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A Multi-Criteria Evaluation of Technical Faculty Choice in the Czech Republic from the Applicant's Perspective

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Abstract: Choosing a technical faculty represents a complex decision process in which applicants balance multiple academic, institutional, and economic criteria. This paper presents a multi-criteria decision-making framework for evaluating and ranking selected technical faculties in the Czech Republic from the applicant's perspective. The proposed model integrates the Analytic Hierarchy Process (AHP) to determine the relative importance of decision criteria and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to generate a transparent ranking of alternatives. Five faculties are assessed using criteria derived from the literature on higher education choice and engineering education, operationalized through publicly available institutional data and city-level cost-of-living indicators. To capture heterogeneity in applicant preferences, two contrasting weighting scenarios are constructed: an academically oriented profile and a practically and economically oriented profile. The results indicate that faculty rankings are highly sensitive to preference structures, with different institutions emerging as optimal choices under each scenario. The study highlights the usefulness of multi-criteria modelling for analysing higher education choice and provides a replicable analytical framework that can be extended with empirically elicited preferences and additional indicators of institutional quality.

Keywords: multi-criteria decision-making; analytic hierarchy process; TOPSIS; higher education choice; technical universities; Czech Republic

JEL Classification: I23; C44; M31

1. Introduction

1.1. Context and Relevance of the Problem

The choice of a higher education programme represents a complex decision for applicants, as it simultaneously involves academic, economic, social, and institutional aspects. In the field of technical education, this choice is further shaped by specific student expectations (e.g. future employability, study difficulty, and the quality and prestige of the programme) and takes place in an environment of increasing competition among universities for qualified applicants. Empirical research focusing on students' decision-making processes shows that the choice of a technical school is the result of the influence of multiple groups of factors and cannot be explained by a single criterion (Gille et al., 2022). From the perspective of research on recruitment into technical fields, it is therefore crucial to understand how students weigh different factors and how these factors may come into mutual conflict (e.g. prestige and quality versus the financial costs of study).

1.2. Motivation of the Paper and Broader Research Context

In recent years, the importance of higher education branding has increased, referring to the ways in which institutions build and communicate their identity, reputation, and value proposition to prospective students. Brand-related communication may influence perceived prestige, credibility, and the overall "fit" between the applicant and the institution, thereby contributing to the formation of the student's decision-making process as one of the relevant factors. From the perspective of research on study choice, branding is therefore understood as part of a broader set of determinants that applicants consider when comparing alternatives.

The motivation of this paper is to verify the applicability and suitability of selected multi-criteria decision-making methods for modelling the process of technical faculty choice from the applicant's perspective. The paper is conceived as the design and pilot application of a decision-making model whose objective is not to capture actual student preferences through empirical research, but to test a methodological approach that allows the structuring of a decision problem, the simultaneous consideration of multiple criteria, and the generation of a transparent ranking of alternatives.

The chosen approach reflects the fact that applicants' decision-making is a complex process that cannot be adequately described by a single indicator. Multi-criteria decision-making methods provide tools for formalising this process and enable the systematic capture of relationships among individual criteria, including potential conflicts between them. In this sense, they represent a suitable analytical framework for examining factors influencing the choice of higher education study.

At the same time, the paper is understood as a methodological preparation and exploration of research procedures that may be further developed in the future within a doctoral dissertation focused on the branding of Czech higher education institutions. Although branding is not operationalised in this paper as a standalone decision criterion, the proposed multi-criteria decision-making model creates a framework into which factors related to perceived reputation, image, and communication strategy of universities can be systematically incorporated in subsequent research.

1.3. Why MCDA and AHP–TOPSIS

As the choice of a technical faculty can be understood as a decision involving multiple (often conflicting) criteria, the use of multi-criteria decision-making methods (MCDM/MCDA) is appropriate, as these methods allow criteria to be structured transparently, their relative importance to be taken into account, and a ranking of alternatives to be derived. A systematic review mapping the use of MCDM methods in educational research shows that methods such as AHP and TOPSIS are among the most frequently applied and that typical tasks in this field include ranking and choice problems (Maral & Özdemir, 2025).

