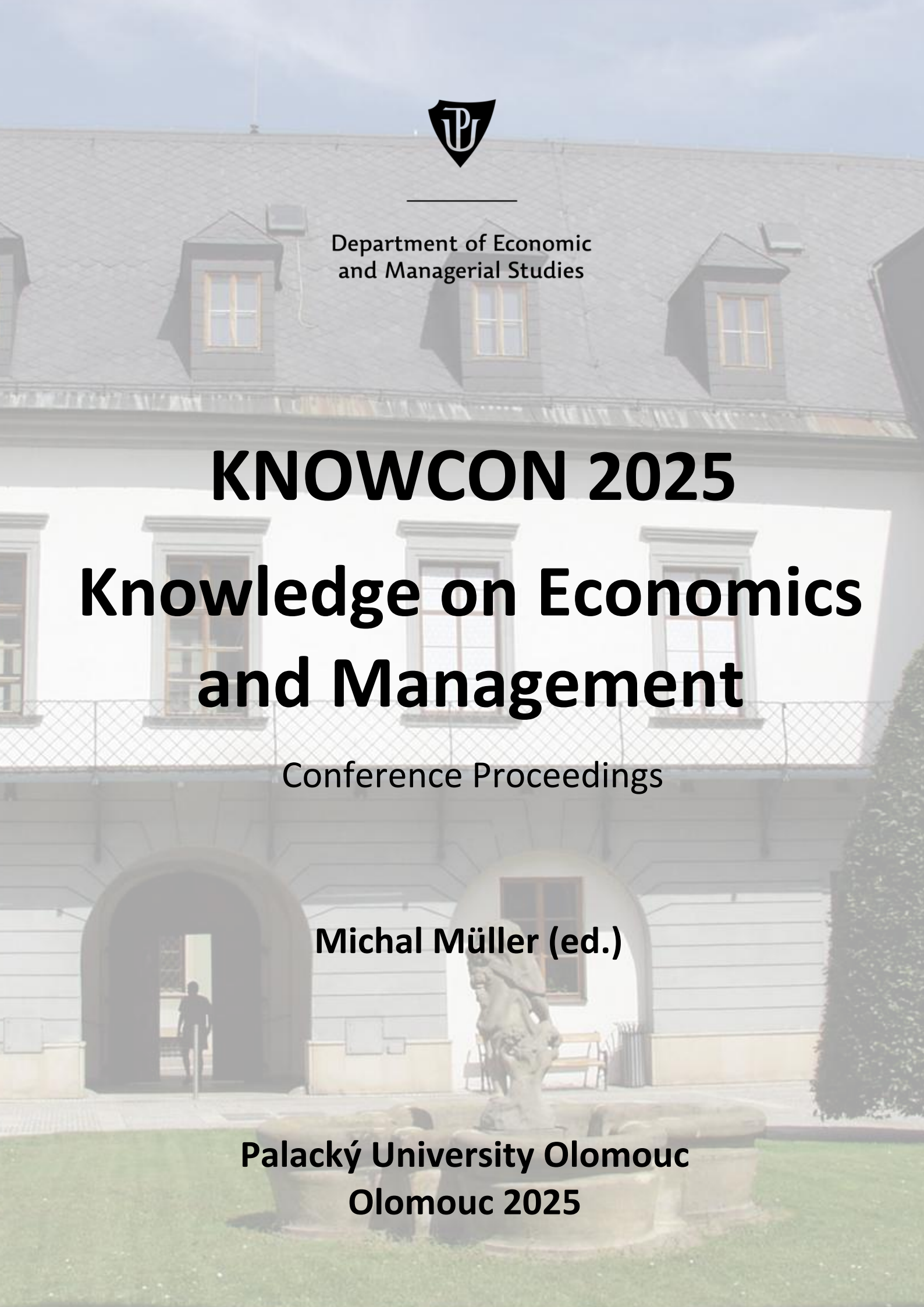

Department of Economic
and Managerial Studies

KNOWCON 2025

Knowledge on Economics and Management

Conference Proceedings

Michal Müller (ed.)

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Contents

The nature of the evaluation method matters. On the importance of "relative- vs. absolute-type" method choice in assessing the effect of tourism on UNESCO natural heritage sites

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Abstract: When the ranking of alternatives is the main objective of a decision-support model, it is usually one of the wide family of relative-type evaluation methods that is chosen to be applied. These methods are designed to provide ranking. However, they also derive the evaluations of the alternatives, and thus also their corresponding ranking, from comparisons with other alternatives or with benchmarks based on the set of alternatives. As such the (often implicit) assumption of the set of alternatives being final is crucial. However, in many cases the set of alternatives is to some extent arbitrary, composed of the alternatives for which the needed criteria values are currently available etc. In the recent turbulent times, it is also the variability and instability of the whole decision-making environment that can make some alternatives unavailable, introduce new alternatives, or otherwise influence the composition of set of alternatives. In this paper we show how the ranking of selected UNESCO natural heritage sites based on tourism-related risk derived by a relative-type method (VIKOR) depends on the alternatives being evaluated. We discuss the rank-reversal effect connected with changes in the set of alternatives and its implications on the robustness and managerial usefulness of the outputs derived by such a decision support. In short, we show that the choice of the type of method (relative vs. absolute) matters, and that, if made incorrectly, it can render the results useless or difficult to interpret.

Keywords: VIKOR, evaluation, absolute, relative, tourism, risk

JEL classification: D81 L83 C44

1. Introduction

In decision-support systems where the primary goal is to rank the alternatives within a given set (i.e. alternatives that are being considered), *relative-type evaluation methods* are frequently employed. These methods, including well-established ones such as VIKOR, derive rankings not by assessing each alternative in isolation, but by comparing them either directly with one another or against composite benchmarks created from the set of considered alternatives itself. While effective in producing rankings, this approach inherently relies on a crucial though often overlooked assumption: that the set of alternatives under evaluation is complete, fixed, and representative. However, in real-world scenarios, particularly those characterized by dynamic conditions, this assumption rarely holds true. The composition of the set of alternatives may be influenced by data availability, contextual constraints, cognitive and behavioral constraints on the decision-maker side (related to the set of alternatives being considered), or rapidly changing environments, all of which introduce a level of instability into the decision-making process when relative-type evaluation methods are being used. This can significantly affect the stability and thus reliability of the outcomes generated by relative-type methods. One important consequence of this dependency is the rank-reversal effect where the

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introduction or removal of alternatives leads to, potentially unexpected and difficult to anticipate, changes in the ranking of the remaining options. This phenomenon raises critical questions about the robustness and interpretability of the outputs of such models, especially when used for informing policy or strategic decisions in variable contexts – particularly if the set of alternatives is expected to change or when the set of alternatives has been chosen arbitrarily e.g. as a subset of a much larger alternatives set. In this case the ranking can be influenced by the arbitrary reference set choice.

In this paper, we outline these concerns by examining a real-life case study involving the ranking of selected UNESCO natural heritage sites based on tourism-related risk (Selcuk et al., 2023) and show the potential adverse effect of relative-type evaluation. Using the VIKOR method as a representative of the relative-type methods family, we demonstrate how sensitive the resulting rankings are to the content of the set of alternatives considered. Our findings underscore the importance of method selection, particularly the choice between relative- and absolute-type evaluation approaches and highlight the potential pitfalls of applying relative methods in contexts where the stability of the alternative set cannot be assured.

2. Methodology

The objective of this paper is to demonstrate how rankings generated by a relative-type evaluation methods are sensitive to the composition of the set of alternatives and what real-life consequences this can have in decision-support. In line with Selcuk et al. (2023) we take the VIKOR method as a representative of relative-type multi-criteria decision-making (MCDM) methods and show how the rankings of alternatives suggested by VIKOR are affected by removals of alternatives from the set of alternatives. More specifically we identify and comment on pairwise rank reversals stemming from removals of a single alternative. This is done iteratively, so all $m-1$ element subsets of an m element original set of alternatives are investigated. After each removal the rankings of the remaining alternatives obtained by VIKOR are stored and analyzed and pairwise ranking changes are outlined.

2.1. Overview of the VIKOR Method

The VIKOR method was developed by Opricovic and Tzeng (2004) to determine a compromise solution for problems involving conflicting criteria. It evaluates each alternative relative to the best and worst performance observed among all alternatives in the current decision set. This inherently relative nature makes VIKOR susceptible to shifts in rankings when alternatives are added or removed. Here are the steps of the VIKOR method as suggested by Opricovic and Tzeng.

Step 1: Define the Decision Matrix

Let $[\boldsymbol{A_{m\times n}} = \{\boldsymbol{a_{ij}}\}_{\boldsymbol{i=1,j=1}}^{\boldsymbol{m,n}}]$ be the matrix of performance evaluations where $[a_{ij} \in X_j \subseteq R$, where x_j is the largest value in criterion $C_j]$, and $\sum_{j=1}^{n} w_j = 1$ and $w_j \geq 0$ for all $j = 1, \dots, n$. Each a_{ij} represents the evaluation score of the i-th alternative under the j-th criterion. This matrix contains the raw, non-normalized values.

Step 2: Determine the positive ideal solution (PIS) and negative ideal solution (NIS):

$$[PIS = \{x_1^*, x_2^*, \dots, x_n^*\}],$$

where $x_j^* = \max_i \ a_{ij}$ if C_j is a benefit-type criterion and $x_j^* = \min_i \ a_{ij}$ if C_j is cost-type. Analogously

$$[NIS = \{x_1^o, x_2^o, \dots, x_n^o\}],$$

where $x_j^o = \min_i a_{ij}$ if C_j is a benefit-type criterion and $x_j^o = \max_i a_{ij}$ if C_j is cost-type. Before calculating utility and regret measures in step 3, normalize the performance scores between 0 and 1 by expressing them as relative distances from the PIS, scaled to the range between the PIS and NIS:

Step 3: Calculate Distance Measures (S_i) and (R_i) for each Alternative

$$S_i = d_{L_{1ij}}(A_{ij}, PIS) = \sum_{=1}^{n} w_j \left(\frac{x_j^* - a_{ij}}{x_j^* - x_j^o}\right),$$

where $S_i \in [0,1]$ and L_1 norm can be defined as $\sum_{i=1}^{m}|x_i|$, and

$$R_i = d_{L_{\infty ij}}(A_{ij}, PIS) = \max_j \left[w_j \left(\frac{x_j^* - a_{ij}}{x_j^* - x_j^o}\right)\right],$$

where $R_i \in \left[0, \max_j w_j\right]$ and L_∞ norm can be defined as $\max_{i=1}^{n}|x_i|$ and

w_j is the weight of the j-th criterion,

x_j^* is the ideal value of the j-th criterion,

x_j^0 is the anti-ideal value j-th criterion,

a_{ij} is the performance value (normalized evaluation) of the i-th alternative with respect to the j-th criterion.

Step 4: Calculate the Composite Utility Q_i for Each Alternative

$$Q_i = \nu\left(\frac{S_i - S^*}{S^o - S^*}\right) + (1-\nu)\left(\frac{R_i - R^*}{R^o - R^*}\right),$$

where $Q_i \in [0,1]$ and

$$S^* = \min S_i \text{ and } S^0 = \max S_i$$
$$R^* = \min R_i \text{ and } R^0 = \max R_i$$

The parameter ν is introduced as the weight of the strategy of "the majority of attributes". Its value lies between 0 and 1. For specific choices of the value of v we have specific interpretations:

$\nu = 1$ is maximizing group utility,

$\nu = 0$ means minimum individual regret strategy,

$\nu = 0.5$ is a compromise, usually preferred, approach between the two previously mentioned.

Step 5: Rank the alternatives based on the values of S_i, R_i and Q_i.

First arrange the alternatives in ascending order, according to the values of S, R, and Q. This provides three ranking lists. We can conclude that a' is the best alternative, if two conditions are satisfied. Firstly:

$$Q(a'') - Q(a') \geq DQ$$

where a' is the compromise solution with minimum Q value and a'' is the second-best alternative. However, the above-mentioned condition is not enough on its own. For alternative a' to be considered the best, it must have a significant enough difference in its Q value compared to the second-best alternative and the difference must be greater than or equal to a threshold called DQ, which is calculated as:

$$DQ = \frac{1}{m-1}$$

where m is the total number of alternatives. And secondly a' should not only be the best choice based on Q, but it should also outperform the other alternatives in S or R.

2.2. Limitations of Relative Evaluation

Rank reversal in the VIKOR method arises primarily from the sensitivity of certain computational steps to the composition of the set of alternatives. The most critical step contributing to this phenomenon is Step 2, where the best and worst values for each criterion are determined based on all available alternatives. When an alternative is removed, these extreme values may change, even if the actual performance of the remaining alternatives remains the same. This leads to a recalibration of the normalized performance matrix, thereby altering the subsequent calculations. In Step 3, the aggregated group utility (S_i) and individual regret (R_i) are computed using the normalized values. Since these are directly influenced by the best and worst criterion values from Step 2, any changes there affect all alternatives scores. In Step 4, the VIKOR index (Q_i) is calculated by combining (S_i) and (R_i) and then scaling them based on the minimum and maximum values across the set. Removal or addition of an alternative can change these min/max values, which in turn affects the scaling and final rankings.

Table 1: Description of Alternatives, adapted from Selcuk et al. (2023)

Alternative	Site Name
A1	Atlantic Forest Southeast Reserves (Brazil)
A2	Białowieża Forest (Belarus, Poland)
A3	Brazilian Atlantic Islands (Brazil)
A4	Forest Complex of Dong Phayayen-Khao Yai (Thailand)
A5	Durmitor National Park (Montenegro)
A6	Galápagos Islands (Ecuador)
A7	Gondwana Rainforests of Australia (Australia)
A8	Greater Blue Mountains Area (Australia)
A9	Historic Sanctuary of Machu Picchu (Peru)
A10	Hyrcanian Forests (Iran)
A11	Kenya Lake System in the Great Rift Valley (Kenya)
A12	Komodo National Park (Indonesia)
A13	Lake Baikal (Russian Federation)
A14	Lake Malawi National Park (Malawi)
A15	Mana Pools National Park (Zimbabwe)
A16	Cultural and Natural Heritage of the Ohrid Region (Albania)
A17	National Park of Phong Nha-Ke Bang (Viet Nam)
A18	Rainforest of the Atsinanana (Madagascar)
A19	Sagarmatha National Park (Nepal)
A20	Serengeti National Park (Tanzania)
A21	Sinharaja Forest Reserve (Sri Lanka)
A22	Vredefort Dome (South Africa)
A23	Western Caucasus (Russian Federation)
A24	Western Ghats (India)

In VIKOR and other relative-type approaches, alternatives are evaluated in comparison to each other rather than against fixed, external benchmarks. Consequently, the outcome depends heavily on the composition of the alternatives set. If alternatives are added or removed, the reference points shift, potentially altering the entire ranking outcome. If the set of alternatives is chosen arbitrarily, then the reference points and the corresponding ranking of alternatives can be arbitrary too. While the relative-type evaluation structure may appear to reflect interactions among alternatives, it introduces significant instability when the set is not finalized (note that stability of the set of alternatives is a crucial assumption of all relative-type methods, even though it is not frequently explicitly stated). Thus,

the evaluation method chosen relative or absolute significantly influences how robust and dependable the decision-making process will be. Some issues with relative type methods have been identified recently by Amjad and Stoklasa (2025). Their paper argues that relative-type methods inherently carry a risk of rank reversal, and it needs to be further quantified through the development of rank reversal indices. In contrast, absolute-type methods, by their design, use stable reference points that are not affected by the presence or absence of some alternatives, leading to pair-wise stable rankings. This distinction underscores the importance of understanding the nature of evaluation when choosing a method, particularly in decision-making contexts where stability and reliability are critical.

3. Case Study: Re-Examining Tourism Risk Rankings in UNESCO Natural Heritage Sites

To demonstrate the risks and limitations associated with relative-type evaluation methods, particularly the rank-reversal phenomenon, this study builds upon an existing multi-criteria decision-making (MCDM) analysis conducted by Selcuk et al. (2023). In their paper, the authors assessed tourism-related threat levels for 24 UNESCO natural heritage sites with twelve different criteria shown in table 1 and table 2 respectively by using a combination of MCDM techniques ultimately identifying which sites are the most endangered ones. The original authors aim to determine the effects and threat levels of tourism in World Natural Heritage Sites by identifying top 3 most risky sites and used three individual methods and aggregated their outputs using a fourth method, aiming to ensure robustness and objectivity. In our case study, we use their results as a baseline and apply the VIKOR method under different compositions of the set of alternatives to analyze how sensitive the pairwise rankings are to changes in the set of evaluated alternatives. Specifically, we replicate their setting but iteratively remove a single alternative from the original set of alternatives and then observe how the rankings shift.

Table 2: Definition of Criteria (Selcuk et al., 2023)

Code	Criterion name	Definition
C1	Property	Size of the area in hectares
C2	Date of Inscription	How many years have it been on the UNESCO heritage list?
C3	Assistance	Total donations and assistances for the site (USD dollar)
C4	Reporting Trend Point	Score showing the danger level of the area received in the evaluation report submitted to UNESCO
C5	Biodiversity Fauna	Number of fauna species living in the area
C6	Biodiversity Flora	Number of flora species living in the area
C7	Number of visitors	The current number of people who visited the site recently
C8	Accommodation	The number of accommodation facilities is within 50 km of the area
C9	Impact of tourism	Level of assessment of tourism impact included in the UNESCO conservation report
C10	Infrastructure in the buffer zones	Level of assessment of the impact of tourism on infrastructure in the UNESCO conservation report
C11	Overall assessment for threats	Overall assessment level of threats in the UNESCO conservation report
C12	Tourism and visitation management	The level of assessment of the tourism and visitation management status of the area included in the UNESCO conservation report

4. Results

The analysis revealed significant sensitivity in the VIKOR-generated rankings when a single alternative was removed from the evaluation set. In all 24 exclusion scenarios, rank changes occurred, demonstrating the non-robust nature of the method. Particularly notable were rank reversals affecting the top-tier alternatives, those deemed most at risk. For example, the removal of the Kenya Lake System resulted in a re-ranking that affected globally recognized sites such as Machu Picchu (A9), which shifted in relative position despite no change in its input data (under some compositions of the set of alternatives, it is among the top three sites most at risk, under some it is not among to top three). These findings are clearly illustrated in Table 3, which presents the original ranking of the 24 UNESCO natural heritage sites (denoted as A1 through A24 and summarized in the first column) alongside the rankings generated under each exclusion scenario (alternatives excluded from the original set of alternatives are presented in the top row in Table 3, the ranking of the remaining ones from most at risk to the least at risk constitutes the rest of the respective column). The table highlights the frequency and magnitude of rank changes, including shifts in the top three and bottom three positions. Instances of rank reversal where the relative order between two alternatives changes are widespread, with several sites experiencing multiple reversals across different scenarios.

Table 3: Rank Reversal in Relative Type Evaluation (VIKOR) by Removing Alternatives

Original Ranking	Removed alternative																								
	A1	A21	A8	A2	A18	A7	A6	A11	A22	A24	A10	A3	A4	A15	A12	A20	A5	A16	A23	A19	A9	A17	A13	A14
14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	
13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13		13
17	17	17	17	17	17	17	17	9	9	17	9	17	17	17	17	17	17	17	17	17	17		17	17
9	9	9	9	9	9	9	9	17	17	9	17	9	9	9	9	9	9	9	9	9		9	9	9
19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19		19	19	19	19
23	23	23	23	23	23	22	23	5	16	23	23	23	23	23	23	23	23	23		23	23	23	23	23
16	16	16	16	16	5	15	16	16	20	16	16	16	16	16	16	16	16		16	16	16	16	16	16
5	5	5	5	5	16	5	5	23	23	5	5	5	5	5	5	5		5	20	5	5	5	5	5
20	20	20	20	20	20	20	20	20	5	20	20	20	20	20	20		20	20	5	20	20	20	20	20
12	12	12	12	12	12	11	15	12	15	12	15	12	12	12		12	12	12	12	12	15	12	12	12
15	15	15	15	15	15	14	4	15	12	15	12	15	15		15	15	15	15	15	15	12	15	15	15
4	4	4	4	4	4	4	3	4	4	4	4	4		4	4	4	4	4	4	4	4	4	4	4
3	3	3	3	3	3	3	10	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3	10
10	10	10	10	10	10	9	22	10	10	10		10	10	10	10	10	10	10	10	10	10	10	10	3
24	24	24	24	24	24	23	24	24	24		24	24	24	24	24	24	24	24	24	24	24	24	24	24
22	21	22	22	22	22	21	13	22		22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
11	11	11	11	11	11	10	11		11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
6	6	6	6	6	6	6		8	7	6	6	6	6	6	6	6	6	6	6	6	7	7	6	6
7	7	7	7	7	7		18	6	18	7	7	7	7	7	7	7	7	7	7	7	18	6	7	18
18	18	18	18	18		17	7	7	6	18	18	18	18	18	18	18	18	18	18	18	2	8	18	7
2	2	2	2		2	2	2	18	2	2	2	2	2	2	2	2	2	2	2	2	8	18	2	2
8	8	8		8	8	7	8	2	8	8	8	8	8	8	8	8	8	8	8	8	6	2	8	8
21	21		21	21	21	20	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	1	21	1
1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21	1	21

This ranking instability is not a reflection of underlying changes in site conditions or data but a direct consequence of the relative nature of the method. As VIKOR benchmarks against the current set's best and worst, changes to the set alter reference points and computed solutions. For an absolute-type method the pairwise rankings would not be changing at all, as they rely on fixed, external benchmarks. Therefore, we do not present a side-by-side comparison with an absolute method, as its leave-one-out exercise would trivially show no change in ranking, offering no further insight into the instability demonstrated here.

