competence Index**, which signifies a strong logistics sector. Its corporate tax rate of 19%, combined with moderately low **labor costs of \$13.17** per

hour, makes Poland an attractive option for business expansion, balancing substantial market potential with operational cost efficiency.

Czechia's Tissue and Hygiene sector contributes **\$1.09 billion** to its economy, sized at \$332.02 billion with a **population of 10.5 million**. Czechia scores **76.3 on the Ease of Business Index** and has a projected **corporate tax rate of 19%** for 2024, positioning it competitively among neighboring countries. Czechia has a **moderately low Infrastructure Quality Index score of 3.0**, this indicates that while the country has a solid infrastructure, there is room for improvement to reach the standards of more developed countries. Czechia also scores **3.6 on the Logistics Quality and Competence Index**, which is relatively high especially compared to the low infrastructure score. The **labor cost in Czechia is \$17.23 per hour**, offering a balanced perspective on affordability and economic development. However Czechia doesn't excel in any metric alone and its lowest infrastructure score makes it less appealing as an option for purposes of international business expansion.

Hungary, with the **smallest GDP of \$212.61 billion** and a **population of 10.2 million**, competes closely in the **Tissue and Hygiene Market with \$1.08 billion in revenue**, at least with Czechia and Austria. However, **it has the lowest Ease of Business Index score at 73.4** and **second lowest Infrastructure Quality Index score at 3.1** and **lowest Logistics Quality & Competence score at also 3.1**. Despite these challenges, Hungary **offers the most competitive corporate tax rate at 9%** and the **lowest labor costs at \$11.26 per hour**. These factors make Hungary an appealing option for businesses prioritizing cost minimization.

This comparison highlights the significant differences in economic size, market dynamics, business environments, and labor costs across these four Central European countries. Poland's large market and balanced costs make it an exceptionally attractive option for expansion. Czechia offers a blend of affordability and development, while Hungary presents a low-cost, tax-friendly environment despite its infrastructural and regulatory challenges. Austria, with its robust infrastructure and high business ease score, is ideal for companies seeking stability and advanced market conditions. Each country offers unique opportunities and challenges, providing diverse strategic options for business expansion in the region.

3 Solution Proposal and Benefits

In the final chapter of my thesis, I will utilize the MCDM methods to evaluate the variables in context of the criteria and use the results to provide a solution proposal. I have selected three analyses for this purpose. Firstly, I will explore a **Weighted Sum Method (WSM)** followed by the **Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)** and concluding with **Analytic Hierarchy Process (AHP)**. These methodologies are chosen to ensure a comprehensive evaluation of the variables outlined in the analysis of current state section, where a comparative study of these variables has been conducted, considering factors such as population, market size, GDP, logistics and infrastructure ranking and tissue & hygiene industry-specific data. The integration of these methods will aid in deriving a balanced view through diverse analytical lenses, enhancing the decision-making process in identifying the most suitable market for expansion.

3.1 Data Acquisition for Evaluation

At the outset, it is crucial to clarify the origins of the data used in our evaluation. As shown in the analysis of current state section of the thesis, the data sourced for the purposes of this multi-criteria evaluation is based on robust, globally recognized indices and economic indicators, ensuring objectivity and comprehensiveness. The criteria chosen for this assessment include Population, GDP, Tissue & Hygiene Paper Market Revenue, Ease of Business Operations Index, Corporate Tax Rates, Infrastructure Quality Index, Logistics Quality and Competence Index, and Labor Costs.

We sourced the data from several reputable international databases to maintain consistency and reliability across the indicators:

- **Population and GDP data** were retrieved from the International Monetary Fund (IMF) and the World Bank, which provide up-to-date and historically accurate macroeconomic data.
- **Tissue & Hygiene Paper Market Revenue** information was sourced from Statista, which offers detailed and specific industry insights.

- **Ease of Business Operations Index** and **Corporate Tax Rates** were obtained from the World Bank’s annual reports, which evaluate business environments across countries.
- **Infrastructure Quality Index** and **Logistics Quality and Competence Index** data came from detailed reports by the World Bank, reflecting the logistical and infrastructural capabilities of nations.
- **Labor Costs** were gathered from the International Labour Organisation (ILO), providing an accurate reflection of the cost of labor across various economies.

Each criterion's data was critically evaluated for relevance and accuracy.

3.2 Assigning Weights to the Criteria

In this section, we will employ Saaty's Matrix to establish the weights for the criteria. Saaty’s matrix facilitates pairwise comparisons among the criteria, enabling us to derive their relative importance systematically. Through this method, we aim to capture the subjective judgments of decision-makers in a structured manner, ensuring transparency and consistency in the weighting process. For the maximum objectivity the inputs for the Saaty’s matrix were inputted directly by the CEO of the company and calculated using <https://mcdmaker-software.web.app/index.html>

3.2.1 Weights of the Criteria According to Saaty’s Matrix

In the table below we can see the weights of respective criteria which we calculated using the Saaty’s matrix method. The detailed calculation of the weights seen in the table below can be seen in Attachment 6.

Table 8 Weights of the criteria as calculated using the Saaty's matrix method(Source: Own Processing)

	Tissue & Hygiene Market Revenue	Population	GDP	Ease of Doing Business Index	Logistics Quality and Competence Index	Infrastructure Quality Index	Corporate Tax Rate	Average Hourly Labor Costs	SUM
Weights	0,33	0,23	0,16	0,1	0,07	0,05	0,04	0,02	1,0

In employing Saaty's Matrix to establish the weights for the criteria, the results reveal a varied emphasis on different economic and operational factors. **The Tissue & Hygiene Market Revenue was assigned the highest weight of 0.33**, underscoring its perceived importance in the strategic considerations of the company. This is followed by the

Population criterion, weighted at 0.23, reflecting its significance in terms of market size and potential consumer base. **GDP**, another crucial economic indicator, was given a **weight of 0.16**, indicating its role in assessing the economic strength of a region.

The Ease of Doing Business Index, which evaluates the regulatory environment, received a **weight of 0.10**, suggesting it as a moderately important factor. **Logistics Quality and Competence Index and Infrastructure Quality Index were assigned lower weights of 0.07 and 0.05, respectively**, indicating that while these factors are considered, they are not the primary focus. **The Corporate Tax Rate and Average Hourly Labor Costs received the least weights, at 0.04 and 0.02 respectively**, pointing to a lesser immediate impact on strategic decision-making compared to market potential and operational environment. The sum of these weights equals 1.0, ensuring that the allocation is normalized and proportionally distributed across the considered criteria. The consistency index amounted to 0,04 which implies consistent evaluation.

3.3 Evaluation of Variables Using Selected MCDM Methods

In this section, we will evaluate the variables by utilizing a selection of prominent Multi-Criteria Decision-Making (MCDM) methods, including Weighted Sum Model (WSM), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), and Analytic Hierarchy Process (AHP). These methods offer diverse approaches to systematically assess and rank variables based on predefined criteria, providing valuable insights into their relative importance and performance within the decision-making context. By applying these MCDM techniques, we aim to provide a comprehensive analysis of the variables under consideration, facilitating informed decision-making processes and contributing to the overall objectives of the research.

3.3.1 WSM

We have chosen the Weighted Sum Model (WSM) method to compare the criteria due to its straightforward and effective approach in handling multi-criteria decision-making problems. WSM allows for the direct aggregation of performance scores across various criteria, weighted according to their relative importance. This method is particularly useful for its simplicity and ability to provide clear, quantitative insights into which variables perform best against the established criteria, making it an ideal choice for evaluating diverse factors in a coherent and unified framework. We calculated the WSM ranking based on criteria weights established by AHP and utilising <https://mcdmaker-software.web.app/index.html>.

The provided table demonstrates the application of the Weighted Sum Method (WSM) in evaluating the suitability of four countries - Austria, Czechia, Hungary, and Poland - for business expansion from the perspective of Scandi s.r.o.. This decision-making process leverages multiple criteria, and as per the previous section we can see that each was assigned a specific weight based on its perceived importance to the expansion strategy.

Table 9 Normalized decision matrix using WSM (Source: Own processing using <https://mcdmaker-software.web.app/index.html>)

Alternatives/Criteria	GDP 0.16 +	Population 0.23 +	T & H Market Revenue 0.33 +	Ease of Doing Business 0.1 -	Corporate Tax Rate 0.04 -	Infrastructure Quality 0.05 +	Logistics Q & C 0.07 +	Labor Costs 0.02 -
Austria	519.71	9	0.95	78.7	25	3.9	4	41.07
Czechia	332.02	35.5	1.09	76.3	19	3	3.6	17.23
Hungary	212.61	35.2	1.08	73.4	9	3.1	3.1	11.26
Poland	681.43	41	3.02	76.4	19	3.5	3.6	13.17

Results

Normalized decision matrix

Alternatives/Criteria	GDP 0.16	Population 0.23	T & H Market Revenue 0.33	Ease of Doing Business 0.1	Corporate Tax Rate 0.04	Infrastructure Quality 0.05	Logistics Q & C 0.07	Labor Costs 0.02
Austria	0.763	0.220	0.315	1.000	0.360	1.000	1.000	0.274
Czechia	0.487	0.256	0.361	0.970	0.474	0.769	0.900	0.654
Hungary	0.312	0.249	0.358	0.933	1.000	0.795	0.775	1.000
Poland	1.000	1.000	1.000	0.971	0.474	0.897	0.900	0.855

The process begins by **normalizing the raw data** from the input table to allow for a fair comparison across all countries and criteria. This normalization ensures that higher values (e.g., GDP, Population) are seen as beneficial, whereas for criteria Corporate Tax Rate and Labor Costs lower values are normalized inversely.