The selected combination of AHP–TOPSIS corresponds to the logic of the problem-solving process: AHP is used to determine the weights of criteria, while TOPSIS enables the ranking of alternatives according to their closeness to an ideal solution. The approach is designed as a "framework" that can be further extended in subsequent research and supplemented with deeper empirical evidence on student preferences.

1.4. Aim of the Paper and Research Intention

The aim of the paper is to propose and demonstrate the application of a multi-criteria decision-making model for the choice of a technical faculty in the Czech Republic using a set of five alternatives: FEL ZČU, FEL ČVUT, FEKT VUT, FEI VŠB-TUO, and FEI UPCE. The model works with a set of criteria derived from the literature on the choice of technical schools and the choice of higher education institutions (Gille et al., 2022; Moody, 2020).

The paper is conceived as the design of a methodological procedure; at the same time, its ambition is to create a reproducible basis for future extensions within doctoral research.

Unlike many existing AHP–TOPSIS applications in higher education, which aim to normatively recommend a single optimal institution, this paper adopts a decision-support perspective reflecting heterogeneous applicant preferences. The scenario-based weighting is not intended to produce a universal ranking, but to illustrate how different preference profiles lead to different outcomes. The contribution of the study is therefore methodological and illustrative rather than predictive.

2. Theoretical Background

2.1. Technical Faculty Choice as a Multi-criteria Decision Problem

Decision-making regarding the choice of a technical faculty represents a complex process influenced by a set of interrelated factors of different nature. Research focusing on the choice of technical and engineering fields shows that applicants simultaneously take into account academic, institutional, economic, and individual aspects in their decision-making, with none of these factors acting in isolation (Gille et al., 2022). The choice of a school is thus the result of balancing multiple criteria, which may differ in their importance and, in some cases, may also be mutually conflicting.

The study by Gille et al. (2022), which specifically focuses on the choice of a technical (engineering) school, identifies four main groups of determinants influencing students' decision-making processes: individual factors (e.g. personal interests and abilities), social factors (the influence of family, peers, or teachers), economic factors (costs associated with study and future employment), and institutional factors (characteristics of the school itself and the study programme). The authors emphasise that it is precisely the combination of these groups of factors that shapes the final decision and that their relative importance may vary among individual applicants (Gille et al., 2022).

Similarly, in her doctoral dissertation, Moody (2020) summarises that students' decisions regarding the choice of a higher education institution are determined by a set of academic characteristics (programme offerings and teaching quality), reputational and institutional aspects, student support services, and the economic conditions of study. The results of these studies confirm that the choice of a higher education institution cannot be reduced to a single criterion, but must be understood as a multidimensional decision problem.

A systematic review by Maral and Özdemir (2025) further shows that a similarly complex character applies to many decision-making tasks in the educational context, particularly at the level of higher education. The authors state that the selection and evaluation of study programmes, institutions, or educational pathways belong among the most frequent types of problems addressed using multi-criteria decision-making methods, with typical tasks being choice and ranking of alternatives. These tasks are characterised by the need to work with multiple criteria simultaneously and with differing levels of importance assigned to individual factors.

Based on these findings, the choice of a technical faculty from the applicant's perspective can be considered a typical case of a multi-criteria decision problem, in which it is necessary to systematically structure relevant criteria and take their relative importance into account. This nature of the problem creates methodological scope for the use of multi-criteria decision-making tools, which enable transparent and reproducible comparisons of alternatives based on multiple evaluation criteria.

2.2. Multi-criteria Decision-making Methods in Educational Research

Multi-criteria decision-making methods (multi-criteria decision-making, MCDM/MCDA) are described in the academic literature as analytical tools designed to solve decision problems in which it is necessary to simultaneously consider multiple evaluation criteria that cannot be reduced to a common unit of measurement and that may be mutually conflicting. A systematic review focusing on the use of MCDA in educational research shows that decision-making tasks characterised by a high degree of complexity and multidimensionality, particularly at the level of higher education, represent a typical application area for these methods. In this context, the most frequently addressed types of tasks are choice and ranking of alternatives, which corresponds to the nature of decision-making regarding the choice of a study programme or a higher education institution (Maral & Özdemir, 2025).