5. Discussion

Our findings have important implications for decision-makers who rely on such rankings for policy formulation, funding distribution, or prioritization of conservation interventions. Relative-type methods are applicable under fixed and complete sets of alternatives. But the rankings produced by such methods can be unstable under changes of the set of alternatives. They can thus lead to inconsistent or potentially misguided actions. A site may be deemed high-risk in one evaluation and significantly less so in another, solely due to changes in the composition of the set of alternatives. This raises concerns about fairness, transparency, and reliability in resource allocation and strategic planning with relative-type methods, particularly under "arbitrarily composed", incomplete or potentially unstable sets of alternatives . However, this cannot always be avoided by decision-maker's choice. One possible remedy lies in the use of absolute-type methods, which assess each alternative on its own merits rather than relative to others. Such methods are inherently more stable under changing decision environments, making them potentially more appropriate for long-term planning. While our study is based solely on VIKOR, the insights are broadly applicable to other relative-type methods as well. A more comprehensive comparative analysis with an absolute method, exploring different datasets and scenarios beyond a simple leave-one-out exercise, is a valuable avenue for future research and would further clarify the trade-offs involved in method selection.

6. Conclusion

This study underscores a critical but often overlooked point in decision-support modeling: the nature of the evaluation method matters. Specifically, the choice between relative and absolute-type methods can materially affect the outcomes and interpretations of rankings, particularly in sensitive applications such as the evaluation of UNESCO natural heritage sites. In contexts where the decision space is fluid and evolving, relative methods like VIKOR can introduce ranking volatility that undermines the reliability of the results. Absolute-type methods, by contrast, offer stable and thus interpretable outputs and are better suited for informing long-term policy and funding decisions. Our analysis calls for greater methodological awareness in policy-relevant evaluations. Practitioners and analysts should critically consider not just the data and criteria, but also the nature and assumptions of the methods they apply and the composition of the set of alternatives. Doing so will improve transparency, robustness, and ultimately, the effectiveness of their decisions.

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Structure, Agency, and the Recursiveness of Social Practices: A Structuration Theory Perspective on Organizational Resilience and Crisis Adaptation

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Abstract: This article explores the recursive interplay between structure and agency within organizational settings through the lens of Anthony Giddens's structuration theory. By examining a high-pressure industrial organization during a crisis, this study highlights how institutional actors navigate constraints and exercise strategic agency to sustain organizational stability and adaptation. The research adopts a qualitative case study methodology, including participant observation, document analysis, and semi-structured interviews to capture micro-level negotiations among key stakeholders. Findings reveal how structural imperatives and managerial discretion coalesce in moments of uncertainty, demonstrating the practical relevance of structuration theory in contemporary organizational analysis. The study contributes to broader discussions on organizational resilience, power asymmetries, and institutional change, offering theoretical and managerial insights into balancing continuity and transformation in complex environments.

Keywords: Structuration Theory, Organizational Resilience, Strategic Agency, Crisis Adaptation, Institutional Change

JEL classification: M14, L22, D83

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1. Introduction

Understanding the complexities of social systems requires a conceptual framework that integrates the recursive interplay between structure and agency. Anthony Giddens's theory of structuration offers such a lens, challenging traditional dichotomies by positing that the fundamental domain of social science is neither the isolated subject nor the overarching social totality but rather "social practices ordered across space and time" (Giddens, 1984, p. 2 see also Whittington, 2024). This perspective emphasizes the dynamic and mutually constitutive relationship between human actions and the social structures they instantiate and transform (Orlikowski, 2000).

Structuration theory is well-suited in examining organizational dynamics in high-pressure environments, where decision-making, power asymmetries, and institutional continuity are in constant negotiation (Scott & Myers, 2010; Duchek, 2020). Giddens's insights into the reflexive monitoring of action, the rationalization of practices, and the stratification of agency shed light on how individuals navigate systemic constraints and opportunities within institutional settings (Feldman & Pentland, 2003; Klementová & Šatanová, 2017). His conceptualization of structure as both enabling and constraining foregrounds the recursive processes through which actors sustain or transform social systems (Sewell, 1992). In contemporary organizational contexts, this theory provides an invaluable

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analytical tool for understanding how rules and resources are mobilized in moments of conflict, uncertainty, and adaptation (Feldman & Pentland, 2003).

From a managerial standpoint, structuration theory provides a framework for analyzing how organizations balance stability and change amid complex institutional pressures (Barley & Tolbert, 1997). Contemporary management research increasingly acknowledges that organizations are neither fully deterministic nor purely agentic but are instead shaped by an ongoing dialectic between institutional constraints and strategic agency (Jarzabkowski, 2008; Whittington, 2024). This perspective is particularly relevant in understanding how managers enact and modify organizational routines in response to exogenous events, such as technological disruptions, regulatory shifts, or global crises.

This study applies structuration theory to a detailed case study of an industrial organization dealing with the cascading challenges of a global pandemic, supply chain disruptions, and conflicting operational priorities. Over the course of two days in Sector Alpha, we observe the intricate negotiations and tensions that unfold between key stakeholders—Sam, Marcus, Raymond, and Elena—as they attempt to balance competing demands in development and production. Their interactions reveal how agency is exercised within the structural constraints of organizational norms, technological dependencies, and institutional hierarchies, with individual performance also shaped by organizational efforts to develop human potential (Klementová & Šatanová, 2017). By analyzing these micro-level dynamics, we aim to uncover the broader processes through which structures are reproduced or altered in response to crises and shifting institutional logics (Greenwood et al., 2011).

2. Method

This study employs a qualitative case study methodology to explore the recursive interplay between structure and agency within an organizational context, drawing upon Giddens's structuration theory as an analytical framework. A case study approach is particularly suited for examining complex social processes, as it allows for an in-depth, contextualized understanding of actors' behaviours, decision-making, and institutional constraints in a real-world setting (Orlikowski, 2020; Scott & Allen, 2022). By integrating multiple data collection methods—including participant observation, document analysis, and semi-structured interviews—this study ensures methodological triangulation, enhancing the validity and reliability of the findings (Riessman, 2008).

2.1. Research Design

The study follows an interpretive research paradigm, emphasizing the reflexive nature of social practices and the embeddedness of agency within institutional structures (Morrison, 2023). The unit of analysis is the sequence of decision-making and negotiation processes among key stakeholders in a high-tech manufacturing firm (Sector Alpha). This design enables an investigation of how institutional structures shape and are shaped by human agency in moments of crisis and uncertainty.

The case study spans a two-day observational period, capturing micro-level interactions and power dynamics in a high-pressure industrial setting. The research focuses on key organizational actors (project managers - Sam, Marcus, Raymond, and Elena) and their strategic responses to operational constraints, particularly within the context of production and development trade-offs. These individuals were selected based on their direct involvement in critical operational decisions during a documented time of organizational disruption.

2.2. Research Questions

The four research questions were derived from the literature on structuration theory, particularly the concepts of duality of structure (Giddens, 1984), reflexive monitoring (Orlikowski, 2000), power asymmetries (Sewell, 1992), and temporal structuring (Whittington, 2024). These themes are recurrent in studies of crisis management, institutional change, and organizational resilience.

Duality of Structure and Decision-Making (RQ 1): *How does the duality of structure both constrain and enable organizational actors' decision-making during crises?*

Reflexive Monitoring and Organizational Resilience (RQ 2): *How does reflexive monitoring of action contribute to organizational resilience in high-pressure environments?*

Power Asymmetries and Structural Change (RQ 3): *How do power asymmetries influence the negotiation of structural change within organizations?*

Stability, Transformation, and Strategic Agency (RQ 4): *How does the interaction between stability and transformation mediate organizational change through temporal structuring and strategic agency?*

3. Case Study

The high-tech manufacturing sector operates in an environment characterized by rapid technological advancements, globalized supply chains, and complex operational interdependencies. During periods of crisis, such as the global pandemic, these organizations face unprecedented disruptions that test their capacity for resilience, adaptation, and strategic decision-making. This case study examines how structural constraints and managerial agency interact in Sector Alpha, a production and development unit within a high-tech manufacturing firm (NACE Code - C), where tensions arise between long-term product innovation and short-term production demands.

By tracing the interactions among managers, engineers, and executives over two consecutive days, this study demonstrates how actors draw upon institutional norms, hierarchical authority, and resource dependencies to make strategic decisions under uncertainty. The findings illustrate how power asymmetries, reflexivity, and communication shape organizational responses to crises, contributing to discussions on managerial discretion, institutional resilience, and the adaptability of organizational practices in volatile environments (Feldman & Pentland, 2003; Weick, 1995).

3.1. Case Narrative: Managing Conflict in Sector Alpha

This excerpt illustrates the lived dynamics of strategic agency and institutional constraint. It captures real-time decisions made by stakeholders during a production crisis, providing grounded insight into RQ2 and RQ3.

Act I, Scene 6 – Sector Alpha, Interaction: Real–Real, Sequence: 13:00–13:30

Marcus started by expressing his frustration with how Sam was approaching the P3/P2 development project activities. I replied that I understood since I had been in a similar situation before. I tried to explain that this might just be a misunderstanding. I didn't want the conversation to take a turn where the involved parties would start blaming each other for incompetence. Marcus replied that he hoped the matter would be resolved quickly. He added that despite their differing opinions, he understood

Sam's perspective to some extent, but he assumed that the production line would have to be halted because he had received reports from procurement that the supply contract for optical chips had not been renewed. I had a meeting scheduled with Raymond, so I asked Marcus for a short meeting in the afternoon. He said it wouldn't be a problem, and I then left for my next meeting.

Act I, Scene 7 – Sector Alpha, Interaction: Real–Real, Sequence: 14:00–14:30

Over the next few minutes, I spoke with Raymond, who had no further information on the situation. He said I had arrived just as Sam was about to "step down" and that Marcus had said he was leaving too. Raymond hoped I could resolve the matter and added that while conflicts between development and production occasionally occurred, this time, it was worse. He believed the problems were caused by the pandemic, which led to a global shortage of semiconductor components that Marcus urgently needed for development and Sam for mass production for customers. The entire situation had escalated into a conflict that, although always present between development and production, was usually manageable under normal conditions. However, the pandemic introduced new challenges that could only be resolved through active measures and cooperation that benefited both departments and the organization as a whole.

4. Findings: Key Themes and Broader Implications

This study identifies key themes that emerge from the analysis and discusses their broader implications for organizational theory, managerial practice, and structuration research. By examining the recursiveness of social practices within Sector Alpha, the findings illuminate the reciprocal relationship between structure and agency in shaping organizational resilience and crisis adaptation. The study highlights how reflexive monitoring, power asymmetries, and temporal structuring influence decision-making processes, providing insights into how institutional actors maintain continuity while simultaneously adapting to evolving constraints.

RQ 1: *How does the duality of structure both constrain and enable organizational actors' decision-making during crises?*

Findings: The case study supports this question by showing that while formalized rules initially restricted crisis resolution (e.g., rigid production schedules delaying testing), actors leveraged reflexivity and strategic negotiation to adapt institutional constraints (e.g., reallocating resources to enable temporary production halts for validation testing).

RQ 2: *How does reflexive monitoring of action contribute to organizational resilience in high-pressure environments?*

Findings: This question is addressed through the iterative negotiations between Elena, Sam, and Marcus, where strategic adaptation emerged through reflexive assessment of constraints (e.g., financial risks, production quotas, supply chain bottlenecks) and cross-functional collaboration to develop feasible compromises.

RQ 3: *How do power asymmetries influence the negotiation of structural change within organizations?*

Findings: The case study provides insights into this question by demonstrating how Raymond, as a senior executive, mediated disputes between Sam (production) and Marcus (development). Sam's structural advantage within operational hierarchies enabled him to resist production halts, while

Marcus relied on external justification (e.g., procurement reports, future cost savings) to advocate for change.

RQ 4: *How does the interaction between stability and transformation mediate organizational change through temporal structuring and strategic agency?*

Findings: This question is explored through evidence showing that short-term constraints (e.g., production targets, supply shortages) influenced immediate decisions, while long-term strategic goals (e.g., improved optical module efficiency) guided broader structural adaptations. The compromise between Marcus and Sam—limiting automated production halts to a few hours—demonstrates how organizational actors negotiate between operational continuity and innovation imperatives.

See **Table 2** for a summary of these answers across themes and actors.

Table 1: Key Findings, Challenges, Manager Insights, and Conclusions

Finding	Key Challenge	Manager Insights	Conclusions
Organizations operate within structural constraints but retain the ability to reinterpret and modify these structures to sustain operations during crises.	Reconciling Immediate Constraints with Strategic Objectives	Managers should adopt a reflexive approach, continuously re-evaluating constraints and adapting strategies to align with evolving conditions.	Organizational resilience emerges not from passive adaptation but from active negotiation of structural constraints.
Decision-making power is asymmetrically distributed, but strategic actors can leverage agency to negotiate change and shape crisis responses.	Managing Power Dynamics in Decision-Making	A participatory decision-making approach reduces power imbalances, fostering collective ownership and accountability in organizational responses.	Resilience is not solely determined by hierarchical authority but by the institutionalization of adaptive mechanisms that persist beyond immediate crisis responses.
Organizational structures undergo adaptive transformations during crises, but these shifts must align with long-term strategic imperatives to avoid short-lived, reactionary changes.	Adapting Institutional Structures Amid Uncertainty	Crisis-driven structural adaptations should be deliberately integrated into long-term transformation strategies to ensure organizational sustainability.	The interplay of structure, agency, and reflexivity shapes an organization's capacity to navigate uncertainty and institutionalize lasting change.

Table 1: Continuation

Short-term operational imperatives must be balanced with long-term strategic priorities, requiring leaders to manage temporal tensions between continuity and transformation.	Sustaining Operational Continuity While Driving Transformation	Leaders should institutionalize crisis-driven adaptations, embedding them into structured long-term planning to sustain both stability and innovation.	Strategic evolution is dependent on leaders' ability to actively manage power asymmetries and competing priorities, ensuring that short-term crisis responses contribute to enduring institutional change.

5. Discussion and Critical Reflection

This study provides new empirical insights into the application of structuration theory in the context of organizational crisis adaptation, shedding light on the recursive interplay between structure and agency in high-pressure environments. Through an in-depth case study of Sector Alpha, our findings illustrate how institutional constraints and managerial agency co-evolve, shaping the ways organizations navigate, resist, and transform structural conditions during crises.

While this study provides rich qualitative insights into structuration in crisis adaptation, it also has limitations that should be addressed in future research.

- A limitation of this study is its single-case design, which, while providing rich empirical insights, limits generalizability to other organizational contexts.
- The study captures a two-day crisis period, offering a snapshot of adaptation rather than a long-term view.
- With the growing reliance on digital infrastructures and remote collaboration, future studies should investigate how digital technologies mediate structuration processes in crisis adaptation.
- This study focuses on a high-tech manufacturing firm, where innovation and operational constraints shape structuration dynamics. Future research could explore these processes in public sector institutions and health care organisations.

6. Conclusion

This study highlights the analytical value of structuration theory in examining organizational resilience and crisis adaptation, demonstrating that institutional constraints do not unilaterally determine organizational behavior. Instead, these constraints are actively navigated, reinterpreted, and reshaped by actors engaging in reflexive monitoring and strategic agency. By extending structuration theory into the domain of crisis management and resilience-building, this research contributes to broader theoretical discussions in organization studies, sociology, and management theory.

Future research should further investigate the dynamic interplay between structure and agency, exploring how institutions evolve through ongoing negotiations between institutionalized constraints and agentic adaptations.

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The need of AI interpretation of accounting data

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Abstract: This paper explores the growing necessity of artificial intelligence (AI) in interpreting accounting data. As financial information becomes increasingly complex, AI technologies such as machine learning and neural networks are transforming how organizations analyse, forecast, and manage financial performance. The study examines AI applications in financial forecasting, risk detection, fraud prevention, and automation of accounting processes. Drawing on international research, it highlights how AI enhances data accuracy, improves decision-making, and strengthens financial transparency. The paper concludes that integrating AI into accounting systems is no longer optional but essential for timely, relevant, and reliable financial reporting in the digital era.

Keywords: accounting, data, interpretation, AI, decision-making

JEL classification: M40, M41, M49

1. Introduction

The use of artificial intelligence (AI) and machine learning in accounting has grown rapidly in recent years, driven by the need to interpret ever-increasing volumes of financial data and to enhance the quality of decision-making. Accounting data are often complex, voluminous, and multidimensional, making it challenging for humans to extract all relevant insights in a timely manner. AI offers tools to analyze patterns, predict outcomes, and detect anomalies that might be missed by traditional methods. For instance, AI techniques have significantly improved cash flow analysis and forecasting in the finance sector (Dholu & Hirani, 2025). In India, the transition from traditional ledger-based cash management to digital finance exemplifies how AI-driven analytics can provide predictive insights for liquidity planning. At the same time, the interpretation of accounting data must uphold accounting principles and standards. However, some studies suggest that conventional accounting standards can yield results that are artificial or not faithfully representative of economic reality (e.g., in complex areas like pension accounting), underscoring the need for enhanced analytical tools (Garvey et al., 2020).

The aim of the paper is to examine the AI need in accounting data interpretation.

1. AI-Driven Financial Analysis and Forecasting

One of the primary drivers for AI in accounting is the complexity of financial analysis and forecasting. Traditional financial analysis relies on predefined ratios and human judgment, but AI can uncover nonlinear patterns and relationships in data that enhance predictive accuracy. Machine learning algorithms (including deep learning models) are now used to forecast key financial indicators more accurately and efficiently than before. For example, Pozhueva et al. (2024) studied AI-based forecasting in enterprises and found that machine learning techniques improve the accuracy of financial forecasts, reduce risks, and increase the efficiency of financial management (Pozhueva et al., 2024). These technologies can analyze large volumes of historical data, identify hidden trends, and

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generate more reliable predictions of future performance. In practice, major financial firms have adopted AI for tasks like portfolio management, asset valuation, and market trend prediction, yielding better risk-adjusted returns and proactive decision-making (Farion et al., 2024). A concrete illustration of this is provided by Farion et el. (2024), who note how companies like JPMorgan Chase, Goldman Sachs, and BlackRock have successfully deployed machine learning to forecast market movements and manage risks (Farion et al., 2024). This not only improves planning and investment decisions but also addresses the need for timeliness in financial reporting by providing real-time or near-real-time insights.

AI's impact on financial analysis is also evident in specialized domains. Cash flow analysis is a fundamental part of accounting that AI has enhanced. Dholu and Hirani (2025) document the evolution of cash flow management in India from traditional practices to an AI-supported digital framework. They highlight that the adoption of AI tools has improved cash flow forecasting and liquidity planning, contributing to better financial stability and compliance. The AI-driven analytics offer predictive insights that help companies anticipate cash shortfalls or surpluses and optimize their working capital accordingly (Dholu & Hirani, 2025). This demonstrates the need for AI interpretation: modern businesses operate with fast-paced transactions and data, and AI helps interpret this data to ensure financial transparency and sound decision-making (Mukeshbhai & Hirani, 2025).

Another emerging area is the incorporation of AI in sustainability and climate-related financial analysis. Financial institutions face new types of data (e.g., climate risk metrics, ESG scores) that are complex to integrate into traditional financial models. Capizzi et al. (2023) introduced a special issue on *Climate Risk and Sustainability* for financial intermediaries, emphasizing that AI and advanced analytics are crucial for interpreting climate-related financial data and scenario analysis. They argue that financial intermediaries must leverage AI to model the long-term impacts of climate risks on asset values and credit portfolios (Capizzi, Dell'Atti & Di Biase, 2023). This example underscores a broader theme: as the scope of accounting information expands (from traditional ledgers to big data including non-financial metrics), the need for AI to interpret and integrate this information becomes critical.