Following normalization, each normalized value is multiplied by the respective weight of its criterion to produce a **weighted normalized decision matrix** as seen in the table below. This matrix provides a comprehensive view of each country's performance adjusted by the importance of each criterion.

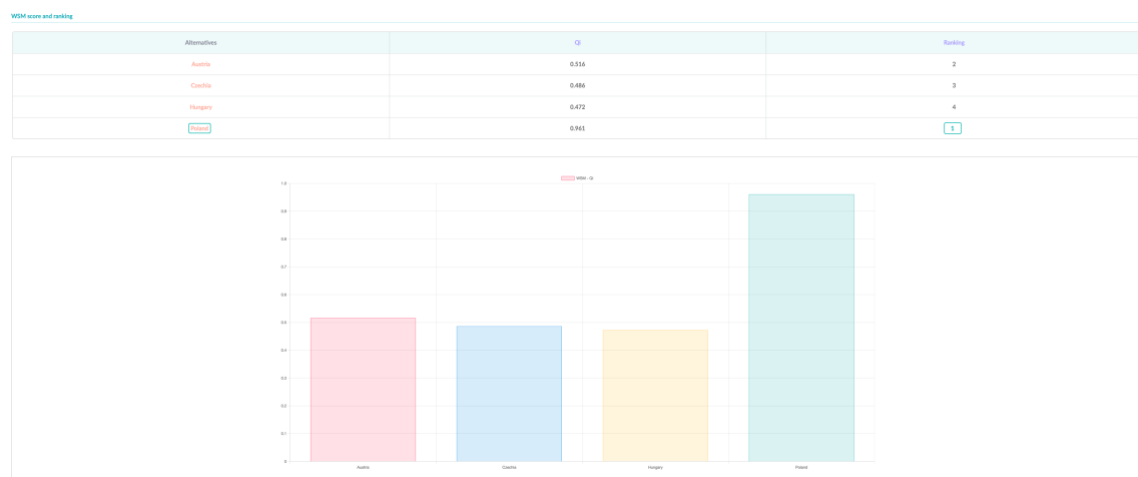
Table 10 Weighted Normalized decision matrix using WSM (Source: Own processing using <https://mcdmaker-software.web.app/index.html>)

Weighted normalized decision matrix

Alternatives/Criteria	GDP	Population	T & H Market Revenue	Ease of Doing Business	Corporate Tax Rate	Infrastructure Quality	Logistics Q & C	Labor Costs
Austria	0.122	0.050	0.104	0.100	0.014	0.050	0.070	0.005
Czechia	0.078	0.059	0.119	0.097	0.019	0.038	0.063	0.013
Hungary	0.080	0.057	0.118	0.093	0.040	0.040	0.054	0.020
Poland	0.140	0.230	0.330	0.097	0.019	0.045	0.063	0.017

The final step in WSM is to **sum the weighted scores for each country** to obtain a single score (Qi), which quantifies overall suitability based on the aggregated weighted performance across all criteria.

Table 11 WSM Score and ranking of variables (Source: Own processing using <https://mcdmaker-software.web.app/index.html>)



According to the results:

Poland scores the highest with a **Qi of 0.961**, ranking it first. This is attributed to its top scores in critical areas such as Population, T&H Market Revenue, and relatively high scores in other criteria.

Austria follows with a **Qi of 0.523**, boosted by high scores in Ease of Doing Business and Infrastructure Quality.

Czechia and **Hungary** are close contenders achieving **Qi scores of 0.492 and 0.478, respectively**, indicating competitive but slightly less favorable conditions compared to Austria and significantly less favourable compared to Poland.

This analysis, supports the selection of Poland as the most advantageous location for business expansion, aligning with strategic goals that prioritize market potential and demographic advantages. The comprehensive use of WSM ensures that the decision is grounded in a systematic evaluation of relevant factors, as it represents a robust tool for supporting strategic business decisions.

3.3.2 TOPSIS

The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method was selected as a secondary approach for comparing the criteria. TOPSIS facilitates the systematic comparison of alternatives by evaluating their proximity to the both positive ideal solution (best option) and negative ideal solution (worst option). The method's strength lies in its ability to integrate diverse criteria by assigning weights based on their relative significance, enabling a comprehensive assessment of options against benchmarks which imply from the best and worst performing variables across the selected criteria. With its clear quantitative output, TOPSIS offers valuable insights into identifying the most favorable alternatives, thus proving to be a well-suited technique for analyzing complex decision matrices effectively and efficiently. Same as for WSM we calculated the TOPSIS ranking of the variables based on criteria weights established by AHP and utilising <https://mcdmaker-software.web.app/index.html>.

In the context of my thesis, which aims to identify the optimal country for business expansion of Scandi s.r.o., the TOPSIS analysis provides a critical quantitative framework for decision-making. This analysis again evaluates Austria, Czechia, Hungary, and Poland based on the previously established criteria : GDP, Population, Tissue & Hygiene Market Revenue, Ease of Doing Business, Corporate Tax Rate, Infrastructure Quality, Logistics Quality & Capacity, and Labor Costs.

The criteria weights were already determined through a systematic approach of Saaty's matrix, reflecting the relative importance of each factor in the context of business expansion of Scandi s.r.o.

Table 12 Normalized decision matrix using TOPSIS (Source: Own processing using <https://mcdmaker-software.web.app/index.html>)

Alternatives/Criteria	GDP + 0.16	Population + 0.23	T & H Market Revenue + 0.33	Ease of Doing Business + 0.1	Corporate Tax Rate - 0.04	Infrastructure Quality + 0.05	Logistics Q & C + 0.07	Labor Costs - 0.02
Austria	519.71	9	0.95	78.7	25	3.9	4	43.07
Czechia	332.02	10.5	1.09	76.3	19	3	3.6	17.23
Hungary	212.61	10.2	1.08	73.4	9	3.1	3.1	11.26
Poland	485.43	41	3.02	76.4	19	3.5	3.6	13.17

Results

Normalized decision matrix

Alternatives/Criteria	GDP 0.16	Population 0.23	T & H Market Revenue 0.33	Ease of Doing Business 0.1	Corporate Tax Rate 0.04	Infrastructure Quality 0.05	Logistics Q & C 0.07	Labor Costs 0.02
Austria	0.55	0.20	0.27	0.52	0.66	0.57	0.56	0.66
Czechia	0.35	0.34	0.31	0.50	0.50	0.44	0.50	0.36
Hungary	0.23	0.23	0.31	0.48	0.24	0.46	0.43	0.24
Poland	0.72	0.52	0.66	0.50	0.50	0.52	0.50	0.28

The TOPSIS method involves several structured steps to ensure a thorough and unbiased evaluation. Initially, the input **data** for each country and criterion is **normalized**, creating a leveled playing field for comparison. This normalization process converts various units and scales of measurement into a **comparable range**, typically between **0 and 1**. This step is crucial as it mitigates the influence of differing scales on the decision-making process, ensuring that each **criterion is equally represented**.

Following normalization, the weighted normalized decision matrix is constructed. This matrix integrates the normalized values with the predetermined weights, reflecting the relative importance of each criterion. The weighting process ensures that **more critical factors**, such as T&H Market Revenue, exert a **greater influence** on the final outcome. This step effectively prioritizes the criteria in alignment with the strategic objectives of Scandi s.r.o.'s business expansion plans.

Table 13 Weighted Normalized decision matrix using TOPSIS method and positive ideal and negative ideal solutions (Source: Own processing using <https://mcdmaker-software.web.app/index.html>)

Weighted normalized decision matrix

Alternatives/Criteria	GDP	Population	T & H Market Revenue	Ease of Doing Business	Corporate Tax Rate	Infrastructure Quality	Logistics Q & C	Labor Costs
Austria	0.09	0.05	0.09	0.05	0.03	0.03	0.04	0.02
Czechia	0.06	0.05	0.10	0.05	0.02	0.02	0.04	0.01
Hungary	0.04	0.05	0.10	0.05	0.01	0.02	0.03	0.00
Poland	0.12	0.21	0.28	0.05	0.02	0.03	0.04	0.01

The next phase of the TOPSIS method involves the calculation of the ideal positive and negative conditions for each criterion. The positive ideal condition represents the most favorable scenario for each criterion, while the negative ideal condition represents the least favorable one.