With regard to specific methods, the most frequently applied approaches in educational research include the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), as well as their modifications. These methods are used in the literature both independently and in combination, with the combined approach allowing the phase of determining the relative importance of criteria to be separated from the phase of evaluating and ranking alternatives. The review further states that the use of multiple methods within a single decision-making model is common practice in educational research, particularly in cases where the aim is to increase the transparency and interpretability of results (Maral & Özdemir, 2025).

In the context of students' decision-making regarding the choice of study, multi-criteria decision-making methods are primarily used as a tool for structuring a complex decision-making process and for systematically comparing alternatives based on multiple factors. The application of these methods makes it possible to explicitly work with the relative importance of individual criteria and provides a clear output in the form of a ranking of alternatives, which is suitable both for analytical purposes and for further interpretation in subsequent research.

3. Methodology

3.1. Definition of the Decision Problem and Alternatives

This paper proposes a multi-criteria decision-making model for the evaluation and ranking of selected technical faculties in the Czech Republic from the perspective of prospective students. The decision problem is formulated as a ranking of alternatives, the aim of which is to determine the order of faculties based on a set of evaluation criteria.

The objective of the decision-making process is to compare and rank the available alternatives in such a way that the model output provides a transparent and interpretable ordering of the evaluated faculties. Given the nature of the paper as a design and pilot application of methods, the aim is not to capture empirical student preferences, but to demonstrate the structure of the decision framework and its methodological feasibility.

The alternatives are defined as five technical faculties in the Czech Republic that are compared within the model:

- A1: University of West Bohemia in Pilsen – Faculty of Electrical Engineering (FEL ZČU)
- A2: Czech Technical University in Prague – Faculty of Electrical Engineering (FEL ČVUT)
- A3: Brno University of Technology – Faculty of Electrical Engineering and Communication Technologies (FEKT VUT)
- A4: VSB – Technical University of Ostrava – Faculty of Electrical Engineering and Computer Science (FEI VŠB-TUO)
- A5: University of Pardubice – Faculty of Electrical Engineering and Informatics (FEI UPCE)

The unit of evaluation is the faculty as an organisational and educational unit. The model therefore does not compare entire universities, but specific faculties with comparable disciplinary orientation, to which the selection of evaluation criteria in the following subsection is adapted.

The faculties were deliberately selected to represent comparable fields of study (electrical engineering and informatics) across the major technical universities in the Czech Republic.

3.2. Evaluation Criteria and Their Derivation from the Literature

The selection of evaluation criteria is based on literature focusing on students' decision-making regarding the choice of a technical school and a higher education institution. Previous studies show that applicants take into account multiple groups of factors in their decision-making, relating both to the institution and the study programme itself as well as to the broader conditions of study (Gille et al., 2022; Moody, 2020). Based on these findings, this paper proposes a set of criteria that reflects the main dimensions of the decision-making process while allowing for their practical operationalisation using available data.

For clarity, the proposed criteria are structured into thematic groups. This structure serves primarily to systematise the decision framework and does not affect the calculation of results.

Group A: Characteristics of the faculty and study offer

This group includes criteria related to academic and institutional characteristics of the faculty, which are repeatedly identified in the literature as key factors in the choice of a technical school (Gille et al., 2022; Moody, 2020).

- C1 – Academic reputation and characteristics of the study programme:
  This criterion reflects the perceived quality and reputation of the faculty or study programme. The literature indicates that reputational aspects and programme characteristics belong among the significant determinants of students' choice (Gille et al., 2022). Within the model design, this criterion is understood in general terms, with the possibility of future operationalisation through publicly available indicators.
- C2 – Employment opportunities and links to practice:
  Graduate employability, cooperation with industrial partners, and the existence of practice-oriented forms of study are identified in the literature as important factors, particularly in technical fields (Gille et al., 2022; Moody, 2020). This criterion captures the relationship between the faculty and professional practice and the labour market.

Group B: Study conditions and institutional support

The second group of criteria focuses on institutional study conditions and support mechanisms that may influence the attractiveness of a faculty from the applicant's perspective (Moody, 2020).