It is worth noting that AI is not only about prediction but also about enhancing the interpretability and usefulness of financial reports. Some accounting standards produce figures that require careful interpretation - a case in point is the valuation of defined benefit pension schemes under IAS 19. Garvey, McNally, and O'Connor (2020) argue that the prescribed accounting treatment in IAS 19 can produce results (surpluses or deficits in pension plans) that are misleading and not truly "fair" representations of a company's financial position. This situation exemplifies the complexity of accounting data where economic reality and accounting rules diverge. While the paper by Garvey et al. (2020) is a critique of standards rather than an AI application, it highlights why advanced analytical approaches (potentially AI-driven simulations or scenario analyses) are needed to interpret accounting data more faithfully. AI could assist by running alternative valuation scenarios or stress tests that provide management and stakeholders a clearer picture beyond the standard compliance numbers. In summary, the demands of modern financial analysis - accuracy, speed, complexity, and expanded data - create a strong need for AI-driven interpretation of accounting data to support better forecasts and strategic decisions.

2. AI for Risk Detection and Financial Integrity

Another critical need for AI in accounting data interpretation lies in risk management, including the detection of financial distress, fraud, and compliance issues. Traditional red-flag approaches or manual audits are often insufficient to catch sophisticated patterns of risk. AI algorithms excel at pattern recognition and anomaly detection, making them invaluable for early warnings of financial problems. Financial distress prediction is a prime example where AI has made significant strides. Researchers have applied data mining and machine learning to financial ratios and other data to predict bankruptcy or distress well before it becomes obvious. In a study focusing on Iraqi companies, Abdullah and Al-Anber (2021) used techniques like decision trees (C4.5), support vector machines, and neural networks to detect companies in financial distress. Their results demonstrated very high accuracy: the models achieved classification accuracy around 92-98% in predicting distressed vs. healthy firms. Notably, an artificial neural network (multilayer perceptron) achieved about 97% accuracy, outperforming or matching other methods. Such findings show that AI can process a multitude of financial indicators simultaneously and uncover complex interactions indicative of distress that would be hard for an analyst to manually discern. Early detection via AI allows auditors and managers to take preventive actions (such as restructuring debt or improving cash management) thereby reducing the risk of corporate failure.

Advanced machine learning models are also being developed for broader applicability across markets. Abrahamsen et al. (2024) present an explainable AI model using LightGBM (an ensemble boosting algorithm) to predict financial distress among Nordic companies. By combining financial statement data, market data, and macroeconomic indicators into a comprehensive dataset (2001-2022), their AI model provided more accurate early warnings than traditional logistic regression models (Abrahamsen et al., 2024). The LightGBM model leveraged a high-dimensional feature space and identified key predictors of distress, notably liquidity and solvency ratios and firm size, which aligned with established financial theory. Importantly, they incorporated explainable AI techniques to interpret the model's outputs, ensuring that the predictions could be understood in terms of known risk factors. This combination of accuracy and interpretability is critical; it exemplifies how AI can not only predict risks but also offer insights (e.g., why a company is at risk) that are actionable for decision-makers.

Beyond predicting distress and bankruptcy, AI plays a growing role in fraud detection and compliance, including areas like money laundering detection and financial statement fraud. Financial crimes often hide within large datasets of transactions or accounting entries - patterns that AI can potentially flag. Dzingirai (2024) conducted research on the effects of AI in combating money laundering in Southern Africa. Through a structured literature review, the study identified six positive impacts of AI: detecting suspicious transactions, enhancing legal compliance, augmenting customer behavior analytics, uncovering laundering networks, improving risk assessment calculations, and informing evidence-based policy (Dzingirai, 2024). For instance, banks are using machine learning models to monitor transactions in real-time for atypical flows that might indicate laundering, something that was traditionally done with static rules. The study also noted some challenges (like concerns over privacy and data governance), but overall concluded that AI significantly helps combat money laundering by catching illicit activity that humans might overlook (Dzingirai, 2024). This reflects a broader trend in accounting and finance: regulators and firms are adopting AI to ensure the integrity of financial systems.

Similarly, AI-driven models have been applied to fraud risk assessment in auditing. While not explicitly outlined in the present paper, numerous studies (e.g., on forensic accounting during the 2008 crisis)

have shown that AI can flag abnormal accounting patterns that may suggest earnings manipulation or fraud (KPMG, 2019; ACFE, 2020). Chen and Zhang (2022) focused on *financial crisis early warning* using artificial neural networks in the context of accounting information disclosure. Their model improved the accuracy of predicting a company's financial crisis by 35% and could potentially reduce financial losses by 8% compared to prior techniques (Chen & Zhang, 2022). These improvements underscore how AI interpretation of accounting data - through training on historical cases of corporate failure - enables much earlier and more accurate detection of red flags than traditional ratio analysis alone.

An important aspect of AI in risk management is that it augments human judgment. Auditors and risk officers are incorporating AI outputs into their workflows; for example, an AI system might generate an alert for an unusual revenue recognition pattern, which the auditor then investigates further. This synergy is crucial because AI, despite its power, can also produce false positives or require context understanding that humans provide. Nevertheless, the need for AI is clear: the scope and scale of financial data today (spanning global operations, electronic transactions, and even social media signals that might hint at credit risk) are beyond manual analysis. By leveraging AI for interpreting this data, organizations bolster their financial vigilance - whether it's preventing fraud, complying with laws (like anti-money laundering regulations), or ensuring ongoing solvency.

3. AI-Enabled Automation and Efficiency in Accounting

The third major area driving the need for AI interpretation of accounting data is the quest for greater efficiency and accuracy in accounting operations. Automation of routine accounting tasks through AI (often termed robotic process automation, RPA, when rules-based, or intelligent automation when AI-driven) is transforming how accounting departments function. The interpretation of data in this context means AI systems not only record or transfer data faster but also understand and classify accounting information correctly without constant human oversight. This need has become pronounced as organizations deal with high volumes of transactions and seek real-time financial reporting.

One example comes from the domain of financial management systems in specialized settings, such as museums. Wang (2023) studied the *innovation of computer AI technology in a museum's financial management system*, introducing RPA powered by AI to handle tasks like invoice processing, expense categorization, and auditing. The introduction of AI-driven automation improved efficiency and accuracy in the museum's accounting process by minimizing manual errors and freeing up accountants' time for analysis (Wang, 2023). This case exemplifies how AI's ability to interpret accounting data (e.g., reading receipts or financial documents via OCR and categorizing them appropriately) streamlines operations. Many companies similarly employ AI-based invoice processing systems that can interpret the content of invoices and book entries to the correct ledgers automatically, drastically reducing processing time.

AI's interpretative power is also enhancing how accounting systems handle data integration and anomalies. Song (2024) proposed an optimized financial data processing model for accounting information systems using AI techniques. The model employs a Bagging ensemble algorithm combining Random Forest, Support Vector Machine, and Naïve Bayes classifiers to process imbalanced enterprise financial data. By assigning weights to various financial indicators and analyzing a company's data, the AI model can classify the firm's financial health and performance trends with improved accuracy (Song, 2024). In a case study on a consumer electronics company, the AI-driven model produced a composite

financial score for each year, closely tracking the company's actual improvements and flagging areas needing attention. The takeaway is that AI can efficiently sift through complex accounting datasets, highlight key metrics (profitability, debt service capacity, etc.), and even provide actionable recommendations for management (e.g., focus on improving long-term operating capability in the example of Company W). This level of automated insight was historically difficult to achieve; it showcases why accounting information systems are increasingly embedding AI modules - to interpret data continuously and support managerial decision-making.

AI and Big Data analytics are also proving essential for smaller financial institutions, like credit unions. Millerman (2023) discusses how local credit unions can utilize sophisticated data analytics to drive profitability. By analyzing large datasets on member transactions and behaviors, AI tools can help credit unions segment customers, tailor products, and forecast loan defaults or prepayments more effectively (Millerman, 2023). The improved interpretation of member data translates to better customer service and financial performance for these institutions, which often lack large analytical staff. This scenario exemplifies that the need for AI in accounting isn't limited to corporate finance; it extends to any organization that must extract insights from financial data to remain competitive.

Another facet of efficiency is the quality of financial reporting. Mohammed (2024) examined the relationship between AI and e-accounting systems in Iraqi banks, finding a positive impact on the quality of financial reports. The integration of AI in accounting software improved the accuracy and timeliness of reports, as well as compliance with accounting standards (Mohammed, 2024). Essentially, AI algorithms can continuously check transactions against reporting requirements, ensure disclosures are complete, and even draft preliminary financial statements, allowing accountants to focus on interpretation and decision support. The result is higher-quality information being produced in less time. This aligns with Gou's (2020) perspective that the "financial intelligence" era raises new requirements for accounting information quality, including enhanced timeliness and reliability of data. As AI takes over transactional processing, stakeholders expect accounting information to be updated in real-time and free of human error, which in turn demands that the principles of prudence and verification in accounting be maintained through intelligent system design (Gou, 2020). Accountants thus need to work with AI, overseeing these systems and interpreting outputs, rather than performing all tasks manually.

Lastly, AI has shown promise in complex accounting estimates and asset management. Lutska et al. (2024) explore how digital transformation technologies, including AI and the Internet of Things (IoT), can improve the management of fixed assets. They note that current trends in fixed asset management focus on using AI and data analytics to enhance asset utilization efficiency, predict maintenance needs, and optimize asset life-cycles (Lutska et al., 2024). For example, AI can analyze usage patterns and maintenance logs to determine when equipment is likely to fail or when it's underutilized, thereby informing better capital investment decisions. The researchers also acknowledge the challenges - implementation costs, cybersecurity, need for staff training - but conclude that the benefits (such as reduced downtime, cost savings, and more accurate asset valuation) underscore why a balanced adoption of AI is necessary in this area (Lutska et al., 2024). In summary, from automating bookkeeping entries to enhancing strategic asset management, AI's ability to interpret accounting data quickly and accurately is driving efficiency gains across the accounting function. The need for such AI integration is ultimately rooted in the demand for faster reporting cycles, error reduction, and the capability to derive actionable intelligence from accounting data rather than just recording

4. Conclusion

In conclusion, the interpretation of accounting data is increasingly beyond the scope of manual methods due to the volume, velocity, and complexity of information in today's financial environment. AI and machine learning have emerged as indispensable tools to meet this challenge. They address the need for more accurate forecasting, as evidenced by improved prediction of financial outcomes and early risk warnings in multiple studies (Abdullah & Al-Anber, 2021; Abrahamsen et al., 2024; Pozhueva et al., 2024). They enhance risk management by detecting patterns of distress, fraud, or money laundering that humans might miss, thereby safeguarding financial integrity (Dzingirai, 2024; Chen & Zhang, 2022). Additionally, AI-driven automation brings efficiency and consistency to accounting processes, reducing errors and freeing professionals to focus on analysis and decision-making (Wang, 2023; Mohammed, 2024). The need for AI interpretation of accounting data is also philosophical: as Gou (2020) notes, the advent of "financial intelligence" is reshaping accounting theory and information quality requirements. Timeliness, prudence, and reliability of accounting information all take on new dimensions when intelligent machines are involved in generating reports.

It is important to emphasize that AI is a tool to augment - not replace - human judgment in accounting. The best outcomes arise when accountants and auditors leverage AI's capabilities to gain deeper insights and improve oversight. For instance, an AI model might flag an unusual revenue entry, but a skilled accountant will investigate the context and decide the appropriate action. Therefore, along with adopting AI, organizations must invest in developing their human capital to understand and interpret AI outputs critically.

Overall, the research and cases discussed illustrate a clear trend: organizations that successfully integrate AI into their accounting practices achieve better analytical outcomes, faster and more reliable reporting, and stronger risk controls. This not only improves operational performance but also supports the overarching goals of accounting - to provide a faithful representation of financial reality and useful information for decision-making. As financial data continues to grow in complexity (think of real-time transactions, cryptocurrencies, or global supply chain finance data), the reliance on AI interpretation will become even more central. The need for AI in accounting is no longer a futuristic concept but a present reality, driving a transformation in how financial information is analysed and utilized. Future research will undoubtedly continue to refine AI techniques, address challenges like explainability and data privacy, and broaden the horizons of what accountants can achieve with intelligent systems. Embracing these tools is essential for the accounting profession to fulfil its role in an increasingly digital and data-driven world.

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Duration of development and business potential of innovations: Empirical findings from business practice

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Abstract: The paper analyzes the relationship between innovation development time and the estimated business potential based on data from 170 companies. The study focuses on product and process innovations, using standardized questionnaires where respondents rated key variables on five- and six-point Likert scales. Quantitative methods, including descriptive statistics, Spearman's correlation, and paired nonparametric tests, were applied to examine links between development time, implementation stage, and market potential. The analysis also compares products and processes in terms of efficiency and business utilization. Findings reveal that longer development does not automatically ensure higher market potential, providing practical recommendations for companies investing in innovation strategies.

Keywords: innovation development, business potential, product and process innovation

JEL classification: O31, O32, L26

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1. Introduction

Innovation plays a critical role in strengthening the competitiveness and long-term sustainability of enterprises in today's dynamic and complex global business environment. As noted by Hofer et al. (2020), the shortening of product life cycles and the increasing technological complexity of manufacturing systems require companies to adopt more flexible and agile innovation strategies that effectively combine responsiveness with long-term planning. The ability to manage innovation cycles efficiently has thus become a decisive factor for success in highly competitive markets. The importance of developing innovation capabilities is further emphasized by Rajapathirana and Hui (2018), who argue that a firm's ability to implement various types of innovation (product, process, organizational, and marketing) directly impacts its performance and market position. This relationship is particularly significant for understanding innovation potential, which can be defined as a firm's ability to generate and implement novel ideas that create substantial value for customers while building sustainable competitive advantage. From the perspective of innovation management, balancing development speed and the quality of innovation outcomes is crucial. Chen et al. (2012) warn that accelerating

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innovation cycles may bring short-term competitive advantages but can also jeopardize quality and reduce the long-term market potential of innovations. Conversely, longer development times can provide space for in-depth market analysis, technological refinement, and increased originality, enhancing the value and potential of innovations in the market. Visnjic et al. (2016) expand on this by demonstrating that the complementarity between product innovation and business model innovation can deliver higher customer value and long-term sustainability. However, such an approach often requires longer development times and higher initial investments, underscoring the need for effective resource planning. External linkages and network collaboration also play a critical role in innovation success. Najafi-Tavani et al. (2018) highlight the importance of collaborative innovation networks and absorptive capacity in transforming external knowledge into market-driven innovations. These factors can significantly influence innovation potential, enabling firms to respond faster to technological and market changes. Strategic planning in innovation activities is equally important, as noted by Farida and Setiawan (2022). Their research shows that a well-defined business strategy supported by innovation capabilities substantially enhances competitive advantage, particularly for small and medium-sized enterprises (SMEs). Finally, from an innovation policy perspective, Schot and Steinmueller (2018) emphasize the need to shift from traditional R&D-focused frameworks to transformative approaches that address systemic change and sustainability. This perspective is especially relevant when assessing innovation potential as it extends beyond individual firms and becomes part of a broader innovation ecosystem.

In this context, this study investigates the relationship between innovation development time and the estimated business potential of innovations. The analysis, conducted on a sample of Slovak enterprises, examines whether longer development cycles are associated with higher innovation potential and market success or whether shorter cycles allow for more effective exploitation of market opportunities. The findings aim to contribute to a deeper understanding of innovation strategy effectiveness and provide managerial recommendations for optimizing innovation processes in dynamic business environments.

2. Methodology

In this paper, we use a quantitative approach to examine the relationship between the duration of innovation development and the estimated business potential. The primary data comes from a pre-prepared standardized questionnaire survey, which was conducted between September 2024 and December 2024 in Slovakia. The questionnaire was distributed to respondents online in the form of a Google Form. Data collection is carried out through a questionnaire survey, with the questionnaire structured into several thematic areas. It contains closed questions using 2-point, 5-point, and 7-point scales, as well as open questions that allow for more detailed verbal responses from respondents. The questionnaire focuses on evaluating the innovative activity of companies, the business environment, the business model, internal growth factors, and external stimuli affecting business. The evaluation and interpretation of the results are based on a combination of quantitative and qualitative analysis. Quantitative data from closed questions are processed using Jamovi statistical software, which allows for the analysis of trends and relationships between variables.

The collected data were analyzed using Jamovi statistical software, allowing for descriptive analyses, Spearman's correlation analysis, and paired nonparametric tests. These methods provided insights into the relationships between the studied variables and enabled a comparison of the efficiency of

product and process innovations in terms of their business utilization. The research sample consisted of 170 innovative companies in the Slovak Republic, which were divided according to the European Commission's size categorization of companies, resulting in a research sample of - (micro (42%), small (25%), medium (25%), and large (8%)), with the main criterion for classification being the number of employees.

- ***Independent variable: Length of innovation development***
  measured separately for: product innovations
  process innovations
  determined using a Likert scale (1 = very short development to 6 = very long development)
- ***Dependent variable: Estimated business potential of innovation***
  specifically evaluated for: product innovations (*Potential_product*)
  (for process innovations, the dependent variable was apparently stage progress or efficiency, if also measured by *Stage_process*)
  respondents rated on a scale (1–6), where a higher number means a higher expected market impact or potential

Research assumption

We assume that the duration of innovation development is a significant factor influencing the estimated business potential of innovations. Companies that invest more time in developing product or process innovations may achieve higher market reach and sustainable competitive advantage. However, this relationship may not be linear – a longer development time does not automatically guarantee higher business potential. Therefore, it is necessary to explore whether differences exist between product and process innovations in this regard. The research is based on the assumption that the efficiency of the innovation cycle is a key determinant of innovation success in the market.

Research question

Does the duration of innovation development significantly relate to the estimated business potential of product and process innovations?

Following the research question, 2 hypotheses were set:

H_0: There is no statistically significant relationship between the duration of innovation development and the estimated business potential of innovations.

H_1: There is statistically significant relationship between the duration of innovation development and the estimated business potential of innovations.

3. Results

We formulated a research question and two research hypotheses, which were empirically tested. In the following section, we present a partial analysis and construct conclusions to verify the research hypotheses. Each variable was initially examined using descriptive statistics to provide an overview of innovation development time, implementation stage, and estimated business potential. Subsequently, Spearman's correlation analysis and Wilcoxon signed-rank tests were applied to assess the relationships and differences between product and process innovations.