Table 14 Positive ideal and negative ideal solutions according to TOPSIS method (Source: Own processing using <https://mcdmaker-software.web.app/index.html>)

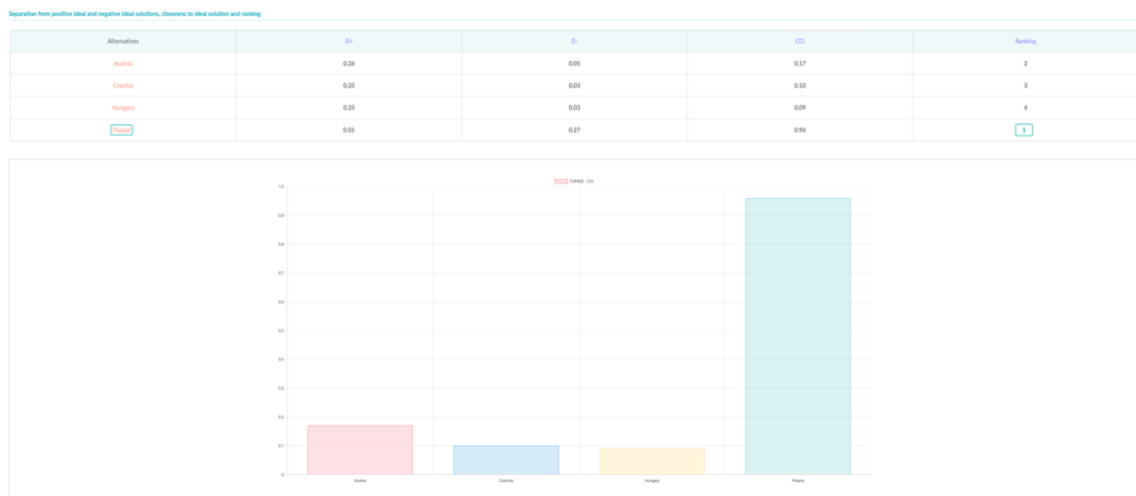
Positive ideal and negative ideal solutions

	GDP	Population	T & H Market Revenue	Ease of Doing Business	Corporate Tax Rate	Infrastructure Quality	Logistics Q & C	Labor Costs
V+	0.12	0.21	0.28	0.05	0.01	0.03	0.04	0.00
V-	0.04	0.05	0.09	0.05	0.03	0.02	0.03	0.02

These ideal conditions serve as benchmarks against which each country's performance is evaluated. By **calculating the Euclidean distance** of each country/variable's performance from positive ideal and negative ideal values and calculating the relative closeness coefficient based on the differences, the analysis quantifies the overall preference of each country/variable.

According to the TOPSIS results, **Poland is again identified as the most suitable location** for business expansion, with the **highest CCI of 0.96** which is more than **10 times the score of Hungary and almost 10 times the score of Czechia**. This outcome is primarily influenced by **Poland's significant advantages in Population and Tissue & Hygiene Market Revenue metrics** which both carry substantial weights, making it highly attractive for businesses looking to leverage a large market. Objectively speaking, Poland's large population provides a substantial customer base, which implies high potential for revenue generation in any particular sector.

Table 15 Variable scores calculated by the TOPSIS method (Source: Own processing using <https://mcdmaker-software.web.app/index.html>)



Austria comes second due to its well-balanced performance across multiple criteria. Austria excels in **Infrastructure Quality** and **Ease of Doing Business**, making it a stable and efficient environment for business operations. However, it does not match Poland’s standout features in terms of market size and potential revenue, which are crucial for Scandi s.r.o.’s expansion strategy.

Hungary and Czechia, while performing well in certain areas, did not exhibit the same level of overall attractiveness as Poland and Austria did. Despite **Hungary** achieving the **best score in Corporate Tax Rate** and favorable **Labor Costs**, its lower scores in Infrastructure Quality and other criteria with higher weights diminish its appeal. Czechia shows strong performance in Logistics Quality & Capacity, but its lower Population and T&H Market Revenue scores significantly reduce its overall suitability for expansion.

This methodical approach supports the thesis's objective to utilize robust, data-driven analysis to recommend the most strategic expansion location, ensuring that the selected country aligns with corporate goals and provides the best market opportunities. The **findings from the TOPSIS** analysis provide compelling evidence that **Poland offers the optimal combination of factors for expansion**, in line with the thesis's strategic framework for international business expansion.

3.3.3 AHP

For the purposes of this thesis I conducted the Analytic Hierarchy Process (AHP) method, by utilising the free web-based AHP solution supplied by bpmsg.com. The software, named "Multi-criteria Decision Making Using the Analytic Hierarchy Process," was an invaluable tool for solving the decision-making objectives of this thesis. This web based programme provides support for both simple and complex decision-making problems as well as enabling both individual and group sessions. The contribution of Klaus D. Goepel, the author of AHP-OS, as cited in the International Journal of the Analytic Hierarchy Process, is worthy of recognition.(26)

3.3.3.1 AHP Tissue & Hygiene Market Revenue Comparison

In the AHP analysis of the **Tissue & Hygiene Market Revenue** criterion, a **pairwise comparison matrix** was used to determine how each country compares to each other in regard to Scandi s.r.o.'s expansion incentive. The comparison of Austria, Czechia, Hungary, and Poland illustrates their relative relevance as a potential markets for expansion based on the revenue potential of their **Tissue & Hygiene** goods industries.

Table 16 Pairwise Comparison of T & H Markets Revenues using AHP method (Source: Own processing by utilizing AHP-OS from bpmsg.com)

Evaluation of Alternatives for AHP-Project

Pairwise Comparison T&H Market Revenue

6 pairwise comparison(s). Please do the pairwise comparison of all alternatives to indicate, how good they fulfill each criterion. Once finished, click *Check Consistency* to get the weights, and *Submit Priorities* to proceed.

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to T&H Market Revenue, which alternative fits better or is more preferable, and how much more on a scale 1 to 9?

	A - wrt T&H Market Revenue - or B?	Equal	How much more?
1	<input type="radio"/> Austria <input checked="" type="radio"/> Czechia	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2	<input type="radio"/> Austria <input checked="" type="radio"/> Hungary	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3	<input type="radio"/> Austria <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4	<input checked="" type="radio"/> Czechia <input type="radio"/> Hungary	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5	<input type="radio"/> Czechia <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6	<input type="radio"/> Hungary <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9

CR = 0% OK

Calculate Submit

Resulting Priorities

Cat	Priority	Rank
1 Austria	16.7%	2
2 Czechia	16.7%	2
3 Hungary	16.7%	2
4 Poland	50.0%	1

AHP-OS author: Klaus D. Goepel, BPMSG. [Contact](#) Last update: Feb 26, 2022 Rev: 172

Poland again showed a very **significant dominance** in this category, with a decisive **50.0% priority score**, demonstrating the superiority of its market potential in comparison to the other analysed countries. Austria, Czechia, and Hungary were **all equally ranked** with a **priority of 16.7%**, showing a significantly lower revenue potential of their tissue & hygiene markets when compared to Poland. This analysis indicates Poland's much greater appeal when considering market expansion based on current revenue prospects in the hygiene industry. The AHP matrix not only emphasised Poland's superior posture, but it also effectively demonstrated the equality of the other three countries in terms of market revenue alone. The consistency index of 0% implies consistent evaluation.

3.3.3.2 AHP Population Comparison

This particular application of the AHP seen in the table below was used to evaluate the **Population** criteria. The tool again utilised a grid for pairwise comparisons to determine the appropriateness of each country based on their population sizes.

Table 17 Pairwise Comparison of Populations using AHP method (Source: Own processing by utilizing AHP-OS from bpmsg.com)

Evaluation of Alternatives for AHP-Project

Pairwise Comparison Population

6 pairwise comparison(s). Please do the pairwise comparison of all alternatives to indicate, how good they fulfill each criterion. Once finished, click *Check Consistency* to get the weights, and *Submit Priorities* to proceed.

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to *Population*, which alternative fits better or is more preferable, and how much more on a scale 1 to 9?

A - wrt Population - or B?	Equal	How much more?
1 <input type="radio"/> Austria <input checked="" type="radio"/> Czechia <input checked="" type="radio"/> 1	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2 <input type="radio"/> Austria <input checked="" type="radio"/> Hungary <input checked="" type="radio"/> 1	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3 <input type="radio"/> Austria <input checked="" type="radio"/> Poland <input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4 <input type="radio"/> Czechia <input checked="" type="radio"/> Hungary <input checked="" type="radio"/> 1	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5 <input type="radio"/> Czechia <input checked="" type="radio"/> Poland <input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6 <input type="radio"/> Hungary <input checked="" type="radio"/> Poland <input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
CR = 0% OK		
<input type="button" value="Calculate"/>		<input type="button" value="Submit"/>

Resulting Priorities

Cat	Priority	Rank
1 Austria	14.3%	2
2 Czechia	14.3%	2
3 Hungary	14.3%	2
4 Poland	57.1%	1

Once again **Poland** significantly stood out in this assessment, achieving a priority score of **57.1%**, demonstrating a strong demographic advantage in comparison to the other countries. In contrast, **Austria, Czechia, and Hungary** all achieved the same score of **14.3%**, implying similar levels of demographic potential. This data indicates very strong correlation between the populations of the variables and the sizes of their respective T&H markets. The AHP framework played a crucial role in elucidating Poland's dominant position while also confirming the demographic parity of the other three states. The consistency index of 0% implies consistent evaluation.

3.3.3.3 AHP GDP Comparison

Analytic Hierarchy Process (AHP) was further utilized to evaluate the economic performance of the variables based on the **GDP** criterion. This assessment was again conducted by the use of a pairwise comparison matrix. The matrix was created with the purpose of identifying the country whose GDP measurements most closely correspond to economic growth objectives.