- C3 – Study and support services:
  This criterion includes the availability and scope of student support services, such as academic counselling, career services, or adaptation mechanisms. These aspects are identified in the literature as part of institutional factors influencing decisions about school choice (Moody, 2020).
  (Note: This criterion was excluded during the pilot application due to zero discriminatory power; see Section 3.4.1.)
- C4 – International opportunities and mobility:
  Opportunities for study abroad, participation in international programmes, and mobility schemes are perceived as factors increasing the attractiveness of study, particularly in technical and natural science fields (Moody, 2020). This criterion reflects the openness of the faculty to international cooperation.

Group C: Economic conditions of study

Economic aspects represent a distinct dimension of decision-making, which is identified in the literature as particularly significant in the context of long-term educational investments (Gille et al., 2022).

- C5 – Economic demands of study:
  This criterion includes financial aspects associated with study, in particular the cost of

living in the place of study. In the model, this criterion is treated as a cost criterion (the lower the value, the more favourable the alternative).

The criterion of economic demands of study (C5) is operationalised using a cost-of-living index for the city in which the faculty is located. The values were taken from the Numbeo database (Numbeo, 2024), which provides comparable estimates of living costs at the city level. The overall cost-of-living index excluding rent was used. For cities not listed separately in the database, the nearest available reference value was applied. The criterion is treated as a cost criterion in the model (a lower value is preferred).

The proposed set of criteria represents a conceptual framework that will be further refined in subsequent steps of the study with regard to data availability and comparability. As the paper is conceived as a design and pilot application of methods, emphasis is placed on transparency and methodological feasibility of the model rather than on comprehensive coverage of all potential factors.

The operationalisation of individual criteria is based on publicly available information presented on the official websites of the faculties. All indicators were defined in a uniform manner across alternatives (e.g. only accredited study programmes of the faculty were included, explicitly listed industrial partners were counted, and formally declared international cooperations were considered). Nevertheless, it should be emphasised that the indicators used represent deliberately simplified proxy variables suitable for a pilot application of the methods.

3.3. Methods and Solution Procedure

Based on the definition of the decision problem, alternatives, and evaluation criteria, this paper proposes a solution procedure founded on a combination of multi-criteria decision-making methods. The selection of methods is derived from the nature of the decision task, which consists in ranking alternatives while taking multiple criteria into account, and corresponds to common practice in educational research, where such tasks are addressed using MCDA methods (Maral & Özdemir, 2025).

The proposed procedure combines the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). These methods are employed in complementary roles: AHP is used to determine the relative importance of the evaluation criteria, while TOPSIS is applied to the evaluation and ranking of alternatives based on these weights.

Scenario-based approach to criteria weighting

Given that the preferences of applicants for higher education may differ significantly, a scenario-based approach to weighting the evaluation criteria was adopted in this study. The aim was not to determine an “optimal” or universal ranking of faculties, but to demonstrate how the resulting evaluation changes depending on the type of applicant and their preferences.

Two basic scenarios representing different decision-making strategies of applicants were defined. These scenarios serve as model situations rather than as an empirical description of a specific group of students.

1. Scenario A – academically oriented applicant

Scenario A represents an applicant who places primary emphasis on the academic quality of study and long-term professional development. For this type of applicant, the breadth and structure of study programmes, the existence of doctoral studies, and the international dimension of study are of key importance. Economic considerations play a secondary role in the decision-making process.

In line with these preferences, higher weights were assigned to criteria C1a (study programme offer), C1b (existence of doctoral studies), and C4 (international opportunities), while criteria focused on economic aspects and links to practice were evaluated as less important.

2. Scenario B – practically and economically oriented applicant

Scenario B represents an applicant for whom practical applicability of study and economic accessibility are the main priorities. This type of applicant places emphasis on the faculty's links to practice, cooperation with companies, and the overall costs associated with study. Academic prestige and research background play a less important role in their decision-making.

In this scenario, higher weights were assigned to criteria C2a (cooperation with industrial partners), C2b (extent of the partner network), and C5 (costs), while academically oriented criteria were evaluated as less important.