Table 1: Descriptive statistics of the main variables

Descriptives					
	Devtime_product	Devtime_process	Stage_product	Stage_process	Potential product
N	170	170	170	170	170
Missing	0	0	0	0	0
Mean	2.59	2.60	5.32	3.72	3.51
Median	2.00	2.00	6.00	4.00	4.00
Standard deviation	1.43	1.36	1.40	0.816	1.54
Minimum	1	1	1	1	1
Maximum	6	6	7	5	6

Source: own processing based on Jamovi results

Table 2: Correlation matrix of innovation development time, implementation stage, and estimated business potential

Correlation Matrix					
		Devtime_product	Devtime_process	Potential product	Stage_process
Devtime_product	Spearman's rho	—			
	df	—			
	p-value	—			
Devtime_process	Spearman's rho	0.340	—		
	df	168	—		
	p-value	<.001	—		
Potential product	Spearman's rho	0.585	0.166	—	
	df	168	168	—	
	p-value	<.001	0.030	—	
Stage_process	Spearman's rho	-0.035	0.186	0.064	—
	df	168	168	168	—
	p-value	0.649	0.015	0.408	—

Source: own processing based on Jamovi results

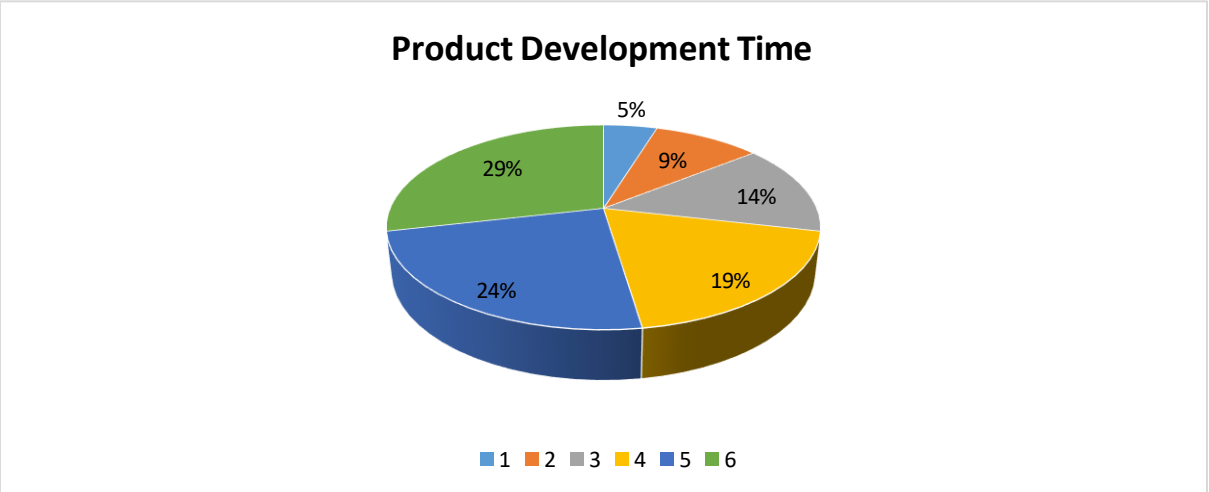

Figure 1: Distribution of product development time

Source: own processing based on survey results visualized in software MS Excel

The results section presents findings from the descriptive analysis, correlation analysis, and data visualization. Table 1 summarizes the basic statistical indicators of the examined variables. The average development time of product innovations was 2.59 (SD = 1.43), while process innovations reached an average of 2.60 (SD = 1.36). The median for both variables was 2, indicating that most enterprises reported a short to moderately short innovation development time. The implementation stage of products reached an average value of 5.32 (SD = 1.40), with a median of 6, suggesting that most product innovations had already reached the advanced stage of sales and revenue growth. In contrast, process innovations were mostly in the deployment stage (mean = 3.72; SD = 0.82; median = 4). The estimated business potential of products was 3.51 (SD = 1.54), indicating that enterprises attribute a moderately high to high market potential to their innovations. Table 2 presents the results of Spearman's correlation analysis. A moderately strong positive relationship was identified between product development time and their estimated business potential ($\rho = 0.585$; $p < 0.001$). For process innovations, the relationship was weaker ($\rho = 0.166$; $p = 0.030$), but still statistically significant. These results support the hypothesis that a longer development time is associated with higher business potential, although the strength of this relationship differs between product and process innovations.

Figure 1 provides a detailed visualization of the distribution of enterprises based on their assessment of product innovation development time. The analysis shows that the majority of respondents reported shorter development cycles. Specifically, 31.8% of enterprises (54 out of 170) rated the development time as 2 – moderately short, and 27.1% (46 enterprises) selected 1 – very short. This indicates that more than half of the surveyed enterprises perceive their innovation development process as efficient and time-effective. A smaller portion of respondents reported longer development times. Specifically, 19.4% (33 enterprises) assessed the duration as 3 – medium, 11.2% (19 enterprises) as 4 – long, 6.5% (11 enterprises) as 5 – very long, and only 4.1% (7 enterprises) as 6 – excessively long. These results suggest that only a minority of enterprises experience prolonged development phases, which may be associated with highly complex or original innovations requiring extended effort and resources. The distribution emphasizes that most innovations are developed within manageable timeframes, reflecting efficient innovation management practices. However, the presence of enterprises in the higher categories of development time also indicates cases where longer development cycles could potentially lead to greater market potential, as supported by the correlation analysis findings.

4. Conclusion

The findings of this study revealed that there is a statistically significant relationship between innovation development time and its estimated business potential, with notable differences between product and process innovations. A moderately strong positive correlation was identified for product innovations (Spearman's $\rho = 0.585$; $p < 0.001$), suggesting that firms investing more time in the development of their products tend to achieve higher market reach and better commercial outcomes. This supports the arguments of Rajapathirana and Hui (2018), who highlight that longer development cycles provide opportunities for technological refinement and higher innovation originality, which ultimately increase market potential. In contrast, the relationship for process innovations was weaker but still statistically significant (Spearman's $\rho = 0.166$; $p = 0.030$). This finding aligns with the perspective of Chen et al. (2012), who suggest that shorter development cycles may suffice for incremental process improvements, particularly when such innovations are less complex and focused on operational efficiency. The role of external networks and absorptive capacity, as emphasized by

Najafi-Tavani et al. (2018), is also evident in these findings. Firms with strong collaborative networks may optimize development time while simultaneously increasing their chances of innovation success. This is particularly relevant for product innovations, where longer development times are not inherently detrimental if supported by effective external knowledge integration. Furthermore, the complementarity between product innovations and business model innovations, highlighted by Visnjic et al. (2016), suggests that Slovak firms should consider integrating business model innovation strategies when developing new products to maximize market potential. These results are also consistent with the findings of Farida and Setiawan (2022), who stress the importance of strategic planning and innovation capabilities, particularly in SMEs seeking to strengthen their market position.

Finally, from a policy perspective, the findings resonate with the transformative innovation framework of Schot and Steinmueller (2018), which advocates for moving beyond traditional R&D approaches toward systemic innovation strategies that promote sustainability and long-term value creation. Assessing innovation potential thus requires considering not only market success but also firms' ability to adapt to broader societal and technological changes.

Verification of research hypotheses and answer to the research question

Based on the statistic analyses conducted, we can state:

We **reject** the hypothesis H_o, there is no statistically significant relationship between the duration of innovation development and the estimated business potential of innovations.

Hypothesis H_1 - we **accept**, there is statistically significant relationship between the duration of innovation development and the estimated business potential of innovations.

Based on the analysis we can answer the research question - *Does the duration of innovation development significantly relate to the estimated business potential of product and process innovations?*

The findings confirm that there is a statistically significant relationship between innovation development time and its estimated business potential. For product innovations, a moderately strong positive correlation was identified (Spearman's $\rho = 0.585$; $p < 0.001$), indicating that longer development times are associated with higher business potential. For process innovations, the relationship was weaker but still statistically significant (Spearman's $\rho = 0.166$; $p = 0.030$). These results suggest that while both types of innovations benefit from carefully managed development time, the impact of duration is more pronounced for product innovations.

Study limitations

1. **Use of self – reported data**
   The primary data in this study was collected through self-assessment questionnaires, which may be subject to respondent bias, including overestimation or underestimation of development times or innovation potential.
2. **Subjective evaluation of business potential**
   The business potential of innovations was evaluated subjectively by company representatives, not based on objective performance indicators such as revenue, ROI, or market share. This may affect the generalizability and accuracy of the findings.

3. **Limited to Slovak enterprises**
   The research sample consists solely of companies operating in the Slovak Republic. Therefore, the findings may not be directly generalizable to other national or regional contexts with different innovation ecosystems.

Directions for future research

1. **Incorporate objective innovation performance indicators**
   Future research should combine subjective assessments with quantitative indicators (e.g., % of revenue from new products, patent count, market success metrics) to provide a more robust evaluation of business potential.
2. **Expand to comparative or multi-country studies**
   To validate findings and enhance generalizability, future research should be extended to different countries or regional innovation ecosystems, allowing for comparative analysis.

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Soft Skills as Civic Skills: Rethinking 21st-Century Skills Frameworks

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Abstract: In the MEGASKILLS project (megaskills.eu), a set of several dozen of the most essential soft skills for the 21st century was identified and categorized, and a comprehensive model was proposed to support their effective development. While this development was initially intended to enhance individuals' professional success and their contribution to organizational performance, recent global events have prompted a reconsideration of their broader societal value. In this paper, the potential of soft skills to function as civic skills is explored, along with the ways in which they might be cultivated across diverse groups of citizens. In addition, alternative frameworks for defining skills and competences are briefly compared, and their practical applicability in both professional and civic contexts is assessed.

Keywords: soft skills, civic skills, development of soft skills

JEL classification: O31

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1. Introduction

One of the outcomes of the research within the MEGASKILLS project (MEGASKILLS, n.d.) is a new, unambiguous definition of the term soft skills: "Soft skills encompass a wide array of personal, interpersonal, and cognitive attributes, allowing individuals to effectively interact and navigate diverse situations. Transferable across jobs, they are vital for both personal growth and performance in professional settings, complementing hard skills. Soft skills are developed through experiences, reflection, and ongoing learning. Soft skills are relevant to individuals of all ages, genders, and cultural backgrounds."(Kubátová et al., 2025, p. 64) The definition underscores the significance of soft skills across a range of contexts, highlighting their relevance in both personal and professional domains. However, recent global developments have led us to reflect more deeply on the broader societal value of soft skills and to consider whether some of the soft skills identified in the MEGASKILLS framework as essential for the 21st century may also qualify as so-called civic skills.

The term civic skills is widely used in academic literature. However, it lacks a universally accepted definition and is often limited to enumerative descriptions of what it entails. Nevertheless, there is broad consensus that the development of civic skills among citizens is essential for the sustainable functioning of democratic societies. In this paper, drawing on Olayinka et al. (2024, p. 114), civic skills are regarded as "a set of competencies that enable individuals to engage effectively in public life and participate in the democratic processes." Admittedly, defining skills using term competencies is not ideal from a conceptual standpoint. However, for the purposes of this paper, this formulation is

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adopted for two reasons. First, it aligns with the way the term is generally used in academic literature. Second, and more importantly, our aim is to examine whether civic skills constitute a subset of soft skills, a concept that has been already defined. The academically documented lack of conceptual clarity surrounding terms such as skills, knowledge, and competence (Cinque, 2016) requires attention, but should not hinder practical efforts to support the democratic development of society.

2. Do civic skills constitute a subset of soft skills?

As a starting point for examining whether civic skills can be considered a subset of soft skills, or to explore the general relationship between the two, we drew on two sources: one conceptualizing soft skills (Kubátová et al., 2025), and the other defining a set of competences that, by definition, represent civic skills (Council of Europe, 2018). The first source presents a model of thirty soft skills identified as particularly significant for the 21st century. The second source identifies twenty competences considered essential for active democratic participation, grouped into four categories: values, attitudes, skills, and knowledge and critical understanding.

In order to explore the relationship between the Council of Europe's (2018) competences and the soft skills defined by Kubátová et al. (2025) qualitative conceptual comparison (Morse, 2016) was conducted. This method enabled a systematic comparison of how individual competences and soft skills are defined in terms of their content, structure, and the individual or societal outcomes they are intended to support. Thus, each of the twenty competences was systematically compared with all thirty soft skills in order to identify conceptual correspondences based on shared definitional elements. Identified conceptual correspondences (shared definitional elements) are presented in table 1.

Ten out of the twenty competences showed a clear functional overlap with one or more soft skills, more specifically with twelve out of the thirty defined soft skills. The competences are defined in much broader terms, which is why some of them are expressed in the plural form. In two cases, a single competence overlaps functionally with two distinct soft skills that are more narrowly and precisely defined. A good example is the distinction between the soft skills collaboration and teamwork, which is relevant in work environments where it is important to differentiate between working groups and teams. From the competence perspective, however, these are merged under a single name - co-operation.

Table 1: Conceptual correspondences between democratic competences and soft skills

(Source: author team based on Council of Europe's, 2018, and Kubátová et al., 2025)

Competence/Soft skill	Conceptual correspondences
Analytical and critical thinking skills/ Critical Thinking	Breaking down complex topics into constituent elements Identifying relationships, patterns, and connections between elements Evaluating evidence and the validity or reliability of information Considering alternative interpretations, meanings, or viewpoints Drawing coherent and well-founded conclusions or judgments Awareness of assumptions, biases, and underlying motives
Conflict-resolution skills/ Conflict Resolution	Identifying and analyzing the causes of conflict Acknowledging and considering different perspectives Facilitating understanding and communication between conflicting parties Exploring and evaluating options for resolution

	Working toward a mutually acceptable solution or consensus
Co-operation skills/ Collaboration	Contributing one's knowledge, skills, or expertise to the group Appreciating the strengths and contributions of all group members Supporting mutual learning and development Encouraging active participation and engagement of others
Teamwork	Working together toward a shared or common goal Coordinating actions with others in a team Adapting one's behavior to support team success Encouraging participation and mutual support among team members
Empathy/ Empathy	Ability to step outside one's own perspective Understanding others' emotions, thoughts, and perspectives Supporting others with compassion and care Recognizing and responding to others' needs and experiences Building genuine interpersonal relationships
Flexibility and adaptability/ Adaptability	Adjusting to new conditions or situations Openness to change Overcoming challenges or obstacles
Flexibility	Managing unexpected tasks or challenges Shifting thoughts, behaviors, or priorities in response to changing conditions Responding constructively to demands and opportunities
Knowledge and critical understanding of the self/ Self-awareness	Awareness and understanding of one's own emotions, motivations, and drives Recognition of one's own strengths and limitations Understanding how one is perceived by others Awareness of the biases and assumptions that shape one's perspective
Linguistic, communicative and plurilingual skills/ Communication	Communicating clearly and effectively in various situations Expressing ideas, beliefs, and needs in oral and written forms Adjusting communication to audience and context Managing misunderstandings or communication breakdowns Recognizing and responding to different modes and conventions of communication (verbal and non-verbal)
Openness to cultural otherness and to other beliefs, world practices/ Cultural Intelligence	Sensitivity and awareness toward cultural diversity Understanding and respecting cultural differences Adjustment or adaptability in diverse cultural contexts Willingness to engage with people from different cultural backgrounds Suspension of judgment toward other worldviews and practices
Skills of listening and observing/ Active Listening	Treating listening as an active, engaged process Paying close attention to what is being said Seeking to understand the speaker's message accurately Remembering or retaining key information
Tolerance of ambiguity/ Coping with Uncertainty, Ambiguity, and Risk	Readiness to tolerate and manage ambiguity Positive or proactive attitude toward risk and complexity Openness to multiple perspectives and interpretations Dealing with incomplete information Constructive approach to unclear or complex situations Cognitive flexibility and non-rigid thinking Willingness to make decisions despite lack of clarity

The answer to the question of whether civic skills constitute a subset of soft skills is that there is a significant overlap between the sets of soft skills and civic skills examined. However, the civic skills analyzed do not constitute a subset of the soft skills. Nevertheless, this finding is significant because if the MEGASKILLS project demonstrates that soft skills can be developed through video games, this would also apply to the corresponding civic skills. From this perspective, critical thinking, adaptability, empathy, and communication appear to be the most promising, as the positive impact of video games on these skills has already been demonstrated by other studies (Kubátová et al., 2024).

3. Themes underpinning soft and civic skills development

It can thus be inferred that certain methods, such as playing games, can simultaneously develop some soft skills as well as civic skills. However, by determining the set of conceptual correspondences, data has been generated that can be used to examine whether it might be possible to find an even more effective approach than developing individual skills. Therefore, the follow-up question is: Are there some underlying themes across the conceptual correspondences that are particularly frequent, and thus offer the greatest leverage for the effective development of the soft and civic skills?

To address this question thematic analysis of the conceptual correspondences was conducted, following the six-phase approach proposed by Braun and Clarke (2006). All conceptual correspondences were thoroughly reviewed. In the initial coding phase, each item was assigned one or more codes reflecting its core process or disposition. These codes were then examined for patterns and grouped into potential themes based on semantic similarity and shared function. Through an iterative process of reviewing, refining, and naming, a set of overarching themes was established. The frequency of these themes was subsequently analyzed to determine which themes recur most often. The results are presented in table 2.

Table 2: Frequency of themes across conceptual correspondences

(Source: author team)

Theme	Frequency
Cognitive and behavioral flexibility	22
Perspective-taking including empathy	16
Constructive communication	14
Collaboration including conflict management	13
Critical thinking	10
Self-awareness and self-regulation	7
Cultural intelligence including intercultural openness	7

Note: Some conceptual correspondences received multiple thematic codes

Seven themes were identified as significantly related to the development of both soft and civic skills. The theme of Cognitive and Behavioral Flexibility will be addressed further, as it emerged with the highest frequency across the conceptual correspondences.

4. Cognitive and behavioral flexibility as a key theme of soft and civic skills

Cognitive and behavioral flexibility permit the appropriate adjustment of thoughts and behaviors in response to changing environmental demands (Uddin, 2021). It falls under the broader category of executive functions necessary for the control of goal-directed behavior. Executive functions are

commonly understood to consist of three core components: shifting - the ability to switch between tasks or mental sets; updating - which involves monitoring and revising information held in working memory; and inhibition - the capacity to suppress automatic or dominant responses.

Cognitive and behavioral flexibility follow a dynamic trajectory across the lifespan. Emerging early in childhood, cognitive and behavioral flexibility continues to mature through adolescence and typically peaks in young adulthood, when executive control systems are most efficient. During adolescence, the development of flexibility is shaped by ongoing maturation of brain networks involved in cognitive control and emotion regulation, making this a particularly sensitive period. In later life, some studies suggest that flexibility may decline, with changes in brain network dynamics and reduced signal variability potentially contributing to increased rigidity in thought and behavior.

Yet cognitive and behavioral flexibility are not fixed traits but can be developed and enhanced through targeted interventions (Uddin, 2021). One approach is computerized cognitive training, which involves structured, repetitive mental exercises delivered via digital platforms. These programs are designed to improve executive functions - working memory, task switching, and response inhibition. Effective training protocols typically include progressively increasing difficulty and individualized challenges based on a participant's baseline performance. Although such interventions often result in improvements in the specific tasks being trained, evidence for broader transfer to untrained domains remains limited. However, game-based versions of flexibility training show more promise. For example, studies have demonstrated that embedding executive function tasks within engaging game contexts can lead to long-term benefits, including improved performance on unrelated cognitive tasks and gains in academic abilities such as reading comprehension.

In addition to cognitive training, physical activity, especially forms that combine movement with cognitive challenge, such as martial arts, may also support the development of flexibility, although findings are mixed. Another potential enhancer is bilingualism, which has been associated with improved cognitive control due to the continuous need to switch between languages. While the so-called bilingual advantage is still debated, there is evidence suggesting that lifelong bilingual experience may act as a protective factor against age-related decline in cognitive and behavioral flexibility.

5. Discussion and conclusion

It has been shown that soft skills, while traditionally associated with professional performance, also play a significant role in supporting democratic participation and civic engagement. Thus targeted development of soft skills can contribute not only to employability but also to the broader goals of social cohesion and active democratic citizenship. Given that cognitive and behavioral flexibility has been shown to be the most prominent shared theme across soft and civic skills, particular emphasis should be placed on cultivating this capacity across all stages of life.

With regard to the enhancement of cognitive and behavioral flexibility, the following activities can be recommended:

- **Engaging in physical activity**, ideally combined with cognitive challenges (e.g., choreographed dance, martial arts, or sports requiring strategic decision-making), across all age groups

- **Learning and actively using foreign languages** from an early age, in order to promote cognitive switching and intercultural perspective-taking
- **Participating in computer-supported interventions, including digital games** designed to train executive functions, switching, updating, and inhibition, provided they are grounded in pedagogical principles and introduced only once a sufficient level of age-related readiness and safety can be ensured

Within the scope of this paper, attention has been focused on a limited range of soft and civic skills. However, with a view to the potential broader applicability of the findings, a brief assessment of the European Skills, Competences, Qualifications and Occupations (ESCO) classification (European Commission, n.d.) was conducted. The ESCO classification was selected for comparison due to its widespread use in the European labor market and education policy. While ESCO provides a valuable structure for categorizing transversal skills in occupational settings, it offers limited conceptual integration of those soft skills that carry civic significance. Constructs such as cultural intelligence, perspective-taking, or empathy tend to be generalized or dispersed, which may obscure their societal relevance. In contrast, the MEGASKILLS framework offers a more coherent basis for curriculum development, training design, and cross-sectoral dialogue. Given that ESCO offers standardization and interoperability for labor market systems, whereas MEGASKILLS provides normative and pedagogical guidance for a more holistic approach to human development, the two frameworks should be viewed as complementary, and their synergy can be strategically leveraged in policy, education, and practice.

Alongside ESCO, for example, the OECD Learning Compass 2030 (OECD, n.d.) also merits attention as an internationally recognized framework that emphasizes the integration of knowledge, skills, attitudes, and values in education. Its potential relevance for the development of soft and civic skills calls for closer academic scrutiny.

To advance the dual agenda of fostering soft and civic skills, several areas merit further exploration. First, there is a clear need for standardized, age-normed assessment tools that capture dimensions of cognitive and behavioral flexibility across the lifespan. Although instruments such as the Cognitive Flexibility Scale, the Psychological Flexibility Questionnaire, and the Cognitive Control and Flexibility Questionnaire are available, their use remains subject to debate and further research is needed in this area.