Table 18 Pairwise Comparison of GDP using AHP method (Source: Own processing by utilizing AHP-OS from bpmsg.com)

Evaluation of Alternatives for AHP-Project

Pairwise Comparison GDP

6 pairwise comparison(s). Please do the pairwise comparison of all alternatives to indicate, how good they fulfill each criterion. Once finished, click *Check Consistency* to get the weights, and *Submit Priorities* to proceed.

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to GDP, which alternative fits better or is more preferable, and how much more on a scale 1 to 9?

	A - wrt GDP - or B?	Equal	How much more?
1	<input checked="" type="radio"/> Austria <input type="radio"/> Czechia	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2	<input checked="" type="radio"/> Austria <input type="radio"/> Hungary	<input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input checked="" type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3	<input type="radio"/> Austria <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4	<input checked="" type="radio"/> Czechia <input type="radio"/> Hungary	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5	<input type="radio"/> Czechia <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6	<input type="radio"/> Hungary <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input checked="" type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9

CR = 3.8% OK

Calculate Submit

Resulting Priorities

Cat	Priority	Rank
1 Austria	32.5%	2
2 Czechia	14.9%	3
3 Hungary	6.7%	4
4 Poland	46.0%	1

AHP-OS author: Klaus D. Goepel, BPMMSG. [Contact](#) Last update: Feb 26, 2022 Rev: 172

Based on the inputs, **Poland** was again identified as the highest achiever, with a priority score of **46.0%**, demonstrating its strong economic position in comparison to the other countries. **Austria** had a notable score of **32.5%**, indicating its robust economic potential, only slightly lower than Poland and quite impressive considering its much smaller population. **Czechia and Hungary** were assigned priority scores of **14.9%** and **6.7%** respectively, indicating that they play lesser roles in the analysed economic landscape. The research conducted using the AHP matrix not only confirms Poland's dominant economic prowess but also demonstrates a distinct ranking of the other countries based on their GDP. An in-depth evaluation like this helps inform strategic decision-making by emphasising the comparative economic capabilities of each country. The consistency index of 3,8% implies consistent evaluation.

3.3.3.4 AHP Ease of Doing Business Comparison

A further implementation of the Analytic Hierarchy Process (AHP) was used to evaluate the variables based on the **Ease of Doing Business** criterion. This evaluation again involved the use of a structured pairwise comparison matrix.

Table 19 Pairwise Comparison of EOBI Scores using AHP method (Source: Own processing by utilizing AHP-OS from bpmmsg.com)

Evaluation of Alternatives for AHP-Project

Pairwise Comparison Ease of Doing Business

6 pairwise comparison(s). Please do the pairwise comparison of all alternatives to indicate, how good they fulfill each criterion. Once finished, click *Check Consistency* to get the weights, and *Submit Priorities* to proceed.

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to *Ease of Doing Business*, which alternative fits better or is more preferable, and how much more on a scale 1 to 9?

	A - wrt Ease of Doing Business - or B?	Equal	How much more?
1	<input checked="" type="radio"/> Austria <input type="radio"/> Czechia	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2	<input checked="" type="radio"/> Austria <input type="radio"/> Hungary	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3	<input checked="" type="radio"/> Austria <input type="radio"/> Poland	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4	<input checked="" type="radio"/> Czechia <input type="radio"/> Hungary	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5	<input type="radio"/> Czechia <input checked="" type="radio"/> Poland	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6	<input type="radio"/> Hungary <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9

CR = 1.7% OK

Calculate

Resulting Priorities

Cat		Priority	Rank
1	Austria	41.8%	1
2	Czechia	22.3%	3
3	Hungary	11.0%	4
4	Poland	25.0%	2

AHP-OS author: Klaus D. Goepel, BPMMSG. [Contact](#) Last update: Feb 26, 2022 Rev: 172

Austria emerged as the **frontrunner** in this examination, with a **prominent priority score of 41.8%**, signifying that it offers the most favourable environment for conducting business activities. **Poland** achieved the **second** position with a significant **25.0%** rating, indicating a significantly less favourable business environment in comparison to Austria. **Czechia** came in **third** with a score of **22.3%** only slightly lagging behind Poland and **Hungary** ranked **fourth**, with a rating of **11.0%**, indicating the least business friendly environment. By evaluating the business climates in this way, a more knowledgeable choices can be made when choosing between potential markets for international expansion. This assessment is in line with the overall approach of examining demographic and economic aspects to gain a comprehensive understanding of the economic potential of each country. The consistency index of 1,7% implies consistent evaluation.

3.3.3.5 AHP Logistic Quality and Competence Comparison

Following is the section of the Analytic Hierarchy Process (AHP) which examines the **Logistic Quality and Competence (Q & C)**, again using a pairwise comparison matrix was utilised to thoroughly assess the four variables.

Table 20 Pairwise Comparison of Logistic Q & C using AHP method (Source: Own processing by utilizing AHP-OS from bpmsg.com)

Evaluation of Alternatives for AHP-Project

Pairwise Comparison Logistic Q & C

6 pairwise comparison(s). Please do the pairwise comparison of all alternatives to indicate, how good they fulfill each criterion. Once finished, click *Check Consistency* to get the weights, and *Submit Priorities* to proceed.

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to Logistic Q & C, which alternative fits better or is more preferable, and how much more on a scale 1 to 9?

A - wrt Logistic Q & C - or B?	Equal	How much more?
1 <input checked="" type="radio"/> Austria <input type="radio"/> Czechia	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2 <input checked="" type="radio"/> Austria <input type="radio"/> Hungary	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3 <input checked="" type="radio"/> Austria <input type="radio"/> Poland	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4 <input checked="" type="radio"/> Czechia <input type="radio"/> Hungary	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5 <input checked="" type="radio"/> Czechia <input type="radio"/> Poland	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6 <input type="radio"/> Hungary <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9

CR = 0.4% OK

Calculate

Resulting Priorities

Cat	Priority	Rank
1 Austria	42.4%	1
2 Czechia	22.7%	2
3 Hungary	12.2%	4
4 Poland	22.7%	2

The objective of this examination was to determine the country with the most effective and proficient logistics infrastructure. According to the AHP tool, **Austria** has the highest ranking with a priority score of **42.4%**. This indicates that Austria has excellent logistical capabilities which support company operations and commerce. **Czechia and Poland**, both rank second with **equal scores of 22.7%**, demonstrating modestly developed logistical competencies. **Hungary**, with a score of **12.2%**, was ranked the **lowest**, suggesting that its logistical facilities may be less developed and efficient in comparison to the other countries evaluated in this analysis. The consistency index of 1,7% implies consistent evaluation.

3.3.3.6 AHP Infrastructure Quality Comparison

This part, utilizes the Analytic Hierarchy Process (AHP) to compare variables against each other based on their **Infrastructure Quality** index.

Table 21 Pairwise Comparison of Infrastructure Quality using AHP method (Source: Own processing by utilizing AHP-OS from bpmsg.com)

Evaluation of Alternatives for AHP-Project

Pairwise Comparison Infrastructure Quality

6 pairwise comparison(s). Please do the pairwise comparison of all alternatives to indicate, how good they fulfill each criterion. Once finished, click *Check Consistency* to get the weights, and *Submit Priorities* to proceed.

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to Infrastructure Quality, which alternative fits better or is more preferable, and how much more on a scale 1 to 9?

	A - wrt Infrastructure Quality - or B?	Equal	How much more?
1	<input checked="" type="radio"/> Austria <input type="radio"/> Czechia	<input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2	<input checked="" type="radio"/> Austria <input type="radio"/> Hungary	<input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3	<input checked="" type="radio"/> Austria <input type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4	<input type="radio"/> Czechia <input checked="" type="radio"/> Hungary	<input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5	<input type="radio"/> Czechia <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6	<input type="radio"/> Hungary <input checked="" type="radio"/> Poland	<input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
CR = 5.3% OK			
Calculate		Submit	

Resulting Priorities

Cat	Priority	Rank
1 Austria	52.3%	1
2 Czechia	8.9%	4
3 Hungary	12.6%	3
4 Poland	26.1%	2

AHP-OS author: Klaus D. Goepel, BPMSG. [Contact](#) Last update: Feb 26, 2022 Rev: 172

The emphasis on infrastructure is important because a strong infrastructure background is essential for the operational needs of a expanding business. This review adds to previous analyses of GDP, Ease of Doing Business, and other economic variables by offering a comprehensive picture of the logistical and operational backbone accessible in these countries.

Austria leads this research with a **priority score of 52.3%**, suggesting that it has top-tier infrastructure capable of supporting expanding company activities and ensuring long-term growth. **Poland, ranked second with a 26.1% priority score**, has significant infrastructure capabilities, however not as vast as Austria's. **Hungary and Czechia**, on the other hand, have lower infrastructure development scores (**12.6% and 8.9%**, respectively), which may have negative impact on corporate expansion. The consistency index of 5,3% implies consistent evaluation. This infrastructure study is critical to the overall context of my thesis, which seeks to determine the best country for firm expansion. The thesis creates a strong decision-making framework by combining the findings of this infrastructure quality study with earlier evaluations of economic performance and the business environment. This multi-criteria approach ensures that the recommended expansion strategy is not only in line with economic prospects, but also takes into account practical aspects of the underlying infrastructure. This methodology helps to identify a strategically good and operationally viable country for expanding business activities of Scandi s.r.o..