In the proposed model, the AHP method is used exclusively for determining the weights of the criteria. Its application makes it possible to express the relative importance of individual criteria in a structured manner through pairwise comparisons and to transform qualitative preferences into quantitative form.

The calculation of criteria weights was carried out in the R environment using a custom script based on the principal eigenvector method. To increase transparency, consistency indicators (λ_max, *CI*, and *CR*) are also reported for each scenario, providing information on the internal consistency of the pairwise comparisons. This approach corresponds to common practice in the application of MCDA methods in design-oriented and methodological studies (Maral & Özdemir, 2025).

Evaluation and ranking of alternatives using TOPSIS

For the evaluation of alternatives and their ranking, the TOPSIS method is applied in the proposed procedure. This method enables alternatives to be compared based on their distance from the ideal and the worst solution, taking into account both the values of individual criteria and their relative weights determined in the previous step. The output of the method is a ranking of alternatives that allows for clear interpretation of results within individual scenarios.

The use of TOPSIS is particularly appropriate in situations where the objective is a transparent ranking of alternatives based on multiple criteria, which corresponds to the nature of the decision problem addressed in this paper. The combination of AHP and TOPSIS also makes it possible to separate the phase of criteria weighting from the phase of alternative evaluation, thereby increasing the clarity and interpretability of the proposed decision-making framework (Maral & Özdemir, 2025).

3.4. Construction of the Decision Matrix and Data Sources

For the application of the TOPSIS method, a decision matrix was constructed in which the alternatives (faculties A1–A5) are evaluated according to the operationalised criteria. Given that the paper has the character of a design and pilot application, data for the criteria are drawn from publicly available sources and are selected so as to be comparable across alternatives and transparently verifiable.

Operationalisation of criteria

For the purposes of the pilot model, the conceptual criteria defined in Section 3.2 are operationalised using the following indicators:

- C1a – number of accredited study programmes (Bachelor's + Master's):
  A quantitative indicator expressing the breadth of the study offer at the level of bachelor's and follow-up master's programmes as presented in publicly available faculty information.
- C1b – existence of a doctoral programme:
  A binary indicator (*1/0*) expressing whether the possibility of doctoral study is publicly communicated by the faculty; in the pilot phase, the value is based on the traceability of this information on the faculty website.
- C2a – existence of systematic cooperation with industry:
  A binary indicator (*1/0*) expressing whether the faculty publicly presents organised cooperation with industry (e.g. a dedicated section, a long-term partner network, or regularly described forms of cooperation).
- C2b – number of industrial partners listed on the faculty website:
  A quantitative indicator based on the publicly published list of cooperating entities (partners).
- C3 – study and career counselling:
  A binary indicator (*1/0*) expressing the availability of information on counselling services (academic and/or career) in the faculty's public sources.
- C4 – number of partner universities (Europe and worldwide):
  A quantitative indicator expressing the number of published partner institutions, which represent an applicant-interpretable approximation of the "breadth of mobility opportunities". In the pilot phase, the indicator is used without distinguishing between types of agreements; the aim is to capture the availability and scope of partnerships in public sources.

- C5 – city cost-of-living index:
  An economic indicator at the level of the city in which the faculty is located; in the model, it is considered a cost criterion (a lower value is preferred). The data were obtained from the Numbeo database (Numbeo, 2024), which provides comparable data for cities in the Czech Republic.

The values of criteria C1a, C1b, C2a, C2b, C3, and C4 were obtained through manual content analysis of publicly available websites of the individual faculties (January 2025). The values of criterion C5 are based on the Numbeo database (Numbeo, 2024).

Prior to the construction of the final decision matrix, a basic variability check of individual criteria across the evaluated alternatives was conducted within the pilot application of the model. It was found that criterion C3 (availability of study and career counselling) exhibits the same value for all assessed faculties. The criterion therefore has no discriminatory power and does not contribute to differentiating alternatives in the decision-making process. For this reason, criterion C3 was excluded from the final decision matrix. This procedure corresponds to common practice in multi-criteria decision-making, where criteria without variability across alternatives are removed from the model, as their inclusion would be merely formal and would have no effect on the resulting ranking of alternatives. The decision matrix used for the TOPSIS calculation is presented in Table 1.