Second, future research should explore the transferability of cognitive and behavioral flexibility training from specific contexts (e.g., games, bilingual education) to broader civic outcomes. Longitudinal and mixed-methods studies may help clarify how these interventions shape not only cognitive performance but also behaviors related to democratic participation.

Finally, the interdisciplinary nature of cognitive and behavioral flexibility research calls for collaboration across psychology, education, neuroscience, computer science, and public policy. Integrating insights from these fields may lead to the development of more effective and inclusive strategies for building skills that support both personal agency and the collective good.

In sum, the research results presented here highlights the importance of soft skills as both professional assets and civic capacities. Their developmental potential across the lifespan, and their responsiveness to diverse pedagogical interventions - from language learning and digital games to physical activities -

position them as critical levers for future-oriented education. The MEGASKILLS framework provides a conceptual foundation for supporting this vision, while complementing more operationally oriented systems such as ESCO. The integrated development of soft and civic skills is not only essential for individuals to navigate professional and societal challenges, but also constitutes a strategic requirement for sustaining democratic life in the 21st century.

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Institutional engagement in the advancement of Polish-Czech cooperation and shared cultural heritage management

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Abstract: This paper examines the role of non-governmental associations and organizations in fostering cross-border cooperation between Poland and the Czech Republic. Emphasizing both historical context and contemporary dynamics, the study explores how civil society initiatives contribute to regional integration, cultural exchange, heritage preservation, and the development of local partnerships. Drawing on case studies and institutional reports, the research highlights the mechanisms through which grassroots and institutional actors facilitate bilateral dialogue and address shared social, economic, environmental, and cultural challenges. The analysis underscores the importance of sustained civic engagement in strengthening Polish-Czech relations and safeguarding common heritage within the broader framework of European integration.

Keywords: Polish-Czech cross-border cooperation, grassroots initiatives, cultural heritage, smart heritage

JEL classification: F5, O1, Z1

1. Introduction

In recent decades, Polish-Czech cross-border cooperation has emerged as a significant aspect of regional integration in Central Europe, driven by shared history, cultural proximity, and common developmental challenges (Durand & Decoville, 2020; Bufon & Markelj, 2010). The borderland areas between Poland and the Czech Republic—marked by a complex heritage shaped by shifting borders, diverse ethnic communities, and intertwined historical narratives—offer fertile ground for collaboration in areas such as cultural exchange, environmental protection, economic development, and heritage preservation (Dolzblasz, 2013; Lendel, 2024; Łangowska-Marcinowska). Civil society organizations and institutional actors play a crucial role in shaping and sustaining this cooperation. Non-governmental associations, local governments, and cross-border partnerships such as Euroregions have become essential facilitators of dialogue and collaboration (Castanho et al., 2017; Medeiros, 2014, 2016). Their engagement has not only strengthened bilateral relations but also contributed to the protection and promotion of shared cultural heritage, fostering a sense of regional identity and mutual understanding. These efforts are particularly important in the context of broader European integration, where local and transnational initiatives contribute to building social cohesion and sustainable development across borders (Stoffelen et al., 2017; Decoville & Durand, 2019; Makkonen & Leick 2020).

This article investigates the role of civil society and institutional actors in advancing Polish-Czech cooperation, with a particular focus on cultural heritage management. It addresses the following research questions: 1. What are the mechanisms through which civil society and institutions support cross-border cooperation in the Polish-Czech borderland? 2. How do these actors contribute to the safeguarding and promotion of shared cultural heritage? 3. What are the challenges and opportunities in fostering sustainable and inclusive regional partnerships?

The study draws on qualitative analysis of case studies and institutional reports, including project documentation, policy papers, and stakeholder interviews. By examining specific initiatives and programs, the research seeks to identify best practices and highlight the conditions necessary for effective and enduring cross-border engagement. Through this lens, the paper offers insights into

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how local-level cooperation contributes to broader goals of European cohesion, cultural resilience, and regional development.

2. Literature review: historical background of Polish-Czech relations

The Polish-Czech borderland has long been shaped by dynamic historical transformations, marked by shifting boundaries, ethnic pluralism, and complex political legacies. These regions, once divided by imperial frontiers and later influenced by the rigid separations of the Cold War, experienced limited contact for much of the 20th century (Bufon & Markelj, 2010). Following the fall of communism in 1989, the political and ideological barriers that had fragmented Central Europe were lifted, enabling a new era of Polish-Czech rapprochement based on democratic values, economic transition, and regional cooperation (Dolzblasz, 2013). In the early post-communist years, bilateral relations evolved from informal civic initiatives to more structured forms of cooperation. Institutions such as Euroregions—transboundary frameworks for collaboration—emerged as key instruments for facilitating dialogue, economic development, and cultural exchange (Łangowska- Marcinowska, 2022; Lendel, 2024). Civil society organizations, border municipalities, and regional authorities played vital roles in laying the groundwork for trust-building and cross-border integration (Kurowska-Pysz & Szczepańska-Woszczyna, 2017). Over time, the scope of cooperation expanded to include joint tourism strategies, environmental projects, educational programs, and the preservation of shared cultural heritage. EU accession in 2004 marked a turning point in the trajectory of Polish- Czech cooperation. With the support of European funding instruments such as Interreg and the European Territorial Cooperation programs, cross-border initiatives gained institutional strength and financial viability (Medeiros, 2014). European integration provided not only technical and administrative frameworks for cooperation, but also reinforced norms of multi-level governance, subsidiarity, and civic engagement across national borders (Castanho et al., 2017). Civic and institutional actors have increasingly responded to EU policy priorities related to cohesion, sustainability, and identity-building, which has supported the emergence of multi-scalar forms of governance in border regions (Decoville & Durand, 2019). At the same time, challenges persist, including administrative asymmetries, funding discontinuities, and disparities in local development, all of which can affect the depth and sustainability of cooperation (Stoffelen et al., 2017).

Nevertheless, the evolution of Polish-Czech cross-border collaboration demonstrates the resilience and adaptability of civic engagement in overcoming historical divisions. These partnerships increasingly serve as laboratories for experimenting with integrative strategies that promote not only economic development but also cultural connectivity and shared regional identities within the broader European framework (Makkonen & Leick, 2020; Medeiros, 2016).

3. Materials and method

This study employs a qualitative approach based primarily on desk research and case study analysis. The first step involved reviewing existing research on institutional and civic actors in cross- border cooperation and on the topic of cultural heritage as a driver of cross-border collaboration. The second step also began with an in-depth understanding of the context, policy frameworks, and institutional roles shaping regional collaboration. Based on this, a group of case studies of associations and institutional initiatives was identified, providing concrete examples of how grassroots and formal actors contribute to fostering cross-border ties. These case studies are offering insights into the mechanisms, challenges, and successes of cross-border cooperation in practice. Together, these methods allow for a holistic analysis of the interplay between civil society engagement, institutional support, and heritage preservation within the broader framework.The research part is presented in a simplified way in Figure 1.

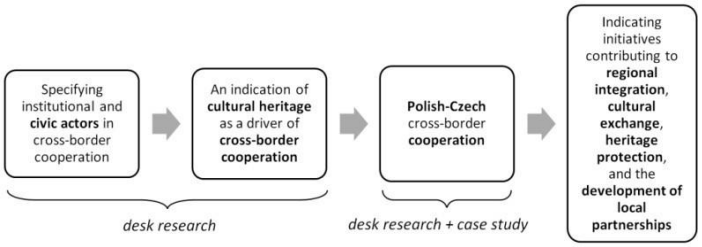

Figure 1: Visualization of the research process. Source: own study.

4. Results

4.1. Cultural heritage as a driver of cross-border cooperation

Cultural heritage has the potential to play an essential and active role in sustainable development in the environmental, social, and economic areas (EX.PO AUS, 2015). The international scientific community emphasizes the importance of protecting border heritage (Timothy & Więckowski, 2022; Yang et al., 2022), as well as creating initiatives aimed at using cultural heritage as a development resource (Schafranski, 2022; Nasrolahi et al., 2022). As Ploae (2017) notes, borders and border areas are places where cultures remain in contact without losing their traditions and specific characteristics. Borders are places where different cultures, unwilling to give up their specificity, interact. On the other hand, cross-border cooperation is an institutionalized form of cooperation between regional and local authorities located in border areas, encompassing multifaceted relationships in all spheres of socio-economic life, with the active participation of key stakeholders. Cultural identity is the foundation of cross-border development. Areas with a shared historical and cultural identity enjoy more intense cross-border cooperation (Ploae, 2017). Engagement with cultural heritage fosters a deeper understanding and interpretation of historical divisions and connections, enabling the shaping of narratives that influence the development of cooperation and the creation of spaces for dialogue and understanding (McDermott & McDowell, 2021). According to Rădoi (2017), borders are constantly changing from barriers to bridges of cooperation. This researcher emphasizes, that cultural activity serves as a tool for reconciliation between conflicting communities (Rădoi, 2017). Reconciliation requires i) equal status between groups, ii) common goals, iii) intergroup cooperation, iv) support from authorities, law, or custom, and v) the so-called "potential for friendship" (Reid, 2021). Cooperation between communities is the starting point for good neighborly policies and institutionalized cooperation. The potential of such cooperation can be measured by indicators such as cultural projects, the results of cultural projects, treaties, agreements, media coverage, the degree of border permeability, economic exchange, public opinion on cultural cooperation, the presence of communities from one country in the territory of another, the number of cultural events, the presence of cultural institutions, and the number of higher education institutions (Rădoi, 2017). The literature on the subject provides examples from the cross-border areas of Romania and Serbia (Rădoi, 2017; Ploae, 2017), Cyprus and Turkey (Reid, 2021), and Croatia and Serbia (Jelinčić & Knezović, 2021).

Results of research conducted by Jelinčić and Knezović (2021) indicate that cultural elements can primarily serve as a starting point for obtaining funding, but they do not always constitute a cause for reconciliation. Shared cultural values can influence successful cooperation, reinforced by economic benefits. These benefits determine conflict resolution (Jelinčić & Knezović, 2021). The above can be illustrated by the course of action shown in Figure 2.

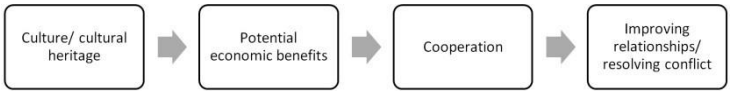

Figure 2: Actions influencing the resolution of cross-border conflicts.
Source: own elaboration based on Jelinčić & Knezović (2021).

Mentioned by the team of Zhang et al. (2023) examples from outside Europe also indicate that the link between heritage and cooperation is emphasized in connection with contemporary geostrategic projects. With the launch of the Belt and Road Initiative (2013), the cultural heritage of border areas has become particularly important for stimulating local economies, improving geopolitical relations, and strengthening international cultural exchange and cooperation. Challenges related to this include the regional natural environment (topography and climate) and social environment (population density and level of economic development), particularly in areas of unbalanced distribution, asynchronous development, and protection, as well as insufficient cross- border cooperation mechanisms and management systems. Guidelines based on existing research from China indicate the need to i) increase investment in border cultural heritage, ii) improve transport infrastructure in border areas, iii) ensure dynamic heritage, iv) ensure cultural heritage protection, v) promote the joint development of various types of cultural heritage; vi) improve the efficiency of use and economic benefits of heritage resources (Zhang et al., 2023).

The desire to transform national borders into "borders connecting" states and regions is emphasized within the European Union. These initiatives encourage addressing ethnic and cultural fragmentation by increasing the intensity and number of cross-border contacts. This fosters the development of cultural tourism through such "attractions" as cultural values, monuments, and heritage sites (Hardi et al., 2021). Cultural heritage and cultural tourism serve as tools for economic development and play a vital role in increasing social cohesion and mutual understanding. Critical roles in promoting cross-border cooperation in the field of heritage include: i) sharing information (through formal and informal networks) using digital tools and platforms, ii) actively seeking partnerships, iii) fostering cultural sensitivity and inclusiveness, and iv) committing parties to sustainable practices that promote long-term benefits for local communities and the preservation of cultural heritage (Kulyniak et al., 2024). Research on the heritage of the Polish-Ukrainian borderland indicates that elements of intangible culture, including the gastronomic culture of displaced nations and aspects of religious and musical culture, are best preserved in the collective memory of borderland residents. Visual and functional elements, such as churches and cemeteries, also hold a strong place in collective memory. These can constitute cultural heritage bridges that foster mutual understanding, dialogue, and cooperation (Cherkes et al., 2021).

4.2. Case studies

The Table 1 provides a detailed overview of selected Polish associations operating in the Czech Republic, with particular emphasis on their roles in preserving cultural heritage, strengthening the identity of the Polish national minority, and supporting cross-border and regional cooperation initiatives.

Table 1: Summary of key civil society organizations and their activities

Organization	Established	Main Focus	Key Activities
Olza Pro Association (*Stowarzyszenie Olza Pro*)	1991	Research and promotion of the Polish minority's cultural heritage in Zaolzie	- Documenting disappearing heritage sites as cultural capital- Chapel renovation in Mexico cemetery - Mapping Zaolzie cemeteries and monuments - *"Polishness in Zaolzie"* multimedia project - *"Bilingual Zaolzie"* mapping of minority rights
Polish Club in Prague Association (*Stowarzyszenie Klub Polski w Pradze*)	1988 (restarted 1991)	Promotion of Polish culture and history in Prague	- Language and literature promotion - Historical lectures, concerts, exhibitions- Commemoration of key events - Publishes *Kurier Praski* magazine - Engages in multicultural events - Faces age-related membership challenges
Polish Artistic Society Ars Musica (*Polskie Towarzystwo*	1999	Artistic promotion of Polish minority culture	- Supports choirs and ensembles - Co-organizes cultural festivals (e.g., Cieszyn

Artystyczne Ars Musica)		in Czech Republic	Folk Song Review, KRESY Recitation Competition)
Association for Development and Regional Cooperation "Olza" (*Stowarzyszenie Rozwoju i Współpracy Regionalnej "Olza"*)	1998	Regional development and cross-border cooperation (17 municipalities)	- Manages the *Cieszyn Silesia Tourist Brand*- Coordinates *Iron Bicycle Trail* reuse project- Leads *Polish-Czech-Slovak EuroInstitute* network- Promotes economic, cultural, and environmental projects- Facilitates EU integration through grassroots partnerships
Association of Friends of the Czech Republic in Opole (*Stowarzyszenie Przyjaciół Czech w Opolu*)	2023	Promotion of Czech culture, language, and bilateral relations	- Organizes *Czech Days* in Opole- Hosts author events, concerts, exhibitions- Supports Czech-Polish tourism and business cooperation- Promotes Czech language and culture in Poland- Winner of "Opolskie International" award

Source: own study.

5. Conclusion

This study underscores the crucial role of non-governmental organizations and local associations in fostering Polish-Czech cross-border cooperation and safeguarding shared cultural heritage. The examined case studies—such as Olza Pro Association, Polish Club in Prague, Polish Artistic Society Ars Musica, Association for Development and Regional Cooperation "Olza," and the Association of Friends of the Czech Republic in Opole—exemplify how grassroots initiatives complement formal institutional efforts by promoting cultural exchange, regional development, and minority identity preservation. Their diverse activities highlight the capacity of civil society actors to strengthen transnational ties and enhance social cohesion in border regions. Civil society initiatives complement formal institutional frameworks, fostering regional integration, cultural exchange, and sustainable local partnerships (Dolzblasz, 2013; Kurowska-Pysz & Szczepańska-Woszczyna, 2017).

The findings reveal that sustained collaboration between grassroots organizations and public institutions is essential to effectively address shared social, economic, and environmental challenges. Supporting these partnerships through targeted policy measures, including financial aid, capacity building, and streamlined administrative processes, is vital for maximizing the impact of cross-border initiatives. Furthermore, these case studies demonstrate the potential of local cultural heritage projects to contribute to broader European integration by reinforcing common historical narratives and fostering inclusive regional identities. Despite their achievements, the organizations face challenges such as aging membership, environmental disruptions, fragmented data availability, and limited cross-border coordination. Addressing these issues, alongside broadening linguistic and methodological scopes in future research, will be key to advancing knowledge and practice in Polish-Czech cooperation and cultural preservation.

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Spiritual Knowledge Management – Managing Unmanageable

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Abstract: The paper discusses the newly emerging discipline of spiritual knowledge management. There are many approaches to knowledge and knowledge management apart from Nonaka and Takeuchi's classification of explicit and tacit knowledge. One of these approaches reflects the difference between ourselves and the body and mind, classifying knowledge into three groups: rational, emotional and spiritual knowledge. Rational knowledge reflects our physical world and is developed by rational thinking in symbolic language. Emotional knowledge expresses our emotions via body language. Spiritual knowledge integrates all this together with values and our existential meanings. As such, it is the basis of knowledge. It is about understanding one's connection to oneself and others and to what is over us. The paper discussed basic questions concerning spiritual knowledge management, its meaning for individuals and organisations, the results of the Symposium on spiritual knowledge management (Wachau, Austria, 2025) and the relationship of spiritual knowledge management AI.

Keywords: Spirituality, spiritual knowledge, spiritual knowledge management

JEL classification: M1

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1. Introduction

The paper focuses on spiritual knowledge management, a newly emerging discipline that searches for ways to manage spiritual knowledge in organisations and the results of doing so.

There are many approaches to knowledge and knowledge management apart from Nonaka and Takeuchi's classification of explicit and tacit knowledge (Nonaka & Takeuchi, 1995). One of these approaches reflects the difference between ourselves and the body and mind, classifying knowledge into three groups: rational, emotional and spiritual knowledge. Rational knowledge reflects our physical world and is developed by rational thinking in symbolic language. Emotional knowledge expresses our emotions via body language (Bratianu, 2024). Spiritual knowledge integrates all this together with values and our existential meanings. As such, it is the basis of knowledge (Neck & Milliman, 1994; Rocha & Pinheiro; Bratianu, 2024). It is about understanding one's connection to oneself and others and to what is over us. Spiritual knowledge lets us into the deeper aspects of our existence, including our place in the universe.

Historically, care for spiritual knowledge was the work of churches and spiritual schools. However, these days, more and more people are searching for spirituality outside of these traditional formations. From this perspective, spirituality is “concerned with qualities of the human spirit – such as love and compassion, patience, tolerance, forgiveness, contentment, a sense of responsibility, a sense of harmony – which bring happiness to both self and others” (Dalai Lama, 1999, p.22).

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As many people are deeply concerned about various aspects of spirituality, for example, the meaning of their working life, organisations also search for ways to work with and manage spiritual knowledge.

The paper discussed basic questions concerning spiritual knowledge management, its meaning for individuals and organisations, the results of the Symposium on spiritual knowledge management (Wachau, Austria, 2025) and the relationship of spiritual knowledge management with ICT tools, namely AI.

2. Rational, Emotional and Spiritual Knowledge

The field of knowledge and knowledge management appeared at the end of the 20th Century and emerged at the beginning of the 21st Century. Still, after 40 years of development, the field is struggling with the basic aspects, like a clear definition of what we mean by knowledge and what knowledge management actually is. There are many approaches to these two terms because the perspectives from which both academia and practice see them are numerous. There are two basic streams of how we understand knowledge – the technical and the human-oriented, and in many organisations they are separated (Serenko, 2013).

One of the leading approaches in knowledge management is the famous Nonaka and Takeuchi's (Nonaka & Takeuchi, 1995) classification of knowledge into tacit and explicit and explanation of their conversion by the SECI process. Nonaka and Takeuchi's approach is simple. It allows us to distinguish two different basic dimensions of knowledge, and each requires different tools to be managed. The approach does not go deeper into individual dimensions or identify their different components.

However, contemporary neuroscience suggests that the problem of knowledge, its creation, and its management are very different from how we traditionally understand them. Discoveries that "imagined actions activate motor areas almost to the same extent as executed actions" (Jeannerod, 2006, p. 39), neural synchronicity that synchronises the brain waves of two or more people and allows us to feel motoric sensation when observing (or hearing about in the form of the story) what other people do (Bolens, 2012) or works on brain plasticity (Merzenich, 2015) indicate that knowledge is probably more subjective than objective.

Also, "technological advancements such as artificial intelligence are fundamentally transforming how knowledge is created, shared, and applied. In such a dynamic environment, conventional KM models are reaching their limits. By combining new future-oriented methods with creative, user-centered design approaches, organizations are now in a position to rethink their knowledge systems—or even reimagine their very understanding of knowledge and knowledge management—to better align with the demands of the digital era" (Kaiser et al., 2025, p. 499).