3.3.3.7 AHP Corporate Tax Rates Comparison

In the coming section of the Analytic Hierarchy Process (AHP) the emphasis changes to comparing **Corporate Tax Rates** between the selected countries.

Table 22 Pairwise Comparison of Corporate Tax Rates using AHP method (Source: Own processing by utilizing AHP-OS from bpmsg.com)

Evaluation of Alternatives for AHP-Project

Pairwise Comparison Corporate Tax Rate

6 pairwise comparison(s). Please do the pairwise comparison of all alternatives to indicate, how good they fulfill each criterion. Once finished, click *Check Consistency* to get the weights, and *Submit Priorities* to proceed.

AHP Scale: 1- Equal importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to Corporate Tax Rate, which alternative fits better or is more preferable, and how much more on a scale 1 to 9?

A - wrt Corporate Tax Rate - or B?	Equal	How much more?
1 <input type="radio"/> Austria <input checked="" type="radio"/> Czechia <input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2 <input type="radio"/> Austria <input checked="" type="radio"/> Hungary <input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3 <input type="radio"/> Austria <input checked="" type="radio"/> Poland <input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4 <input type="radio"/> Czechia <input checked="" type="radio"/> Hungary <input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5 <input type="radio"/> Czechia <input checked="" type="radio"/> Poland <input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6 <input checked="" type="radio"/> Hungary <input type="radio"/> Poland <input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
CR = 2.2% OK		
<input type="button" value="Calculate"/>		<input type="button" value="Submit"/>

Resulting Priorities

Cat	Priority	Rank
1 Austria	11.7%	4
2 Czechia	19.4%	2
3 Hungary	49.5%	1
4 Poland	19.4%	2

AHP-OS author: Klaus D. Goepel, BPMSG. [Contact](#) Last update: Feb 26, 2022 Rev: 172

Corporate tax rates are an important consideration for organisations looking to expand since they have a direct impact on profitability and operating costs. This comparison seeks to establish which country has the most favourable fiscal climate for firms wishing to expand. According to the comparison, **Hungary has the most advantageous corporate tax environment, with a priority score of 49.5%**, making it an appealing destination for enterprises looking to reduce their tax bills. **Poland and Czechia come second closely with respective priority scores of 19.4% each.** In contradiction to its strong infrastructure and favourable economic circumstances, and possibly in connection to them, **Austria**

ranks last in terms of corporate tax attractiveness with a **score of 11.7%**, indicating a rather high tax rate that may discourage business development efforts. The consistency index of 2,2% implies consistent evaluation.

3.3.3.8 AHP Labor Costs Comparison

In the last segment of the Analytic Hierarchy Process (AHP) used in my thesis, the evaluation will focus on **Labor Costs** across the four countries which can be perceived critical for understanding operational expense implications in the context of corporate expansion. Using the pairwise comparison approach again, we now assess which country has the most favorable labor cost environment.

Table 23 Pairwise Comparison of Labor Costs using AHP method (Source: Own processing by utilizing AHP-OS from bpmsg.com)

Pairwise Comparison AHP-OS

Evaluation of Alternatives for AHP-Project

Pairwise Comparison Labor Costs

6 pairwise comparison(s). Please do the pairwise comparison of all alternatives to indicate, how good they fulfill each criterion. Once finished, click *Check Consistency* to get the weights, and *Submit Priorities* to proceed.

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2,4,6,8 values in-between).

With respect to Labor Costs, which alternative fits better or is more preferable, and how much more on a scale 1 to 9?

A - wrt Labor Costs - or B?	Equal	How much more?
1 <input type="radio"/> Austria <input checked="" type="radio"/> Czechia <input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	
2 <input type="radio"/> Austria <input checked="" type="radio"/> Hungary <input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input checked="" type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	
3 <input type="radio"/> Austria <input checked="" type="radio"/> Poland <input type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input checked="" type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	
4 <input type="radio"/> Czechia <input checked="" type="radio"/> Hungary <input type="radio"/> 1	<input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	
5 <input type="radio"/> Czechia <input checked="" type="radio"/> Poland <input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	
6 <input checked="" type="radio"/> Hungary <input type="radio"/> Poland <input type="radio"/> 1	<input checked="" type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9	
CR = 2.4% OK		
<input type="button" value="Calculate"/>	<input type="button" value="Submit"/>	

Resulting Priorities

Cat	Priority	Rank
1 Austria	5.9%	4
2 Czechia	17.6%	3
3 Hungary	47.6%	1
4 Poland	28.9%	2

AHP-OS author: Klaus D. Goepel, BPMSG. [Contact](#) Last update: Feb 26, 2022 Rev: 172

This comparative analysis is integral to determining where lower operational costs can enhance investment returns and business sustainability. The results from this analysis highlight **Hungary** as the most **cost-effective** option with the highest **priority score of 47.6%**, making it an attractive choice for minimizing labor expenses. **Poland** is seen as the **second most advantageous** in terms of labor costs with a score of **28.9%**. **Czechia** follows **third** with a score of **17.6%** And finally **Austria** ranks **last** with a score of **5.9%**. This labor cost evaluation complements the previous analyses of GDP, corporate tax rate, and infrastructure quality, providing a comprehensive view of the economic landscape that businesses may enter upon expansion. The consistency index of 2,4% implies consistent evaluation.

3.3.3.9 AHP Conclusion

The **conclusion** of Analytic Hierarchy Process (AHP) again utilizes weights previously determined using Saaty's method.

Table 24 Evaluation of Variables using AHP Method (Source: Own processing by utilizing AHP-OS from bpmmsg.com)

Evaluation of Alternatives for AHP-Project

Compare alternatives with respect to criteria (click on AHP). How good is the fit of alternatives with each criterion?

Project Structure

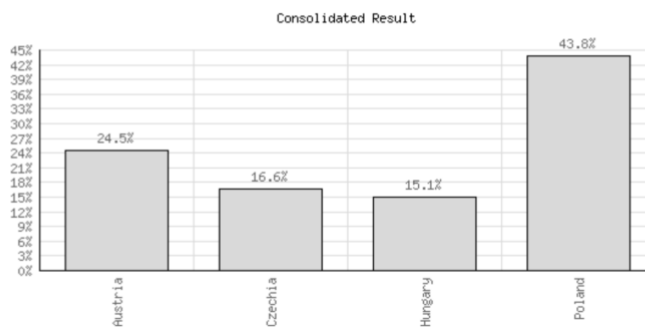
Hierarchy with Alternatives								
No	Node	Criterion	Gib Prio.	Compare	Austria	Czechia	Hungary	Poland
1.	AHP-Project	T&H Market Revenue	33.1%	AHP	0.167	0.167	0.167	0.500
2.		Population	23.1%	AHP	0.143	0.143	0.143	0.571
3.		GDP	15.8%	AHP	0.325	0.149	0.067	0.460
4.		Ease of Doing Business	10.7%	AHP	0.418	0.223	0.110	0.250
5.		Logistic Q & C	7.2%	AHP	0.424	0.227	0.122	0.227
6.		Infrastructure Quality	4.9%	AHP	0.523	0.089	0.126	0.261
7.		Corporate Tax Rate	3.4%	AHP	0.117	0.194	0.495	0.194
8.		Labor Costs	2%	AHP	0.059	0.176	0.476	0.289
Total weight of alternatives:					0.245	0.166	0.151	0.438
All evaluations are completed.								

As this method provides a systematic and quantitative approach to assign relative importance to the selected criteria which is relevant for the purposes of this thesis. The

comprehensive Project Structure in the AHP analysis compares again compares the selected countries/variables across the established criteria

The detailed matrix illustrates how each country fares across these categories, employing the weights to emphasize the criteria deemed most significant to the expansion decision. **Poland**, for instance, once again demonstrates **strong potential** in **Market Revenue** and **Population**, indicating a large and thriving market. **Hungary** again scored favorably in terms of **Corporate Tax Rate** and **Labor Costs**, suggesting it offers cost efficiencies. Conversely, **Austria** again shows strengths in terms of **Ease of Doing Business Index** and **Infrastructure Quality**, which are indicative of supportive business environments. The elements of the AHP method were compiled and the method was ultimately applied to determine the optimal country for expansion based on combining the variables scores against selected criteria, as evidenced by the detailed results and rankings depicted in the provided charts.