Table 1. Decision matrix – values of criteria for the evaluated faculties

Faculty	C1a	C1b	C2a	C2b	C4	C5
FEL ZČU	18	1	1	130	83	51.1
FEL ČVUT	22	1	1	35	131	60.2
FEKT VUT	38	1	1	56	150	53.4
FEI VŠB-TUO	11	0	0	0	0	50.8
FEI UPCE	8	1	0	0	277	50.1466

4. Results

This chapter presents the results of determining the weights of criteria using the AHP method and the subsequent ranking of alternatives using the TOPSIS method. In line with the design-oriented nature of the paper, the criterion weights are derived using a scenario-based approach (hypothetical applicant preferences), while the decision matrix of alternatives remains identical in both scenarios.

4.1. AHP Results: Criteria Weights and Consistency

The resulting weights of the evaluation criteria determined using the AHP method for both scenarios are summarised in Table 2, while the values of the consistency indicators of the pairwise comparisons (λ_max, CI, and CR) are presented in Table 3.

Using the AHP method, the weights of the evaluation criteria were determined on the basis of pairwise comparisons for two scenarios representing different applicant preferences. Following the variability check of criteria (Section 3.4.1), criterion C3 was excluded from the final model, and the weights were therefore calculated for six criteria (C1a, C1b, C2a, C2b, C4, and C5).

In Scenario A (academically oriented applicant), the highest weight was assigned to criterion C1a (breadth of study programmes; *w = 0.4277*), followed by criterion C4 (international opportunities; *w = 0.2601*) and criterion C1b (existence of doctoral studies; *w = 0.1399*). Criteria related to links with practice, C2a and C2b, both received lower and identical weights (*w = 0.0669*), while the cost criterion C5 exhibited the lowest weight (*w = 0.0384*).

In Scenario B (practically and economically oriented applicant), the cost criterion C5 dominated (*w = 0.4015*), followed by criterion C2a (systematic cooperation with industry; *w = 0.2377*) and criterion C2b (number of industrial partners; *w = 0.1800*). Criteria related to the academic profile, C1a and C1b, had lower weights in this scenario (*w = 0.0664* and *w = 0.0393*, respectively).

The values of the consistency ratio (CR) in both scenarios did not exceed the recommended threshold of *0.10*, indicating an acceptable level of internal consistency of the pairwise comparisons.

Table 2. Weights of evaluation criteria in Scenarios A and B

Criterion	Weight_A	Weight_B
C1a	0.42773272	0.06640741
C1b	0.1399153	0.03927434
C2a	0.06692895	0.23772168
C2b	0.06692895	0.17996037
C4	0.26009586	0.07514606
C5	0.03839821	0.40149014

Table 3. Consistency indicators of pairwise comparisons

Scenario	lambda_max	CI	RI	CR
A	6.4734	0.0947	1.24	0.0764
B	6.3729	0.0746	1.24	0.0602

4.2. TOPSIS Results: Ranking of Alternatives in Scenarios A and B

The TOPSIS method was applied to the decision matrix, with criteria C1a–C4 treated as benefit criteria (higher = better) and criterion C5 treated as a cost criterion (lower = better). The output of the method is a closeness coefficient to the ideal solution in the interval *⟨0;1⟩*, on the basis of which the ranking of alternatives is derived.

Scenario A

In the academically oriented Scenario A, the highest value of the closeness coefficient was achieved by the alternative FEKT VUT (TOPSIS = *0.7467*), which indicates the best compromise with respect to the emphasis on the academic profile and the international dimension. This is followed by FEL ČVUT (*0.4919*) and FEI UPCE (*0.4459*). FEL ZČU ranked fourth in this scenario (*0.3930*), while FEI VŠB-TUO recorded the lowest value (*0.0741*).