In the past twenty years, this need has led to the emergence of new concepts of knowledge and its management, for example, responsible knowledge management (Durst, 2021), concept of spiritual knowledge (Bratianu, 2024), conscious business (Kofman, 2006), spiritual intelligence (Vaugham, 2002), spiritual capital (O'Sullivan & Flanagan, 2012). "These approaches introduce spiritual knowledge, wisdom, and phronesis as additional, valuable forms of knowledge" (Kaiser et al., 2025, p. 499). The classification of knowledge into rational, emotional and spiritual corresponds with these approaches.

“Rational knowledge results from rational thinking and using natural or symbolic language“ (Bratianu, 2024, p. 11). Rational knowledge is formalised in explicit knowledge and must be objective. As such, it conforms with the belief that knowledge must be true and justified, or as Audi (2011, p. 247) writes, "knowledge is at least justified true belief – that we know something only if we believe it, it is true, and our belief of it is justified". Though sometimes an illusion, this type of knowledge is often understood as the leading one in Western modern society and its use is supported by modern ICT technologies. But the world and knowledge are not objective. Too much focus on rational knowledge leads to underestimating parts of knowledge that are subjective and partly or fully tacit.

Emotional knowledge is based on emotions and feelings and is tacit (Damasio, 1999, 2012; Hill, 2008; Bratiaunu, 2023). “It is expressed by body language and facial expressivity” (Bratianu, 2024). This knowledge is very important because it helps us to "learn from objects we know do not exist” (Aladama, 2015, p. 82), like stories and feel into one another. “The world of emotions is largely one of actions carried out in our bodies, from facial expressions and postures to changes in viscera and internal milieu” (Damasio, 2012, p. 117). “Emotional knowledge contributes to the decision-making process with rational and spiritual knowledge and becomes critical in situations of possible danger. A fast body reaction is necessary for protection and survival“ (Bratianu, 2024, p. 13; Kahneman, 2011). This knowledge is "experience dependent" (Merzenich, 2015, p. 20).

But, there is another important part of knowledge, spiritual knowledge. "Spiritual knowledge integrates human beings' existential meanings and values (Bratianu, 2024, p. 13). It allows us "to see meanings and value in the world around us, our environment, events, human actions and lives" (Maxwell, 2007, p. 274). "Seeing and understanding those meanings and values is difficult, but we learn to identify them and use them in all our decisions. Values are the guidelines of any decision-making process in our private or professional life“ (Bratianu, 2024, p. 13). Spiritual knowledge is the knowledge about the relationship to self, others, and what exceeds us. It can be both tacit and explicit.

Rational, emotional and spiritual knowledge are not separated; they overlap and influence one another. Together they create one big whole.

3. Spiritual Knowledge Management

We know how to manage rational and emotional knowledge. Rational knowledge is stored and processed in our ICT, it is easily available, and due to the strict orientation of the Western world to this type of knowledge, we have enough tools and experience for working with it. Emotional knowledge is mostly tacit, and we work with it and manage it with traditional tools for tacit knowledge management - storytelling, communities of practice, coaching and mentoring. However, how do we manage spiritual knowledge?

And is it necessary to manage it? We believe that the answer is yes. Kaiser et al. (2025, p. 501) argue that spiritual knowledge management represents “fundamental shift in how we understand the purpose and function of KM. At its heart lies a simple yet profound idea: every individual and every organization seeks to flourish. Reaching such a state of flourishing entails nothing less than becoming the best possible version of oneself—whether on a personal or organizational level. In essence, this is a transformational journey: a continuous movement from the current self toward one’s ideal or most authentic form.“ Kaiser et al. (2025, p. 501) follow: “the journey toward one’s best version can be seen as a deep and transformative learning process. In this process, knowledge is not only generated about

the meaning and nature of this envisioned self (the what and why), but also about the practical steps required to actualize it (the how). Therefore, spiritual knowledge management adds to the traditional understanding of knowledge management as a process of creating, capturing distributing and using knowledge the new dimension of deep transformational non-linear holistic learning. This style of learning and work with knowledge incorporates the principle of resonance, the engagement and relationship with the world" (Kaiser et al., 2025, p. 501).

History shows that people search for spiritual fulfilment. The examples from practice show that organisations that offer a spiritual environment are attractive for employees as common spirituality creates a strong common identity. Therefore, organisations need to learn how to manage the knowledge about this spirituality, especially in a world where people from different cultures and different spiritual traditions must cooperate. The Spiritual Knowledge Management Symposium in Wachau, Austria, in June 2025, tried to address basic questions of spiritual knowledge management.

4. Spiritual Knowledge Management Symposium, June 2025

To answer basic questions on spiritual knowledge management and set the foundations of the new field, Wirtschaftsuniversität Wien and WaVe - Zentrum für Wachstum und Veränderung organised the Symposium on spiritual knowledge management in Wachau, Austria, in June 2025. About ten participants from different parts of the world with different backgrounds discussed the topic for three days. The discussions were moderated and facilitated, following Otto Scharmer's Theory U. The three-day work resulted in a mosaic of big and small ideas that created a unique picture/whole.

The discussions indicated that spiritual knowledge management is a broad umbrella that covers different topics, such as fulfilling life, spirituality, unfolded life, transcendence, organisational forms, and many others. The Symposium collected and discussed all ideas. Participants also discussed whether it is necessary to analyse the collected topics or if it would be better to be selective and narrow the focus to chosen elements of the spiritual knowledge management. This discussion was not finished and was left for the future.

The primary outcomes of the Symposium are as follows.

The Symposium concluded that spiritual knowledge management is not a buzzword. Every day practice shows that when developing knowledge, we do not use scientific methods and data from the outer world, but by integrating our inner world and our subjective experience with the outer world. New knowledge emerges as the transformation between humans and their environment. This process leads to a deeper kind of knowing and leads to a better evolutionary fit. Therefore, developing knowledge about our world is not based on intellectual understanding of our world but on our dynamic interaction with it. We design our background, and our background designs us as active participant.

It was also highlighted that the spiritual knowledge development and work with it requires the right type of space. This space is based on collaboration among people, but also calls and values stillness and emptiness as part of learning and knowing. These findings go against the principle of instant productivity (Kaiser, 2025). Spiritual knowledge management also calls for deep transformative processes in which individuals or organisations lead dialogue about who they are and their future selves. As the future self is a moving target, this dialogue may be very unpleasant. This differentiates spiritual knowledge and spiritual knowledge management from well-being or happiness management initiatives.

Working with the spiritual dimension of knowledge brings enormous practical challenges and questions. One of them concerns the world management. Is it correct to use it when talking about spiritual knowledge? Managing something implies that we control it and can measure it, but it is dubious if we can control and measure spiritual knowledge. Another question is how to incorporate the “mysterious” part of spiritual knowledge (for example, resonance) into the business? Some organisations do it but are managed differently from traditional organisations. Up to this, the whole field raises the questions of ethics. The Symposium concluded that some answers to these questions might be found in system theory, but managing spiritual knowledge requires a new mindset and different tools.

Therefore, it is clear that spiritual knowledge management means fundamental transformation, not reorganisation of knowledge creation.

5. Spiritual Knowledge Management Challenges

Spiritual knowledge management faces various challenges. First, it involves both the management of spiritual knowledge on the personal and organisational levels. Spiritual knowledge of individuals is based on their spiritual tradition, the roots of which may be hidden from the individual. Developing the best version of oneself is a "non-linear journey marked by detours, regressions, and emergent insights. Thus, it is better described as a process of becoming rather than a conventional change process. Crucially, the destination—the full and detailed vision of the best version—is not entirely known at the outset. Rather, it is gradually discovered along the way" (Kaiser et al., 2025, p. 501). This process may be painful and not acceptable to many. Spiritual knowledge management on the individual level may also be limited by the individual's capability to cultivate a resonant relationship with the world. In an ideal situation, this resonant relationship engages people, the environment and what is perceived to be "above us", like the universe or God. Moreover, again, not all individuals can or want to do this.

Spiritual knowledge management on the organisational level faces the challenge of harmonising different spiritual traditions of employees. Simply said, organisations are required to build environment that will allow to open and address “the question of values, underlying beliefs, culture, purpose or the spiritual dimension of organizing” (Kaiser et al., 2025, p. 500). This calls for a new style of organising and developing the organisation or even new mindsets like the Buddhist economics (Brown & Zsolnai, 2018).

The third challenge represents the relationship between spiritual knowledge management and new ICT tools, namely AI. “AI radically expand the supply side of knowledge production and democratises access to this knowledge” (Ritala, 2025). However, AI knowledge is different from human knowledge. The human brain works with the meaning; it works on and develops knowledge of any type based on the meaning, e.g. based on semantics. AI works with probability of relationships among words, e.g. creates knowledge based on syntactics.

Spiritual knowledge management then concerns human knowledge, and is the most human and personal knowledge. It cannot compete with the volume of knowledge developed by AI, but with its quality. Its role is in connecting human knowledge with the artificial one through "emotional intelligence, ethics, judgment, wisdom and taste" (Ritala, 2025) and using AI to "amplify options for

resonance, generating conditions that help human beings encounter themselves in new ways" (Kaiser et al., 2025, p. 502).

6. Conclusion

The Symposium on spiritual knowledge management concluded that to support the development of this new field, it is necessary to deliberately build the community of researchers and practitioners who will support and develop the topic regardless of barriers of current academic structures and procedures. Collecting examples from companies, analysing the tools organisations use, and promoting the whole idea is necessary. Anchoring the topic in a theoretical background will also help. We see the topic not as background for personal growth or organisational effectiveness topics, but as the topic that enters the door open by the latest findings in neurosciences and physics, and as such supports humanity.

Spiritual knowledge management redefines the mission of knowledge management. In future, "it will not merely serve a predefined goal by managing knowledge in a linear, goal-oriented fashion. Rather, it will be about discovering the goal itself—about unveiling the deeper "why" behind action. Knowledge will no longer be a tool to reach an endpoint; it will be the path to uncovering that endpoint in the first place" (Kaiser et al., 2025, p. 502).

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Knowledge Workers' Perceptions of Generative AI and the Erosion of Human Skills

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Abstract: Generative artificial intelligence (GenAI) is transforming knowledge work but raises concerns about its impact on essential human skills. This study explores perceptions of AI-related risks – skill loss, human skill erosion, and critical thinking reduction – among 543 professionals, focusing on differences by gender and AI experience. One-way ANOVAs revealed that AI experience significantly affects risk perception, with those having more than 3 years of experience reporting higher concerns than less experienced users. Gender differences were significant for human skill erosion, with males reporting higher perceptions than females. These findings emphasize the need for critical engagement and training to balance AI adoption and preserve human capabilities.

Keywords: Generative AI, skill loss, soft skills, AI experience, risk perception

JEL classification: M150, O330

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1. Introduction

The rapid advancement of generative artificial intelligence (GenAI) technologies is transforming the nature of knowledge work, automating tasks that traditionally required human expertise, and raising concerns about the long-term impact on human capabilities (Zhang et al., 2025). While GenAI promises increased efficiency and productivity (Noy & Zhang, 2023), researchers and practitioners are increasingly questioning how such systems may influence critical human skills, including creativity, critical thinking, and interpersonal abilities (Bushuyev et al., 2024; Giray, 2024). This dual nature of AI – as both a powerful tool and a potential disruptor – has made understanding its perceived risks a key research priority (Bao & Zeng, 2024; Bengio et al., 2024).

Research offers two conflicting perspectives on the relationship between user experience and perceived technological risks. One view suggests that individuals with greater experience tend to develop a more nuanced understanding of the limitations and unintended consequences of emerging technologies, such as overreliance on automation or potential skill devaluation. This is particularly evident among users familiar with decision-support systems or algorithmic tools, who are often more cautious in their use and aware of the risks involved (Brauner et al., 2024; He et al., 2023). In contrast, less experienced individuals may underestimate these risks, partly due to limited exposure and overconfidence in technology's reliability – commonly described as "automation bias" (Mosier et al., 1997). However, an opposing view supported by studies in the broader domain of technological risk perception posits that users with lower experience actually perceive higher levels of risk, likely due to unfamiliarity and a lack of control over the technology (Slovic, 1987; Visschers & Siegrist, 2008). In this line of reasoning, experienced users – accustomed to the presence of complex tools – may underestimate potential downsides as they become desensitized to risks over time. These contrasting

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perspectives underscore the importance of considering domain, familiarity, and context when interpreting how experience shapes perceived technological threats. Gender-related differences have also been observed in technology acceptance and risk perception, with research suggesting that men and women may differ in their attitudes toward automation and technologies in the workplace (Venkatesh et al. 2012; Gefen & Straub, 1997).

Previous studies have shown that the public perceives artificial intelligence as both a useful tool and a threat (Selwyn et al. 2020; Schwesig et al., 2023). Despite growing interest in the social and ethical implications of AI, relatively little empirical research has focused on knowledge workers' perceptions of how AI contributes to the erosion of human skills. This study addresses this gap by exploring perceived risks related to (1) skill loss, (2) human skill erosion, and (3) critical thinking reduction in the context of generative AI adoption. We also examine whether these perceptions differ based on AI experience and gender, as understanding such differences can provide valuable insights for AI implementation strategies, workforce training, and policy development. The key research questions guiding this study are: **RQ1:** Do gender groups differ in their perceptions of AI-related risks? **RQ2:** Does the level of AI experience influence perceptions of AI-related risks?

To answer these questions, we formulate and test the following hypotheses: **H1:** There are significant gender differences in perceived AI-related risks (skill loss, human skills, and critical thinking). **H2:** Respondents with less AI experience perceive AI as a greater risk to skill loss, human skills, and critical thinking compared to those with more AI experience.

2. Methods

2.1. Participants

The study included 543 knowledge workers from various industries and professional backgrounds. Participants were recruited through online survey distribution and professional networks. The sample comprised 272 males (50.1%), 259 females (47.7%), 9 respondents identifying as non-binary or third gender (1.7%), and 3 participants (0.5%) who preferred not to disclose their gender. AI experience varied across respondents: 60 participants (11.0%) reported less than 6 months of experience, 133 (24.5%) had 6 months to 1 year, 208 (38.3%) had 1–2 years, 92 (16.9%) had 2–3 years, and 50 (9.2%) had more than 3 years of AI experience. The age distribution of respondents is summarized in Table 1, indicating a balanced representation across younger and middle-aged participants, with the majority falling between 18 and 44 years.

Table 1: Age characteristics

Age	Answers	Ratio
18-24	136	25.05 %
25-34	135	24.86 %
35-44	150	27.62 %
45-54	72	13.26 %
55-64	41	7.55 %
65-74	9	1.66 %

Participants represented a variety of professional domains, with research and development, data analysis, and project management being the most common areas (Table 2).

Table 2: Areas of knowledge work (multiple answers possible)

Area of Knowledge work	Answers	Ratio
Research and Development	218	40.15 %
Data Analysis	198	36.46 %
Project Management	163	30.02 %
Training and Education	118	21.73 %
Customer Support	103	18.97 %
Marketing and Advertising	102	18.78 %
Strategy and Consulting	99	18.23 %
Content Creation and Editing	99	18.23 %
Software Development	83	15.29 %
Human Resources and Recruitment	72	13.26 %
Financial Analysis and Reporting	46	8.47 %
Art and Creative Industries	44	8.1 %
Other	27	4.97 %
Legal Research and Documentation	18	3.31 %
No answer	1	0.18 %

2.2. Measures

2.2.1. Demographics

Participants provided basic demographic information, including gender (Male, Female, Non-binary/Third gender, Prefer not to say) and years of AI experience (categorized into five groups: *less than 6 months, 6 months–1 year, 1–2 years, 2–3 years, and more than 3 years*).

2.2.2. Perceived AI Risk Dimensions

Perceptions of AI-related risks were measured using three scales, each based on 7-point Likert-type items (1 = *strongly disagree*, 7 = *strongly agree*): a) Skill Loss (AI_risk_percep_skill_loss): item measuring the extent to which participants believe that using AI may reduce or replace their professional skills; b) Human Skills Erosion (AI_risk_percep_human_skills): item assessing concerns about AI diminishing creativity, emotional intelligence, and other uniquely human skills; c) critical thinking Reduction (AI_risk_percep_critical_thinking): item evaluating the belief that reliance on AI weakens independent thought and analytical reasoning. Descriptive statistics for each dimension (means, standard deviations, and sample sizes) are reported in the Results section.

2.3. Procedure

The survey was conducted online (EUSurvey Platform) and took approximately 10–15 minutes to complete. Participants were informed about the purpose of the study and assured of confidentiality and anonymity before beginning the questionnaire. Data collection involved both multiple-choice demographic questions and Likert-scale items measuring the three AI risk perception constructs. Participants were recruited through the Prolific, SurveyCircle, and Surwayswap platforms and had to meet inclusion criteria – knowledgeable work experience and experience using GenAI in a work environment.

2.4. Data Analysis

The data were analysed using JASP software. To test H1 (gender differences), one-way ANOVA with post hoc Tukey tests was conducted for each risk perception dimension (skill loss, human skills, and critical thinking). To test H2 (impact of AI experience), a separate one-way ANOVA with AI experience as the factor was performed for each risk perception dimension, also followed by post hoc Tukey comparisons. Effect sizes (η^2) were reported for all significant effects, and assumptions of normality and homogeneity of variances were checked prior to analysis.

3. Results: Gender Differences in AI Risk Perceptions

To test H1, a series of one-way ANOVAs were conducted with gender (Male, Female, Non-binary/Third Gender, Prefer not to say) as the independent variable and the three perceived AI risk dimensions (skill loss, human skills, critical thinking) as the dependent variables.

3.1. Perceived Risk of Skill Loss

The ANOVA revealed a significant difference in perceived skill loss across gender groups, $F(3, 539) = 2.96$, $p = 0.032$, $\eta^2 = 0.016$. Descriptive statistics indicate that respondents who selected *Prefer not to say* reported the highest skill loss risk ($M = 4.67$), followed by Non-binary/Third Gender ($M = 3.44$), Male ($M = 3.11$), and Female respondents ($M = 2.78$). However, Tukey post hoc tests did not reveal statistically significant pairwise differences between groups (all $p > 0.05$).

3.2. Perceived Erosion of Human Skills

For human skills, the ANOVA was also significant, $F(3, 539) = 2.89$, $p = 0.035$, $\eta^2 = 0.016$. The *Male group* reported slightly higher mean values ($M = 3.26$) compared to Female respondents ($M = 2.85$), while Non-binary/Third Gender ($M = 3.33$) and Prefer not to say ($M = 3.33$) had similar mean scores. Post hoc Tukey tests showed a significant difference between Male and Female respondents ($p = 0.021$), with males perceiving greater risk of human skills erosion.

3.3. Perceived Reduction of Critical Thinking

A significant effect of gender was found for critical thinking, $F(3, 539) = 2.99$, $p = 0.031$, $\eta^2 = 0.016$. The *Prefer not to say* group had the highest score ($M = 4.33$), while Females had the lowest ($M = 2.61$), followed by Non-binary/Third Gender ($M = 2.89$) and Males ($M = 2.95$). Despite overall significance, Tukey post hoc tests showed no significant pairwise differences between specific groups (all $p > 0.05$). These results provide partial support for H1, as gender differences exist overall (ANOVA significant across all three risk dimensions), but only Male vs Female differences in perceived human skill erosion were statistically significant. The pattern suggests that males and non-binary respondents tend to report slightly higher perceived risks compared to females, with the "Prefer not to say" group reporting the highest means. Descriptive statistics for AI risk perceptions (skill loss, human skills, and critical thinking) by gender are presented in Table 3, highlighting differences in mean risk perceptions among male, female, non-binary, and undisclosed gender groups.

Table 3: Descriptive Statistics of AI Risk Perceptions by Gender

AI risk perception: Skills loss					
Gender	N	Mean	SD	SE	Coefficient of variation
Male	272	3.110	1.667	0.101	0.536
Female	259	2.784	1.696	0.105	0.609

Non-binary	9	3.444	1.424	0.475	0.413
Not to say	3	4.667	1.528	0.882	0.327
AI risk perception: Human skills erosion					
Gender	N	Mean	SD	SE	Coefficient of variation
Male	272	3.261	1.637	0.102	0.502
Female	259	2.846	1.666	0.095	0.585
Non-binary	9	3.333	2.062	0.484	0.618
Not to say	3	3.333	1.528	0.333	0.458
AI risk perception: Critical thinking reduction					
Gender	N	Mean	SD	SE	Coefficient of variation
Male	272	2.952	1.679	0.102	0.569
Female	259	2.606	1.535	0.095	0.589
Non-binary	9	2.889	1.453	0.484	0.503
Not to say	3	4.333	0.577	0.333	0.133

4. Results: Skills Erosion Risks Perception in Relation to AI Experience

To examine the influence of AI experience on perceived risks, three one-way ANOVAs were conducted with AI experience (5 groups) as the independent variable and perceptions of skill loss, human skills erosion, and critical thinking reduction as the dependent variables.