Result for Alternatives



Priorities and ranking

Cat	Priority	Rank
1 Austria	24.5%	2
2 Czechia	16.6%	3
3 Hungary	15.1%	4
4 Poland	43.8%	1

AHP-OS author: Klaus D. Goepel, BPMSG. [Contact](#) Last update: Mar 01, 2022 Rev: 178

Chart 16 Summary of AHP Method Results (Source: Own processing by utilizing AHP-OS from bpmsg.com)

Poland again emerged as the **top-ranked alternative**, securing a substantial lead with a consolidated result of **43.8% according to the AHP analysis**. This outcome was significantly influenced by its **high scores in GDP, Ease of Doing Business**, and notably, **Tissue & Hygiene Market Revenue** where it significantly outperformed other countries. **Austria** followed as the **second** preference with a **total preference score of 24.5%**, demonstrating robust infrastructure and competitive corporate tax rates which are pivotal for business operations. **Czechia and Hungary** were ranked **third and fourth** with total scores of **16.6% and 15.1%**, respectively. Czechia's moderate performance across various criteria, particularly in Population and GDP, placed it slightly above **Hungary**, which, despite a lower ranking, showed potential in specific areas like **Labor Costs** and **Corporate Tax Rate**. This analytic exercise not only **highlights Poland** as the most favorable market for expansion due to its balanced advantages across multiple metrics but also underscores the utility of AHP in providing a structured, quantifiable framework for making complex strategic decisions. The method's ability to synthesize diverse inputs into a coherent ranking system offers invaluable insights for strategic planning and resource allocation.

3.4 Summary of MCDM Methods

As per the table below, we have carefully examined the rankings of four countries - Austria, Czechia, Hungary, and Poland based on the selected multiple criteria by the three distinct MCDM methods.

Table 25 Summary of Results of Chosen MCDM Methods (Source: Own Processing)

WSM Results				
Variables	Qi	Ranking		
Austria	0,523	2		
Czechia	0,492	3		
Hungary	0,478	4		
Poland	0,961	1		
AHP Results				
Alternatives	Priority	Ranking		
Austria	0,245	2		
Czechia	0,166	3		
Hungary	0,151	4		
Poland	0,438	1		
TOPSIS Results				
Alternatives	CCi	Ranking	D+	D-
Austria	0,17	2	0,15	0,05
Czechia	0,1	3	0,13	0,07
Hungary	0,09	4	0,13	0,09
Poland	0,96	1	0,04	0,15

3.4.1 WSM Results

- **Poland** leads the list with the highest score of 0.961, indicating it is the most favorable option for business expansion based on the Weighted Sum Model (WSM).
- **Austria** follows with a score of 0.523, securing the 2nd position, reflecting a strong but not leading performance.
- **Czechia** is close behind Austria with a score of 0.492, placing it 3rd, showing moderate attractiveness for expansion.
- **Hungary** ranks lowest with a score of 0.478, indicating it is the least favorable option among the considered countries.

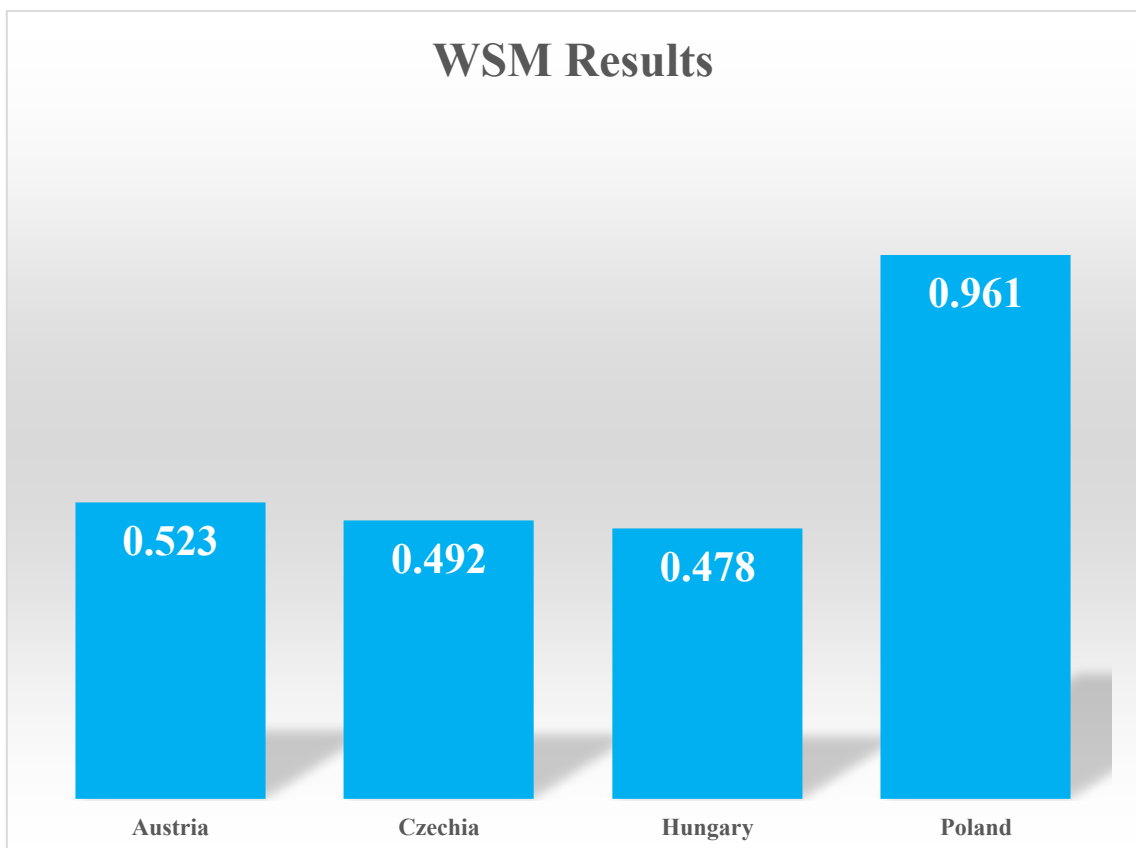


Chart 17 WSM Results Chart (Source: Own Processing)

3.4.2 AHP Results

- **Poland** again tops the chart with a significant priority value of 0.438 and is ranked 1st.
- **Austria** receives a priority value of 0.245, placing it 2nd again, indicating a higher preference relative to Czechia and Hungary.
- **Czechia** is placed 3rd with a priority of 0.166, showing a better performance compared to Hungary but not as strong as Poland or Austria.
- **Hungary** comes last with a priority of 0.151, again reflecting lowest attractiveness according to the Analytic Hierarchy Process (AHP).

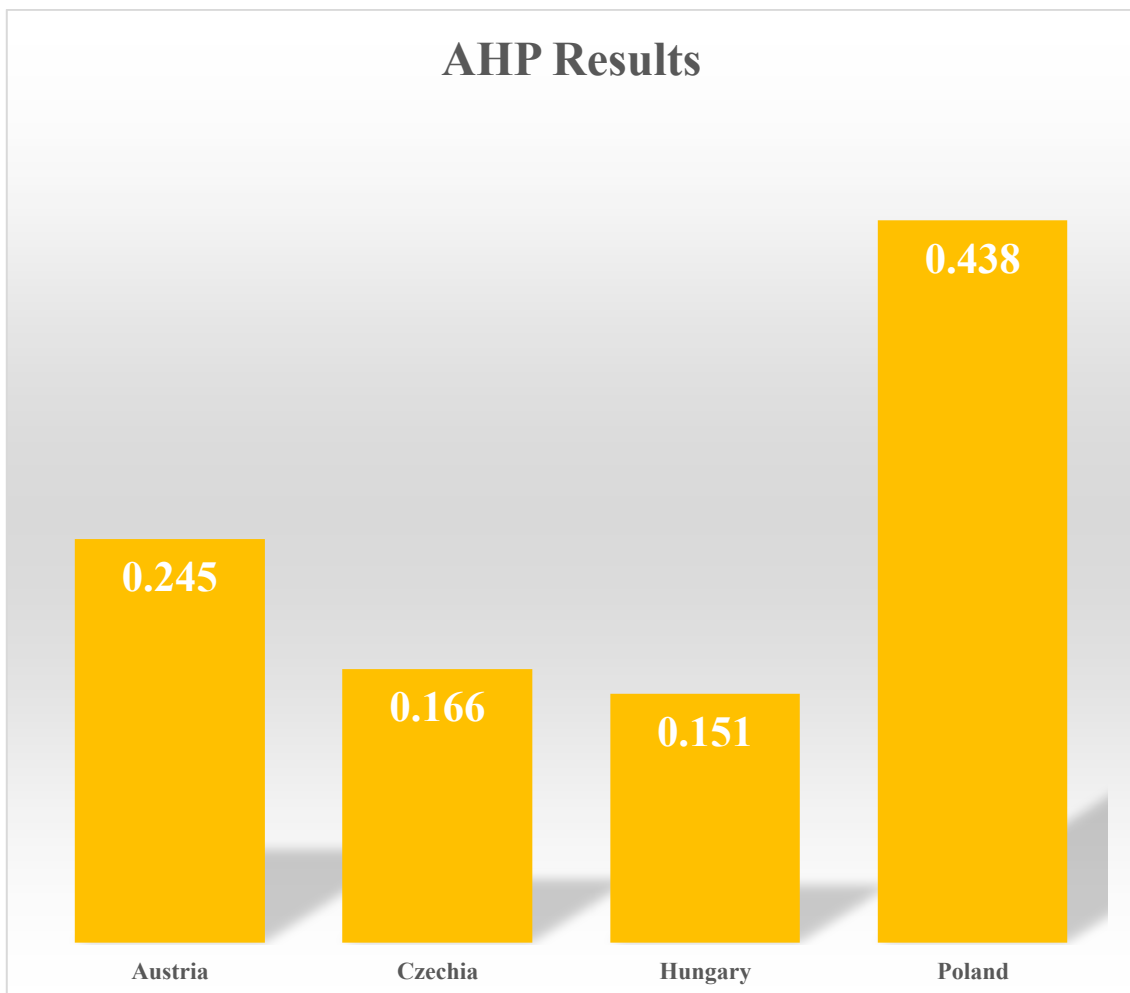


Chart 18 AHP Results Chart (Source: Own Processing)

3.4.3 TOPSIS Results

- **Poland** continues to maintain its dominance with a CCI value of 0.96 and is ranked 1st, demonstrating strong proximity to the ideal solution.
- **Austria** is ranked 2nd with a CCI of 0.17.
- **Czechia** again places 3rd with a CCI of 0.1.
- **Hungary** is again ranked last with a CCI of 0.09.