Table 4. TOPSIS results – Scenario A

Alternative	TOPSIS	d_pos	d_neg	Rank
FEKT VUT	0.746717828750397	0.100028469886802	0.294900511467461	1
FEL ČVUT	0.491935787016526	0.18118544906015	0.17543374282543	2
FEI UPCE	0.445852306433639	0.269481732822709	0.216817742843046	3
FEL ZČU	0.392993218415076	0.225127950629867	0.1457541506245	4
FEI VŠB-TUO	0.0741465783905349	0.326775495929269	0.0261696769267281	5

Scenario B

In the practically and economically oriented Scenario B, FEL ZČU achieved the best result (TOPSIS = *0.8129*), which corresponds to the high weight assigned to the cost criterion and to criteria related to links with practice. Second place was taken by FEKT VUT (*0.6322*), followed by FEL ČVUT in third place (*0.5384*). FEI UPCE and FEI VŠB-TUO ranked in the last positions in this scenario (*0.2484* and *0.1252*, respectively).

Table 5. TOPSIS results – Scenario B

Alternative	TOPSIS	d_pos	d_neg	Rank
FEL ZČU	0.812903486727149	0.0495794455206414	0.215414512161175	1
FEKT VUT	0.632207875690717	0.0959187519035501	0.164877348838646	2
FEL ČVUT	0.538432556786303	0.127811281998947	0.149095774332955	3
FEI UPCE	0.248433592991268	0.214962040417546	0.0710566512282188	4
FEI VŠB-TUO	0.125224168187366	0.223168922771996	0.0319466333008838	5

4.3. Comparison of Scenarios and Sensitivity to Criteria Weights

The comparison of scenarios demonstrates the sensitivity of the resulting faculty ranking to applicant preferences represented by the weights of the evaluation criteria. While in Scenario A, which places emphasis on academic characteristics of study, the alternative with the strongest combination of academic and international attributes (FEKT VUT) dominates, in Scenario B, oriented towards economic accessibility and links to practice, the first position shifts to the alternative favoured by a combination of more favourable economic demands and application-oriented characteristics (FEL ZČU).

The high ranking of FEKT VUT in Scenario A can be explained primarily by the combination of strong values in criteria C1a (broad range of study programmes), C4 (extensive network of partner universities), and C1b (existence of doctoral studies), which exhibit the highest weights in this scenario. In contrast, the success of FEL ZČU in Scenario B reflects in particular the significantly lower cost of living in the city of Pilsen compared to Prague or Brno (criterion C5), which has a dominant weight in this scenario (w = *0.4015*), together with relatively strong values in criteria related to links with practice.

The scenario-based approach thus demonstrates that even with an identical decision matrix, different applicant preferences may lead to different recommendations of the "most suitable" alternative. From a methodological perspective, this result confirms the appropriateness of the AHP–TOPSIS combination for capturing the complexity of the decision-making process, in which there is no universally "best" school, but rather a school that best corresponds to a specific preference profile.

A clear comparison of the resulting faculty rankings in Scenarios A and B is presented in Table 6, which allows for a direct comparison of changes in the evaluation of individual alternatives depending on the configuration of criteria weights.

Table 6. Comparison of faculty rankings in Scenarios A and B

Faculty	Rank – Scenario A	TOPSIS – Scenario A	Rank – Scenario B	TOPSIS – Scenario B
FEKT VUT	1	0.7467	2	0.6322
FEL ČVUT	2	0.4919	3	0.5384
FEI UPCE	3	0.4459	4	0.2484
FEL ZČU	4	0.393	1	0.8129
FEI VŠB-TUO	5	0.0741	5	0.1252

5. Discussion and Limitations

5.1. Limitations of the Pilot Application and the Data Used

The results of the study must be interpreted with regard to its pilot and design-oriented character. The aim of the paper was not to empirically capture the actual preferences of a specific group of applicants, but to verify the methodological feasibility of the combined AHP–TOPSIS approach in modelling decision-making related to the choice of a technical faculty and to demonstrate the sensitivity of results to different configurations of criteria weights. The resulting rankings of alternatives therefore cannot be understood as normative recommendations for real applicants, but rather as an illustration of the behaviour of the decision-making model under different preference scenarios.