4.1. Perceived Risk of Skill Loss

A significant effect of AI experience on skill loss perception was found, $F(4, 538) = 5.66$, $p < .001$, $\eta^2 = 0.040$, indicating that risk perceptions differ across experience groups. Descriptive statistics showed that participants with less than 6 months of AI experience reported the lowest perception of skill loss ($M = 2.10$, $SD = 1.30$), while those with more than 3 years reported the highest perception ($M = 3.32$, $SD = 1.94$). Tukey post hoc tests revealed that participants with less than 6 months of AI experience scored significantly lower than those with 1–2 years ($p < .001$) and more than 3 years ($p = .002$) of experience.

4.2. Perceived Erosion of Human Skills

The ANOVA for human skills also showed a significant effect, $F(4, 538) = 2.75$, $p = 0.028$, $\eta^2 = 0.020$. Respondents with less than 6 months of AI experience reported significantly lower perceptions of human skill erosion ($M = 2.47$, $SD = 1.48$) compared to those with 1–2 years ($p = 0.02$), 2–3 years ($p = 0.02$), and more than 3 years ($p = 0.01$). This suggests that greater AI exposure is associated with higher awareness of human skill erosion.

4.3. Perceived Reduction of Critical Thinking

For critical thinking, a significant effect was also observed, $F(4, 538) = 2.97$, $p = 0.019$, $\eta^2 = 0.022$. Participants with more than 3 years of AI experience ($M = 3.42$, $SD = 1.82$) reported significantly higher perceptions of critical thinking reduction compared to those with less than 6 months ($p = 0.006$), 6 months–1 year ($p = 0.037$), and 2–3 years ($p = 0.008$). Table 4 presents AI risk perception scores according to years of AI experience, showing a trend of increasing concern among respondents with longer exposure to AI tools.

Table 4: Descriptive Statistics of AI Risk Perceptions by years of AI experience

AI risk perception: Skills loss					
AI experience years	N	Mean	SD	SE	Coefficient of variation
1-2 years	208	3.072	1.717	0.119	0.559
2-3 years	92	3.250	1.726	0.180	0.531
6 months - 1 year	133	2.872	1.539	0.133	0.536
Less than 6 months	60	2.100	1.298	0.168	0.618
More than 3 years	50	3.320	1.942	0.275	0.585
AI risk perception: Human skills erosion					
AI experience years	N	Mean	SD	SE	Coefficient of variation
1-2 years	208	3.197	1.776	0.123	0.556
2-3 years	92	3.185	1.561	0.163	0.490
6 months - 1 year	133	2.962	1.578	0.137	0.533
Less than 6 months	60	2.467	1.478	0.191	0.599
More than 3 years	50	3.280	1.703	0.241	0.519
AI risk perception: Critical thinking reduction					
AI experience years	N	Mean	SD	SE	Coefficient of variation
1-2 years	208	2.788	1.675	0.116	0.601
2-3 years	92	2.859	1.573	0.164	0.550
6 months - 1 year	133	2.699	1.497	0.130	0.555
Less than 6 months	60	2.400	1.417	0.183	0.590
More than 3 years	50	3.420	1.819	0.257	0.532

Across all three dimensions of perceived risk (skill loss, human skills, and critical thinking), the results consistently show that participants with less than 6 months of AI experience perceive significantly lower risks compared to those with longer AI experience, particularly those with more than 3 years. H2 is partially supported. Contrary to the initial expectation that less experience would be linked to greater risk perception, results show that more experienced respondents (≥3 years) report significantly higher perceived risks across all three dimensions. This could indicate that prolonged exposure to AI tools increases awareness of potential skill erosion and cognitive impacts.

5. Conclusion

This study examined knowledge workers' perceptions of AI-related risks, focusing on skill loss, human skill erosion, and critical thinking reduction. The findings indicate that AI experience plays a key role, with participants who have greater AI exposure reporting significantly higher perceived risks across all three dimensions. Contrary to the initial assumption (H2), less experienced users tended to perceive fewer risks, suggesting that prolonged use may enhance awareness of AI's potential impact on human skills. Gender differences (H1) were observed at the overall level, but only male and female respondents differed significantly in perceptions of human skill erosion, while non-binary and "prefer not to say" respondents tended to report higher mean scores but with no statistical significance due to small group sizes. The results highlight the need for ongoing training and critical engagement with AI tools to ensure that human capabilities are not diminished in increasingly automated work environments.

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From Protection to Participation: Economic Integration of Ukrainian Refugees in Central Europe

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Abstract: This article examines the labour market integration of Ukrainian refugees in the Czech Republic and Poland, highlighting both the economic benefits and structural barriers that hinder the full utilisation of refugees' human capital. While initial policy responses successfully enabled access to employment, most refugees remain concentrated in low-skilled sectors. This underemployment reflects a mismatch between individual qualifications and labour market demands, exacerbated by language barriers, the complexity of credential recognition processes, and limited access to retraining opportunities. The article identifies two persistent challenges: language policy gaps in host countries and the systemic mismatch between available skills and labour market demand, worsened by inadequate recognition of foreign qualifications and limited access to retraining programs for migrants. These barriers reduce labour productivity, increase dependency risks, and result in missed opportunities for sectoral innovation, particularly in areas facing labour shortages such as healthcare, IT, and education. The analysis concludes with evidence-based recommendations to improve long-term labour market integration and societal resilience, such as a dual-track language strategy and expanded access to retraining, certification, and entrepreneurship pathways for migrants.

Keywords: Refugee integration, Human capital, Labour market, Qualification recognition

JEL classification: J680 Mobility, Unemployment, and Vacancies: Public Policy

1. Introduction

Following the Russian military aggression against Ukraine in February 2022, over five million Ukrainian nationals sought refuge in European Union (EU) member states, taking advantage of temporary protection mechanisms (UN, 2023). Millions of Ukrainian nationals were displaced from their homes, seeking shelter and safety across Europe. The EU, responding to the urgency and scale of this humanitarian emergency, activated the Temporary Protection Directive (2001/55/EC) for the first time. This directive offered immediate protection and access to residence permits, healthcare, and employment opportunities to individuals fleeing the conflict. Among the EU member states, the Czech Republic and Poland emerged as two of the largest host countries. Both nations share borders or close proximity with Ukraine and possess historical, cultural, and economic ties to Ukrainian communities. By April 2023, the Czech Republic had granted temporary protection to approximately 504,000 individuals, while 338,000 Ukrainian nationals remained registered in early 2024 (MVČR, 2024). Poland, due to its geographic location and existing diaspora, assumed an even more pivotal role, absorbing nearly 1.6 million Ukrainian refugees by mid-2023, all of whom received legal status via the PESEL (Polish Universal Electronic System for Registration of the Population created specifically for Ukrainian refugees) (UNHCR & Deloitte 2025). The initial response in both countries was swift, focusing on humanitarian needs: food, shelter, healthcare, and psychological support. However, as the conflict persisted and return prospects remained uncertain, it became evident that a long-term integration

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strategy was essential—particularly regarding economic participation (Macková et al. 2025). Czechia and Poland faced similar imperatives: integrating a large number of newcomers into their labor markets, maintaining social cohesion, and ensuring that public finances remained sustainable. These countries had to invest significantly in language education, labor market services, and qualification recognition systems. Moreover, the demographic opportunity that these young and educated migrants represented had to be balanced with the risk of systemic underemployment, poverty, and social exclusion.

It is crucial to understand the demographic composition of these refugee populations which as per the statistical data for both countries, seems to be similar. Women comprised approximately 65 % of all refugees, reflecting martial restrictions on Ukrainian men aged 18 to 60, who were required to remain in Ukraine. Children made up around 28 % of the refugee population, while seniors accounted for a smaller proportion - roughly 4 % (IOM, 2023). As such, the majority of those who fled were working-age women and children, requiring host countries to address not only employment integration but also family services and educational infrastructure (Macková et al. 2025). While the humanitarian response was immediate, the integration of the refugees into the Czech economy presented both challenges and opportunities.

The negative economic consequences associated with an influx of migration can be attributed to several interconnected factors. The underemployment of skilled labour reduces overall labour productivity and limits the return on investment in human capital. When highly educated individuals are restricted to low-paid sectors, the risks of welfare dependency and poverty increase significantly. Moreover, economies miss out on opportunities for innovation and sectoral growth, particularly in areas facing acute skill shortages, such as healthcare, information technology, and education. Gendered economic marginalisation also plays a critical role, as women disproportionately encounter both care-related burdens and professional downgrading. This article aims to synthesise what has proven effective in integrating Ukrainian refugees into the Central European labour markets, identify persisting barriers, and highlight areas with potential for further improvement. Based on these findings, the article proposes evidence-based recommendations to enhance labour market outcomes for refugees and strengthen societal resilience.

2. Purpose of the study and methods

The present study is grounded in comparative policy analysis and draws on empirical data from various national and international sources. These include official statistics from Czech and Polish government ministries, survey research from the International Organization for Migration (IOM), UNHCR Research, The Consortium of Non-Governmental Organizations (CODA) that shares key statistics and macroeconomic studies (ČNB). Additionally, qualitative data from interviews and focus groups conducted with refugees in both countries supplement the analysis.

The overarching objective of this article is to provide basic information on the economic effects of the large-scale influx of Ukrainian refugees by analyzing labor market integration strategies in Czechia and Poland. Based on data published by the mentioned institutions, this study highlights the underutilized potential associated with the influx of migrants—specifically in terms of labour force contributions. Given the scope of the paper, it offers only a partial overview of the barriers arising from existing institutional frameworks and systemic constraints that hinder the effective utilization of refugees'

professional qualifications and human capital within host economies, despite the implementation of labour market integration strategies. The research questions (RQs) guiding this study are as follows:

RQ1: What institutional and structural barriers limit the full utilisation of refugees' human capital in the Czech and Polish labor markets?

RQ2: What policy reforms and integration strategies could enhance labour market outcomes and foster long-term economic participation among refugees?

To address these questions, primary data from the indicated sources are used as the basis for the analysis and policy review.

3. Results and Discussion

Both countries demonstrated fairly solid administrative flexibility by enabling rapid access to the labor market. Poland passed the Special Act in March 2022, waiving the requirement for work permits and allowing employers to formalize employment contracts with Ukrainian nationals upon digital registration (UNHCR & Deloitte 2025). Czechia activated the EU's Temporary Protection framework and offered refugees legal residency and employment rights, although with slightly more bureaucratic requirements. Importantly, refugee labor did not displace domestic workers. On the contrary, the presence of Ukrainian employees often enabled increased labor participation among native populations, especially Czech women who benefited from the availability of care-related services. This suggests a level of labor market complementarity rather than competition (Postepska & Voloshyna, 2025). As a matter of fact, so far the economic impact of Ukrainian refugees in both countries has been broadly positive. Key findings include employment and tax contributions, macroeconomic effects and public demand. High levels of employment are supposed to be translated into increased contributions to social security and income tax systems, with remarks that are discussed later. In Czechia, working refugees began to offset the fiscal cost of support services within 12–18 months (ČNB, 2024). In Poland, GDP increased by 0.7–0.9 % in 2022 due to the influx of labor and demand stimulation. Forecasts suggest that this figure may rise to 2.7 % by 2024, assuming continued labor market integration. Refugee populations contributed to sustaining local demand for schools, public transportation, and healthcare services, particularly in demographically declining areas (UNHCR & Deloitte 2025). The demographic impact of the refugee inflow was significant. Both Czechia and Poland have been grappling with population aging, labor shortages in key industries, and workforce attrition due to emigration to Western Europe. The arrival of hundreds of thousands of working-age individuals—particularly women—presented an opportunity to stabilize the workforce and support demographic sustainability. Moreover, the rapid labor market entry of Ukrainian refugees helped fill shortages in low-wage sectors such as agriculture, manufacturing, logistics, food processing, and caregiving. Notably, integration occurred faster in urban centers such as Prague, Brno, Warsaw, and Krakow, where labor demand was higher and civil society networks were more robust (Obrizan, 2023). The arrival of Ukrainian refugees did not crowd out native Czech or Polish workers, the inflow of refugees did not negatively affect employment, unemployment, or inactivity rates among Czech citizens. In fact, in districts that received a larger share of refugees, the local female population experienced a statistically significant increase in weekly working hours (Postepska & Voloshyna, 2025). This suggests that the presence of Ukrainian workers may have alleviated time constraints for working mothers by filling roles in domestic or service sectors, thereby facilitating greater labour market participation among Czech women. This evidence supports the view that refugee labour may be complementary

rather than substitutive, enhancing overall economic activity rather than redistributing limited jobs (UNHCR & Deloitte 2025).

Despite the initial success in placing refugees in employment, deeper structural issues limited the full realization of their human capital. These include the following: (1) Language Deficits: Language remains a primary barrier. In Czechia, only about 25 % of working-age refugees spoke Czech fluently. Employment rates among Czech-speaking refugees were 81 %, compared to just 67 % among those with little or no fluency. In Poland, while Ukrainian and Polish are Slavic languages, technical and legal fluency still posed challenges. The provision of language training was often fragmented, non-obligatory, and insufficient in addressing sector-specific terminology (IOM, 2023).

(2) The recognition of foreign qualifications - Credential Recognition (Nostrification), especially in regulated professions such as health, law, education, and engineering was slow and bureaucratic. In Czechia, the process remains complex and discouraging (Postepska & Voloshyna, 2025). In Poland, temporary waivers allowed some Ukrainian medical workers to be employed, but this approach was not uniformly applied across sectors. Without streamlined recognition, many skilled professionals were forced into low-skilled employment (UNHCR & Deloitte 2025). The underemployment and mismatch result not only in economic inefficiency but also in psychological strain and erosion of professional identity. It has become common for both host countries, Czechia and Poland that highly qualified refugees frequently worked in sectors below their education level. In Czechia, 61 % of employed refugees reported working in positions that did not match their qualifications: 43 % worked in manual or support roles, and nearly 30 % held multiple jobs to sustain basic living standards. Older refugees (aged 55 and above) faced higher unemployment rates and lower chances of reintegration. In Czechia, 69 % of refugees aged 60–64 were unemployed and actively seeking work, twice the average unemployment rate for the refugee population (CODA, 2024). The lack of affordable childcare options significantly reduced their availability for full-time employment. Women with young children, particularly single mothers, struggled to balance work and caregiving. Many remained unemployed or accepted precarious part-time jobs with limited career prospects. (3) Entrepreneurship: Over 25,000 Ukrainian-run businesses were registered in Poland by 2023, contributing to job creation and economic dynamism (UNHCR & Deloitte 2025). Many focused on service provision, logistics, retail, and digital services. Under Lex Ukraine legislation Act No. 65/2022 Ukrainian nationals with temporary protection are granted nearly full access to the Czech labor market, including self-employment and the ability to operate a business. The contextual factors related to refugees with their entrepreneurial intentions within the host countries is supposed to be the objective of the following research paper.

To sum up the following practices have demonstrated success: (1) Early legal access to work: allowing refugees to work immediately upon arrival reduced the risks of poverty and informal employment. (2) Targeted sectoral integration – a synergy example demonstrated on the greater labour market participation among Czech women. (3) Community and Civil Society Support: NGOs and local authorities played vital roles in offering language instruction, vocational training, and psychosocial support. (4) Digital Coordination Tools, for example the PESEL UKR system in Poland facilitating streamlined registration, identity verification, and tax processing.

However, to unlock the full economic potential of refugee populations, it is essential to address a number of systemic barriers that continue to limit their productive inclusion. One critical area is language policy. In countries such as the Czech Republic and Poland, where the national languages are

not widely spoken, it is unrealistic to expect the newcomers to acquire fluency quickly enough to enter qualified professions. Host countries should therefore adopt a more strategic approach, actively promoting the teaching of global languages—particularly English—not only among refugees but also among the local population. This would increase the communicative flexibility of both groups and broaden employment prospects in internationally linked sectors. Moreover, this approach complements efforts to facilitate credential recognition, which remains a substantial obstacle across the EU internal market. Streamlining and harmonising the recognition of diplomas and professional qualifications should be prioritised to prevent the waste of skilled labor.

A second structural issue involves the mismatch between existing skills and labour market demand. Many refugees possess relevant qualifications but lack formal recognition or access to retraining. Labour market policies must be adjusted to include migrants in upskilling and reskilling programs, including vocational courses and professional exams. The scope of active labour market policies should be widened to ensure that refugees can participate in training and certification schemes. Entrepreneurship represents another area with considerable potential, particularly given the high rates of business creation among Ukrainians in Poland. Legal access to self-employment exists in Czechia, but in practice, bureaucratic hurdles and the non-recognition of practical skills—especially in craft-based trades—remain significant barriers. Removing these obstacles could enable more refugees to generate their income, contribute to innovation, and reduce long-term dependency on public support.

4. Conclusion

While the Czech Republic and Poland have demonstrated commendable flexibility in facilitating immediate access to employment, structural barriers continue to hinder the full realisation of refugees' economic potential. Persistent underemployment, unrecognised qualifications, and inadequate access to retraining not only compromise individual livelihoods but also constrain macroeconomic benefits. Addressing these issues requires a strategic focus on language policy, streamlined credential recognition, inclusion of refugees in active labour market measures, and the reduction of barriers to self-employment and entrepreneurship. Future research should pay greater attention to the institutional and systemic factors that limit refugees' participation in vocational retraining and small business creation. Understanding and dismantling these obstacles is essential for building inclusive labour markets and resilient host societies.

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Green Innovations in the Age of Big Data: A Bibliometric Study to Guide Future Research.

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Abstract: Companies adopt green innovations in response to global changes and sustainability challenges. Rapid digitalisation enables unprecedented use of big data to support this transformation. Research on how big data contributes to sustainable business practices remains fragmented. This article presents a bibliometric study mapping academic literature on the intersection of big data and green innovation. Using the Web of Science database, the analysis identifies publication trends, key authors, influential journals, and thematic clusters defining the current research landscape. The study highlights key topics, conceptual gaps, and research blind spots, offering clear directions for further research. The findings provide a foundation for the VEGA project, leveraging big data to redesign business models and enhance strategic sustainability. The bibliometric study contributes to practice by offering a roadmap on green innovations and supports the development of new conceptual frameworks for transforming business models with a focus on adaptability and sustainable strategies.

Keywords: green innovation, big data, business models, sustainability, strategy

JEL classification: O32, Q55, C80

Grant affiliation: VEGA 1/0775/25 Data-Driven Green Transformation: Strategic pathways to sustainable business models and green innovations.

1. Introduction

In the current global context, businesses face increasing pressures to implement sustainable solutions that reflect environmental, social and governance challenges. Green innovation are becoming a key tool not only for reducing the negative impacts of business activities on the environment but also for building competitive advantage in complex and dynamic international environment. At the same time, there is a rapid development of digital technologies that are fundamentally changing the way companies collect, analyze and use data. In particular, big data presents a new dimension in creating innovation and rethinking traditional business models. Despite the growing importance of the use of big data in the context of sustainability, research in this area is still fragmented and there is a lack of the systematic mapping and analysis. The purpose of this paper is to provide a detailed analysis of the existing scholarship research on the topic of big data, green innovation, and transformational change in business models. A systematic understanding of the gap in this area is essential for formulating effective strategies and policies, as well as for building theoretical frameworks to better understanding the potential of data-driven transformation towards sustainability.

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2. Theoretical background on green innovations, big data and business models changes

Green innovations has become one of the main component of corporate sustainability strategies in response to environmental challenges and governments' regulatory pressure. Green innovation is usually defined as the development and implementation of new products, processes, or practices that reduce environmental impact (Ge et al., 2024; Han et al., 2024). The transition to green innovation is particularly relevant for industrial and manufacturing sectors, where the ecological footprint tends to be higher. Recent studies highlight the fundamental impact of digital transformation as part of eco-innovation, aiming to enhance operational efficiency and inform data-driven decision-making (Feng et al., 2024; Han et al., 2024). Han et al. (2024) found a significant but non-linear impact of digital transformation on the performance of firms in green innovation. This suggests that although digital tools can facilitate sustainability, their effects are contingent on internal organizational capabilities and strategic synergies.