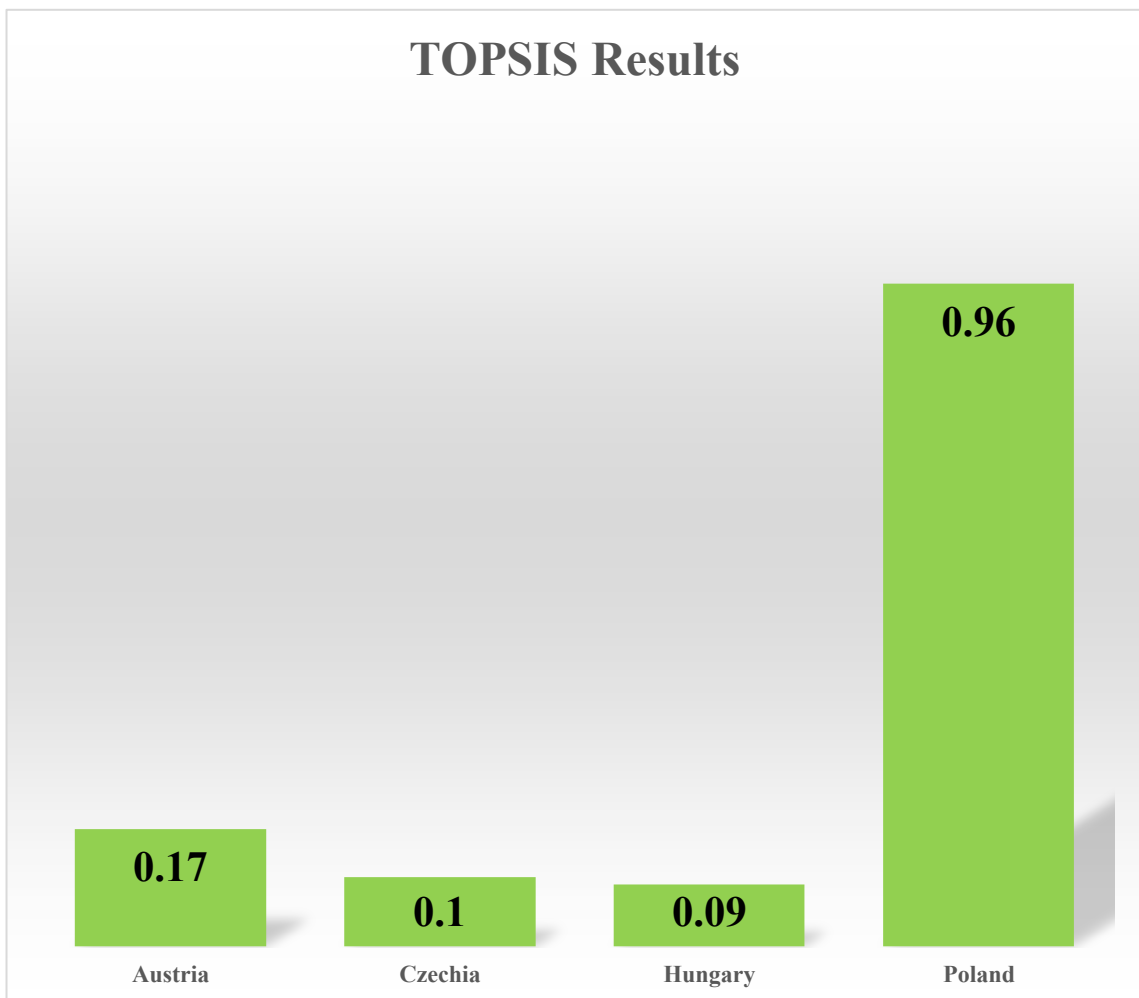


Chart 19 TOPSIS Results Chart (Source: Own Processing)

3.4.4 Results of MCDM Methods - Commentary

Poland's consistent ranking as **the top choice across all methods** underscores its robust performance in various decision-making frameworks. This is reflected in its **high GDP**, **large population** and significant **market size** in the **Tissue and Hygiene market** which were the **criteria assigned with most weight** while also having competitive ease of doing business score, and moderately low labor costs.

Austria consistently ranks **2nd**, demonstrating a **strong business environment** with **competitive infrastructure** and **ease of doing business scores**, despite **higher labor costs** and **corporate tax rates**.

Czechia consistently ranks **3rd across all methods**. Its moderate labor costs and competitive business environment make it a viable option, though not as strong as Poland or Austria.

Hungary consistently **ranks last in all methods**. Despite its **low labor costs and tax rates**, its lower scores in business environment and infrastructure quality and also average/below average scores in **Population** , **GDP** and **Tissue and Hygiene market** criteria diminish its appeal.

This consistency highlights Poland's strong position and suggests that different Multi-Criteria Decision-Making (MCDM) techniques yield similar outcomes. Therefore, while the choice of decision-making method is important and should be informed by the specific context and criteria of the decision, in this case, it appears to have no impact on the final ranking of variables.

3.5 Recommendation

Therefore Based on the synthesis of the three analyses, it is recommended that Scandi s.r.o. **prioritize Poland** for its expansion efforts due to its strong economic indicators and business-friendly environment. Poland's large market size and potential for high revenue generation align well with the company's growth objectives.

Austria should be considered as a **secondary option**, particularly for its stable business environment and advanced infrastructure, which could support long-term strategic initiatives.

Czechia offers a balanced alternative and could be suitable for phased expansion plans, leveraging its moderate costs and reliable market conditions.

Hungary, while offering cost benefits, may require further assessment and strategic planning to mitigate the risks associated with its lower infrastructure quality and regulatory challenges. It may be more suitable for specific cost-driven projects rather than a broad expansion strategy.

In conclusion, the consistent outcomes across different MCDM methods reinforce the reliability of the analysis, providing a robust basis for strategic decision-making in selecting the best country for Scandi s.r.o.'s business expansion.

3.6 Benefits

For Scandi s.r.o., the implementation of Multi-Criteria Decision-Making (MCDM) methodologies specifically the one discussed and performed in this thesis - Weighted Sum Model (WSM), Analytical Hierarchy Process (AHP), and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) offers substantial benefits for informed decision-making in international expansion as well as possibility to utilize this model in other areas of strategic decision making. These techniques facilitate a comprehensive evaluation of scenarios with multiple conflicting criteria, which is critical for robust decision-making.

By applying these MCDM methods to rank potential countries for expansion, Scandi s.r.o. gains a detailed understanding of each country's advantages and disadvantages. This approach ensures a thorough consideration of all relevant criteria, such as market size, regulatory environment, logistics capabilities, and labor costs. For instance, through these methods, we identified Poland as the most suitable country for expansion based on pre-defined criteria, ensuring this decision was supported by rigorous quantitative analysis.

A major advantage of incorporating these MCDM frameworks within the company's decision-making process is the potential for significant cost savings. Conducting this analysis as part of a master's thesis allows Scandi s.r.o. to leverage academic resources and expertise, avoiding the need for outsourcing this complex analysis to external consultants. This internal analysis not only reduces immediate costs associated with hiring external experts but also serves as a foundation for a sustainable model for ongoing strategic assessments which can be used for other areas of strategic planning and decision making within the company. Utilizing this model internally can enhance Scandi s.r.o.'s strategic autonomy, empowering the company to make independent, data-driven decisions.

Conclusion

In conclusion, this thesis has thoroughly examined three Multi-Criteria Decision-Making (MCDM) methodologies-Weighted Sum Model (WSM), Analytical Hierarchy Process (AHP), and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). Notably, all methods yielded the same results, underscoring the reliability of MCDM techniques in complex decision-making processes.

The findings consistently identified Poland as the optimal choice for expansion due to its high GDP, large population, significant Tissue and Hygiene market size, competitive ease of doing business score, and moderately low labor costs. Austria ranked second, offering a strong business environment and competitive infrastructure, despite higher labor costs and corporate tax rates. Czechia, ranked third, provides a balanced option with moderate costs and a competitive business environment. Hungary, ranked last, has low labor costs and tax rates but is hindered by lower scores in business environment, infrastructure quality, population, GDP, and market size.

This consistency across different MCDM methods highlights Poland's strong position and suggests that method selection does not impact the final rankings in this case.