The decision matrix was constructed on the basis of publicly available sources, while the scope, structure, and level of detail of the presented information differ across individual faculties. This limitation may be particularly evident in indicators based on the traceability of information on faculty websites, whether in the form of binary criteria or in the determination of quantitative values derived from publicly presented lists (e.g. industrial partners or partner universities). In this sense, the pilot model partially captures not only institutional characteristics of the faculties, but also the degree of transparency of their online communication from the applicant's perspective.

The pilot application further revealed limited discriminatory power of some binary indicators. Criterion C3 (availability of study and career counselling) exhibited identical values for all evaluated faculties and was therefore excluded from the final decision matrix. Similarly, limited variability was observed for other binary criteria: criterion C1b (existence of doctoral studies) had a value of *1* for four out of five faculties, and criterion C2a (systematic cooperation with industry) for three out of five faculties. This limited variability reduces the discriminatory power of the criteria and, in future research, should be replaced by finer-grained scales or composite indicators that would allow differences among faculties to be captured more effectively.

The use of binary indicators represents a deliberate simplification appropriate for a pilot application, but it also limits the discriminatory power of the model. In subsequent research, such criteria may be replaced or complemented by ordinal or composite indicators capturing the intensity or scope of the respective characteristics.

5.2. Methodological Limitations and Possibilities for Further Extension

In this study, the determination of criteria weights using the AHP method was implemented through a scenario-based approach working with hypothetical decision situations. The consistency of pairwise comparisons was verified for both scenarios using the indicators λ_max, *CI*, and *CR*, with the values of the consistency ratio CR remaining below the recommended threshold of *0.10*. This indicates an acceptable level of internal consistency of the stated preferences and confirms the methodological correctness of the criteria weighting within the pilot application.

It should, however, be emphasised that the scenarios used in this study do not represent empirically derived preferences of real applicants, but rather analytical constructs serving to test the sensitivity of the model. In subsequent research, it would be appropriate to replace scenario-based weighting with empirical data, for example through a questionnaire survey among applicants or students in technical fields, and to verify the stability of results when involving a larger number of respondents.

The proposed model also does not include some potentially relevant dimensions of decision-making, particularly subjectively perceived brand, institutional reputation, or emotional aspects of study choice. These factors play an important role in real applicants' decision-making, but their operationalisation within MCDA requires different approaches and a combination of quantitative and qualitative methods. The integration of these dimensions into an extended decision-making framework represents one of the main directions for further research.

6. Conclusion

This study presented the design and pilot application of a multi-criteria decision-making model for the evaluation and ranking of technical faculties in the Czech Republic from the perspective of prospective students. By combining the AHP and TOPSIS methods, a transparent and reproducible analytical framework was developed that enables the structuring of a complex decision problem, the simultaneous consideration of multiple evaluation criteria, and the systematic analysis of the influence of their relative importance on the resulting ranking of alternatives.

The pilot application of the model demonstrated its methodological feasibility and internal consistency. The determination of criteria weights using AHP achieved an acceptable level of consistency in both scenarios ($CR < 0.10$), and the subsequent application of the TOPSIS method revealed a pronounced sensitivity of the results to changes in criteria weights. The differing rankings of faculties in Scenarios A and B confirm that there is no universally "best" technical faculty, but that the resulting evaluation depends on the applicant's preference profile and decision-making strategy.

At the same time, the pilot phase identified limitations related to the operationalisation of criteria and data availability. In particular, the limited discriminatory power of some binary indicators was revealed, including the criterion of availability of study and career counselling, which was excluded from the final model. These findings are not interpreted as a weakness of the proposed approach, but rather as an important outcome of the pilot phase that provides concrete guidance for further methodological refinement of the model.

The main contribution of the paper lies in the proposal of a structured decision-making framework that can serve as a methodological basis for subsequent empirical research in the area of technical faculty choice. In a future phase, the model may be extended to incorporate preferences of real applicants, more fine-grained and multidimensional indicators of study quality, and additional decision-making dimensions, including the operationalised branding of higher education institutions. The proposed approach thus represents a starting point for the systematic examination of competition and differentiation among higher education institutions from the perspective of prospective students.

Conflict of interest: none

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