Furthermore, the thesis demonstrates that adopting MCDM methodologies can provide strategic and cost benefits, enhancing decision-making processes by integrating multiple criteria. The study's consistent outcomes across methods reinforce the reliability of these tools, offering a robust foundation for strategic business expansion decisions.

As businesses face increasingly complex environments, the role of MCDM tools will become more critical. Future research could explore integrating MCDM with other frameworks or applying it to different business decisions. This thesis provides a solid theoretical and practical basis for effective decision-making, advocating for the broader adoption of MCDM in strategic business planning to improve performance and competitive advantage.

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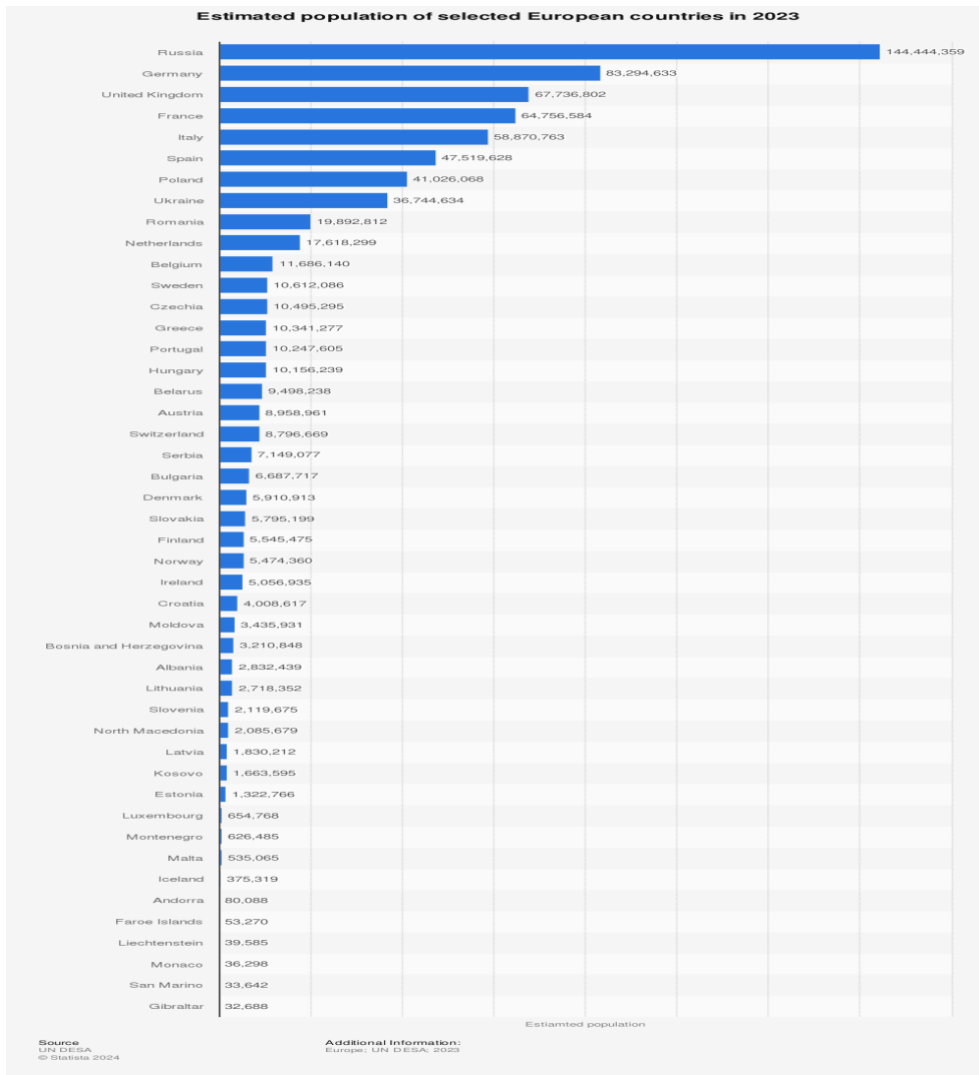
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Attachments

Attachment 1 Estimated population of selected European countries in 2023 (Source: 18)



Attachment 2 Ease of doing business index score in selected European countries in 2020 (Source:21)

Ease of doing business index score in European countries 2020	
Austria	78,70
Poland	76,40
Czechia	76,30
Hungary	73,40

Attachment 3 Corporate Tax Rates in Selected European Countries (Source: 21)

Sources	Statista Market Insights										
Most recent	03/01/2024										
Notes	Based on IMF, World Bank, UN and Eurostat										
TAX RATES (CORPORATE TAX RATE)											
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Slovakia	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Austria	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0
Czechia	19,0	19,0	19,0	19,0	19,0	19,0	19,0	19,0	19,0	19,0	19,0
Hungary	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
Poland	19,0	19,0	19,0	19,0	19,0	19,0	19,0	19,0	19,0	19,0	19,0

Attachment 4 Intrastructure Score and Grouped Rank of Selected Countries (Source: 22)

Country	Infrastructure Score	Infrastructure Grouped Rank
Austria	3,9	16
Poland	3,5	39
Czech Republic	3,0	55
Hungary	3,1	52

Attachment 5 Logistics Quality and Competence Score and Grouped Rank of Selected Countries (Source: 22)

Country	Logistics Competence and Quality Score	Logistics Competence and Quality Grouped Rank
Austria	4,0	11
Poland	3,6	33
Czech Republic	3,6	33
Hungary	3,1	57

Attachment 6 Calculation of criteria weights using Saaty's Matrix (Source : Own Processing)

Criteria	Tissue & Hygiene Market Revenue (T&H MR)	Population (Pop)	GDP	Ease of Business Index (EoBI)	Logistics Quality and Competence Index (LQ&C)	Infrastructure Quality Index (IQI)	Corporate Tax Rate (CTR)	Average Hourly Labor Costs (AHLCL)
Tissue & Hygiene Market Revenue (T&H MR)	1	2	3	4	5	6	7	9
Population (Pop)	1/2	1	2	3	4	5	6	8
GDP	1/3	1/2	1	2	3	4	5	7
Ease of Business Index (EoBI)	1/4	1/3	1/2	1	2	3	4	6
Logistics Quality and Competence Index (LQ&C)	1/5	1/4	1/3	1/2	1	2	3	5
Infrastructure Quality Index (IQI)	1/6	1/5	1/4	1/3	1/2	1	2	4
Corporate Tax Rate (CTR)	1/7	1/6	1/5	1/4	1/3	1/2	1	3
Average Hourly Labor Costs (AHLCL)	1/9	1/8	1/7	1/6	1/5	1/4	1/3	1
Normalized pairwise comparison matrix								
Criteria	Tissue & Hygiene Market Revenue (T&H MR)	Population (Pop)	GDP	Ease of Business Index (EoBI)	Logistics Quality and Competence Index (LQ&C)	Infrastructure Quality Index (IQI)	Corporate Tax Rate (CTR)	Average Hourly Labor Costs (AHLCL)
Tissue & Hygiene Market Revenue (T&H MR)	0,37	0,44	0,4	0,36	0,31	0,28	0,25	0,21
Population (Pop)	0,18	0,22	0,27	0,27	0,25	0,23	0,21	0,19
GDP	0,12	0,11	0,13	0,18	0,19	0,18	0,18	0,16
Ease of Business Index (EoBI)	0,09	0,07	0,07	0,09	0,12	0,14	0,14	0,14
Logistics Quality and Competence Index (LQ&C)	0,07	0,05	0,04	0,04	0,06	0,09	0,11	0,12
Infrastructure Quality Index (IQI)	0,06	0,04	0,03	0,03	0,03	0,05	0,07	0,09
Corporate Tax Rate (CTR)	0,05	0,04	0,03	0,02	0,02	0,02	0,04	0,07
Average Hourly Labor Costs (AHLCL)	0,04	0,03	0,02	0,01	0,01	0,01	0,01	0,02
Priority vector								
Criteria	WI							
Tissue & Hygiene Market Revenue (T&H MR)	0,37							
Population (Pop)	0,23							
GDP	0,16							
Ease of Business Index (EoBI)	0,10							
Logistics Quality and Competence Index (LQ&C)	0,07							
Infrastructure Quality Index (IQI)	0,05							
Corporate Tax Rate (CTR)	0,04							
Average Hourly Labor Costs (AHLCL)	0,02							
Weighted priority vector								
Criteria	WI							
Tissue & Hygiene Market Revenue (T&H MR)	2,8							
Population (Pop)	1,96							
GDP	1,34							
Ease of Business Index (EoBI)	0,91							
Logistics Quality and Competence Index (LQ&C)	0,61							
Infrastructure Quality Index (IQI)	0,42							
Corporate Tax Rate (CTR)	0,29							
Average Hourly Labor Costs (AHLCL)	0,16							
Consistency ratio								
LambdaMax	8,35	RI	1,41	0,04	CR < 0,1			
Weights of criteria								
Criteria	Tissue & Hygiene Market Revenue (T&H MR)	Population (Pop)	GDP	Ease of Business Index (EoBI)	Logistics Quality and Competence Index (LQ&C)	Infrastructure Quality Index (IQI)	Corporate Tax Rate (CTR)	Average Hourly Labor Costs (AHLCL)
WI	0,330	0,230	0,160	0,100	0,070	0,050	0,040	0,020