Big Data analytics has become an increasingly influential mechanism, enhancing companies' ability to collect, process, and act upon complex datasets related to environmental performance and business progress. Several studies underscore the role of Big Data analytics in creating more effective resource allocation, product innovation, and environmental impact monitoring (Sivarajah et al., 2024; Gao et al., 2023). Gao et al. (2023) show that manufacturing companies using big data tools are better positioned to implement green practices and innovate in eco-friendly directions. Similarly, the study of Kristoffersen et al. (2021) links "business analytics capability" to the successful implementation of circular economy practices, reinforcing the idea that data competency is a strategic asset in green transformation. However, the transformation is not automatic. As Sun et al. (2023) argue, companies must actively integrate digital systems with the actual production processes, and without strong leadership and resource optimization, big data remains an underutilized potential.

From a theoretical perspective, these changes require companies to reconsider and reshape their business models to support sustainability and green-oriented value creation. Business models are essential for delivering, building, and sustaining value, and they must evolve to align with environmental goals (Kristoffersen et al., 2021). However, many of the studies focus on innovation outputs or performance metrics rather than showing how core business logic evolves in response to digital and green development (Ge et al., 2024; Xu et al., 2023). We identified a major lack of research linking green innovation to specific business model transitions. The study of Feng et al. (2022) explores the mechanisms through which digital transformation enables green innovation, such as enhancing absorptive capacity, they do not delve into the practical implications for value propositions, customer relations, or financial outputs. Most of the current theoretical and empirical evidence is published from large-scale datasets in China or other resource-intensive economies (Feng et al., 2024; Sun et al., 2023). While this provides valuable insights into how digitalization influences environmental innovation in transformation economies, the findings may not be fully generalizable to smaller, service-driven economies such in Slovakia or other countries in the CEE region. Contextual factors such as institutional support, regulatory frameworks, and innovation ecosystem can significantly mediate the effectiveness of digital and green initiatives. Further research is needed to explore how companies in different economic and institutional contexts respond to the requirements of sustainability and digitalization. This opens up an opportunity to examine how Slovak enterprises (particularly SMEs) navigate the intersection of green innovation, big data use, and business model transformation, thus addressing the underexplored theoretical and geographical dimensions highlighted in current literature.

3. Methodology and data processing

The following work processes and tools were used to process the data. Based on a set of keywords in the article abstract, we create a sample of the filtered research outputs in the Web of Science database (WoS). These outputs were analyzed based on the tools directly in WoS and exported to Excel and a bid file for further processing in Biblioshiny, as well as within the tools available for Microsoft Excel.

For the WoS database search, we focused only on articles published from 2021 to mid-June 2025, with a total sample of 90 research papers (with status: article). The complete statistics from the total database of 90 outputs were as follows – based on the year of publication: year 2021 (5), year 2022 (13), year 2023 (24), year 2024 (30), mid-June 2025 (18). Subsequently, for detailed qualitative analysis, we abstracted the 10 highly cited articles over the period of consideration. Used key words to create a final database of the research papers are green innovation, big data, business models, sustainability, strategy, and transformation.

Below is Figure 1 summarizes the total number of publications in this area as well as the number of citations. An increasing year-on-year trend can be identified in the graph, showing a high interest in the topic of green innovations and big data.

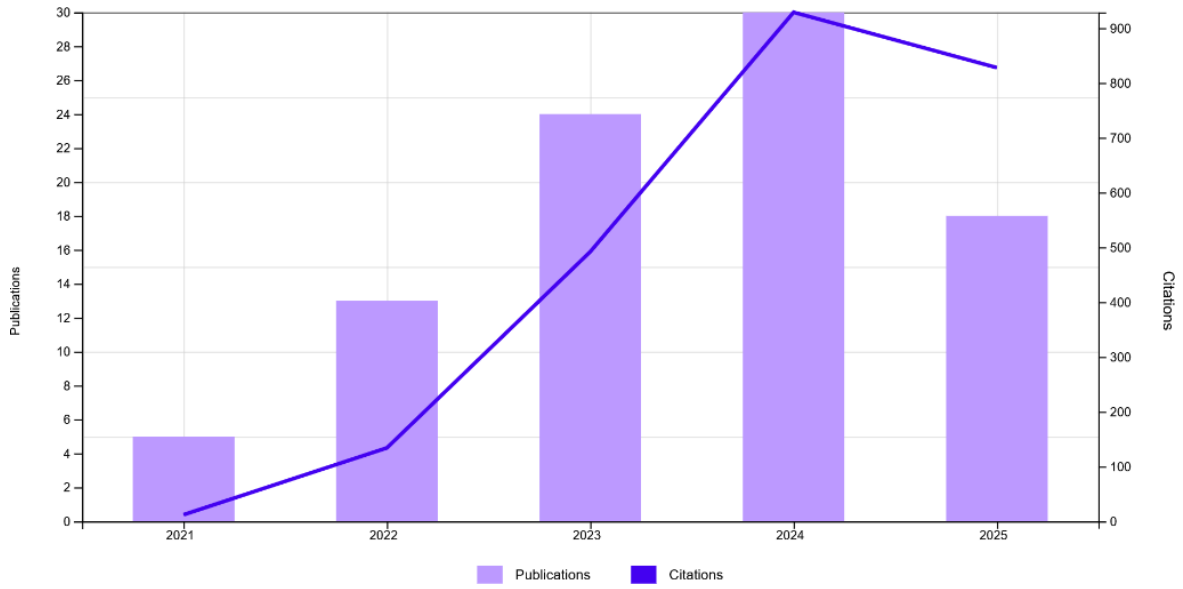

Figure 1: Publications and citations on Green Innovations in the Age of Big Data

Based on the database of selected research articles, the next section will elaborate on the key outputs of a mainly qualitative nature. The database of 90 articles was clustered based on keywords and main findings, and a detailed analysis of the 10 most cited articles reveals the key areas for research and also the research gap for the planned research in Slovakia.

4. Results and key takeaways

Table 1 provides an overview of the seven clusters, which were created by a qualitative analysis based on the typical keywords used, and contains a brief focus of the articles included in each cluster.

Table 1: Structure of thematic clusters (qualitative analysis – 90 research outputs)

Cluster	Key words	Focus of Articles – main areas
Big Data and sustainability	big data, sustainability, green technology, smart data, analytics	How companies use big data to support sustainable decisions and processes. Use of analytics for environmental purposes.
Green innovation in industry	green innovation, eco-innovation, sustainable innovation, industry 4.0	Implementation of green innovations in manufacturing or technology sectors. Focus on environmental performance.
Business model transformation	business model innovation, circular economy, sustainable business models	How traditional business models are being adapted to sustainability demands, including the circular economy.
Digital transformation and green growth	digital transformation, green growth, Internet of Things, AI, digital twin	The intersection of digitalization and green growth – new technologies enabling more sustainable solutions.
Policies and regulatory frameworks	policy, governance, regulation, green policy, institutional pressure	The influence of public policies, regulations, or institutional pressures on the adoption of green innovations.
Company performance and sustainability	company performance, ESG, environmental performance, corporate sustainability	Exploring the link between sustainable practices and corporate performance.
Employees and organizational change	leadership, organizational change, green HRM, culture	The impact of green innovation on internal organizational functioning, leadership, and cultural change.

Table 2 shows the specific published papers that are most cited in this area (green innovation and big data). As we can see, the vast majority of these papers were published between 2023 and 2024. And we identified that the most cited papers fall mainly in the two clusters we identified, namely Big Data and sustainability, and Digital transformation and green growth.

Table 2: Structure of thematic clusters (qualitative analysis – 10 most cited research outputs)

Research paper	Authors	Journal	Cluster	Year
Unravelling the impact of digital transformation on green innovation through microdata and machine learning	Han, YA; Li, ZT; Feng, TC; Qiu, SL; Hu, J; Yadav, KK; Obaidullah, AJ	*Journal of Environmental Management*	Digital Transformation and Green Growth	2024
Digital Transformation on Enterprise Green Innovation: Effect and Transmission Mechanism	Feng, H; Wang, FY; Song, GM; Liu, LL	*International Journal of Environmental Research and Public Health*	Digital Transformation and Green Growth	2022
Relating Sustainable Business Development Practices and Information Management in Promoting Digital Green Innovation: Evidence From China	Huang, W; Chau, KY; Kit, IY; Nureen, N; Irfan, M; Dilanchiev, A	*Frontiers in Psychology*	Digital Transformation and Green Growth	2022
Digital economy, data resources and enterprise green technology innovation: Evidence from A-listed Chinese Firms	Ge, YQ; Xia, YF; Wang, TY	*Resources Policy*	Big Data and Sustainability	2024

Impacts of digital transformation on eco-innovation and sustainable performance: Evidence from Chinese manufacturing companies	Xu, JW; Yu, YB; Zhang, M; Zhang, JZ	*Journal of Cleaner Production*	Digital Transformation and Green Growth	2023
Big data application, factor allocation, and green innovation in Chinese manufacturing enterprises	Gao, Q; Cheng, CM; Sun, GL	*Technological Forecasting and Social Change*	Big Data and Sustainability	2023
A study on big data analytics and innovation: From technological and business cycle perspectives	Sivarajah, U; Kumar, S; Kumar, V; Chatterjee, S; Li, J	*Technological Forecasting and Social Change*	Big Data and Sustainability	2024
Research on the impact of the integration of digital economy and real economy on enterprise green innovation	Sun, GL; Fang, JM; Li, JN; Wang, XL	*Technological Forecasting and Social Change*	Digital Transformation and Green Growth	2023
How does digitalization affect the green transformation of enterprises registered in China's resource-based cities? Further analysis on the mechanism and heterogeneity	Feng, YC; Gao, Y; Hu, SL; Sun, MM; Zhang, C	*Journal of Environmental Management*	Digital Transformation and Green Growth	2024
The effects of business analytics capability on circular economy implementation, resource orchestration capability, and firm performance	Kristoffersen, E; Mikalef, P; Blomsma, F; Li, JY	*International Journal of Production Economics*	Big Data and Sustainability	2021

Resource: own processing based on exporting data from WoS (filtered data based on the citations)

5. Discussion and conclusion

By analysing the ten most cited articles in the area of big data, green innovations, business models, and sustainability, a number of important insights can be identified that point to recent crucial areas and can lead to creating future research scope:

Digitalisation as a driver of green innovation: One of the crucial findings is that digital transformation has a positive impact on the performance of companies in the field of green innovation. This relationship is most evident among the industrial enterprises, where the adoption of digital technologies leads to innovations in products, processes, and management practices. Digitalisation also creates the conditions for creating resource efficiency, reduction of environmental footprint, and adaptation to regulatory or societal requirements in the area of sustainability.

The key role of dynamic capabilities: However, green transformation is not an automatic consequence of technology adoption - its success depends heavily on the so-called dynamic capabilities of enterprises. In particular, the ability to respond flexibly to change, to learn effectively, and to adapt their processes and strategies in a changing environment. These capabilities mediate the relationship between digital transformation and environmental performance.

Big Data and analytics capabilities as a performance tool: The use of big data and advanced analytics tools also has a significant effect on sustainability. Companies that can efficiently process and analyse

large volumes of data are more likely to successfully implement circular economy principles and develop green and environmental innovations. Based on these findings, we can state that analytical capabilities represent a strategic competence that can influence a company's competitiveness in a sustainable economy.

Leadership and HR policy as promoters of sustainability: In addition to technical factors, organisational leadership and HR policy also play an important role. Recent studies highlight that sustainable business practices can create conditions that foster pro-environmental initiatives within organisations (Huang et al., 2022). The transformational leadership and green HR practices that stimulate pro-environmental behaviour of employees. Cultivating sustainable organisational behaviour thus becomes an essential part of green transformation.

The double-edged effect of digitalisation: An interesting finding of some research is the so-called double-edged effect of digitalisation (Feng et al., 2022; Xu et al., 2023). Digital transformation does not always have unambiguously positive impacts. In some cases, implementation strategies can fail, resulting in wasted resources, increased energy consumption, or employee resistance.

Geographical concentration of research in China: A significant methodological limitation is that most of the studies analysed process their data exclusively from China or other developed manufacturing regions. These are mostly large firms in the context of a centrally planned economy, which may limit the transferability of findings to other geographical or economic backgrounds, such as Slovakia.

Lack of connection to business models: Although many articles focus on performance, innovation potential or technological factors, there is no systematic analysis of the transformation of specific business models of companies in the context of sustainability.

Based on a qualitative and quantitative analysis using bibliometric techniques and taking into account the limitations of this study (as only available sources from the WoS database were used), it can be concluded that there is a theoretical, geographical, and practical research gap in the area under study:

- Previous studies have mainly focused on the link between digitalization and green innovation, but the link to business model adaptation is often missing. New conceptual frameworks are needed to capture the complex linkages between big data, dynamic capabilities, and business model change.
- Most research is centralized on the Asian region (especially China) or in the US. It is evident that there is a major low representation of areas such as Central and Eastern Europe, including Slovakia. Due to specific issues (SMEs, transitioning economies, lower digital maturity), research in this region is required.
- It is apparent that businesses are not provided with sufficient practical advice concerning the incorporation of big data and digital tools within the framework of their sustainable strategies. Research should provide practical recommendations and typologies of business models that are suitable for the Slovak context.

Despite analysing an extensive database, the study has its limitations. The study relied solely on data from the Web of Science (WoS) database, which, although highly reputable, may not capture all relevant studies. Research indexed in other databases, such as Scopus, Google Scholar, or specialized databases, was excluded. The study is also focused on the latest research, from 2021, and this selection

discarded older papers that may contain key findings. Research focused on the use of big data in the transformation of business models of Slovak enterprises towards sustainability will fill a gap in knowledge within Central Europe, while contributing to the theoretical anchoring of digitally sustainable business models, and will offer practical recommendations for enterprises operating in regional contexts.

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Shaping the Future of Sustainable Transport: The Role of University Students in the Study Field of Economics and Management in the Adoption of Electromobility

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Abstract: The transition to a sustainable transport system is a key challenge for achieving climate goals and reducing environmental impact. Electromobility through the adoption of electric vehicles is a central element of this transformation. University students in the study field of economics and management play a potentially important role in shaping this future, as they are the future decision-makers, entrepreneurs and consumers. This article examines the perceptions, knowledge and attitudes of these students at the Faculty of Business Management of the Bratislava University of Economics and Business towards electromobility. Using a targeted questionnaire, the study examines the level of awareness, perceived barriers, as well as the willingness of students to engage in initiatives related to electromobility. The article highlights opportunities for integrating electromobility topics into educational courses and promoting cooperation between the automotive industry and the academic community. Strengthening this topic among students could accelerate the spread of sustainable mobility solutions and contribute significantly to its global transition.

Keywords: Electromobility, Electric Vehicles, Sustainable Transport, Education for Electromobility

JEL classification: Q01, Q55, I23

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1. Introduction

The transition to sustainable transport is key to mitigating climate change and improving air quality. Electromobility, which includes various electrified means of transport and related infrastructure, has become a key challenge that offers significant environmental benefits. University students in the study field of economics and management represent an important group that can shape the transition to a sustainable transport system.

The first part of the article is devoted to a theoretical view of the issue under review. This section interprets opinions and views from international journals. The literature review also served as a basis for defining the conceptual framework of the article and compiling questions for the questionnaire in line with the research objectives relating to education in the field of sustainable transport towards electromobility. The second part of the article contains an interpretation of selected questions from the questionnaire using descriptive statistics.

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2. Theoretical Backgrounds

All significant emission sectors must decarbonise in order to achieve a zero-carbon future. This seems to be particularly challenging in the transportation industry (Gota et al., 2019). Our mobility options in 2050, a crucial year when the world hopes to achieve zero carbon emissions, will be shaped by the infrastructure we create today, as demonstrated by the experience of previous decades.

A key challenge for the future is promoting sustainability in everyday life. Sustainable solutions are becoming increasingly important and essential for current and future development (Fidlerová et al., 2022). Sustainable development goals (SDGs) highlight the indispensable role of higher education institutions in nurturing sustainability capable of influencing social, economic, and environmental domains. An interdisciplinary and project-based learning environment, especially in economics and management, equips students with analytical, strategic, and leadership competencies necessary for evaluating market mechanisms, policy incentives, and business models underpinning electromobility adoption (Hübscher et al., 2021).

Economics and management students are uniquely positioned to analyse market and policy dynamics that govern the diffusion of EVs. Research indicates that consumer adoption decisions hinge on cost factors including vehicle purchase price, fuel cost savings, and public incentives (Rapson & Muehlegger, 2021). However, emerging markets face distinct challenges such as high taxation, inadequate electricity infrastructure, and low consumer confidence, which suppress EV uptake despite favorable long-term economics (Scholtz et al., 2023; Tushar Gahlaut et al., 2023). Cattaneo et al. (2018) emphasise that students' environmental awareness and attitudes significantly shape their choice of transportation modes, favoring public transport and non-motorised options when sustainability is prioritised. A study by Wu et al. (2014) surveying university-level offerings in North America and Europe revealed that formal education in sustainable transport remains fragmented, often housed within broader environmental or urban planning programs.

Economics and management can contribute through strategic innovations in supply chain optimisation and customer engagement. Optimisation models that incorporate dynamic variables like load-dependent energy consumption, varying electricity prices, and charging strategies lower operational costs and improve the economic viability of EV fleets, especially in logistics (Wu & Tian, 2024). Moreover, green logistics practices evaluated in various industrial contexts show positive effects on supply chain sustainability, underscoring the importance of logistics operations design in reducing environmental footprints (Roy & Mohanty, 2023). Students equipped with this knowledge are crucial actors in redesigning business processes to embed electromobility, whether by advocating for electric fleet deployment or optimising delivery routes to minimise emissions.

3. Methodology

The main objective of the article was to examine the knowledge, awareness, and attitudes of university students in the study field of economics and management toward electromobility as part of sustainable transport. The aim of the article is to assess the readiness of a sample of students to deal with the challenges and opportunities of electromobility and to strengthen them in the educational dimension of the transition to sustainable transport systems.

To achieve this objective, a literature review of international sources was conducted and an empirical survey was carried out using a structured questionnaire focused on students in the study field of

economics and management at the Faculty of Business Management of the Bratislava University of Economics and Business.

The survey was distributed electronically. Participation in the survey was voluntary and anonymous. A total of 328 valid responses were received. Of these, 47 students (14.33 %) were in the 1st year of the first degree, 78 (23.78 %) in the 2nd year of the first degree, and 71 (21.64 %) in the 3rd year of the first degree (bachelor's program). In addition, 74 respondents (22.56 %) were enrolled in the 1st year of the second degree and 58 students (17.68 %) in the 2nd year of the second degree (master's program) This distribution indicates a balanced representation of individual years of study, which allows for a comparison of students' views on the development of their perspectives in individual years in study field of economics and management.

4. Findings

Table 1 provides a structured overview of students' knowledge of electromobility in different academic years within the study field of economics and management. The findings indicate a progressive increase in knowledge and understanding throughout the study. Notably, none of the respondents selected the response " I don't know at all," suggesting a baseline level of familiarity with the concept of electromobility among the entire student sample. The highest level of knowledge was recorded in the 2nd year of the first degree, where 80.77 % of students stated that they were " know very well" with the concept of electromobility. This peak may reflect the content of the syllabus in the subjects or increased interest at this stage of study. A similarly strong response was recorded among 2nd year students in second degree of study, where 67.24 % reported a high level of knowledge, followed by 3rd year students in first degree (61.97 %) and 1st year students in the second degree (56.76 %). In contrast, 1st year students in the first degree showed the lowest level of advanced knowledge (46.81 %) and the highest combined proportion of limited or superficial knowledge (53.19 %), including 17.02 % who admitted that they had only heard of the concept.

Table 1: Assessment of Students' Knowledge of the Concept of Electromobility

	1st year of first degree	2nd year of first degree	3rd year of first degree	1st year of second degree	2nd year of second degree
I know very well	46.81 %	80.77 %	61.97 %	56.76 %	67.24 %
I know a little	36.17 %	11.54 %	30.99 %	35.14 %	29.31 %
I've heard of it, but I don't know	17.02 %	7.69 %	7.04 %	8.11 %	3.45 %
I don't know at all	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %
Total	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %

Table 2 illustrates students' awareness of the advantages of electric vehicles (EVs) in each year of study, with each respondent able to select up to three options. The most recognised benefits varied by year of study. Lower carbon emissions and reduced dependency on fossil fuels were highly acknowledged, particularly by students in the 2nd year of both the first and second degree, suggesting growing environmental awareness as students advance. In contrast, lower operating costs stood out among 1st year of second degree (93.24 %), indicating a shift toward economic considerations at the graduate

level. Quieter operation was slightly recognised in most years, while government incentives remained the least selected benefit in all years of the study. The frequent selection of the "Other" option, especially among 1st year of first degree (91.49 %), may point to either additional perceived benefits not listed or ambiguity in the response process.

Table 2: Student Awareness of the Perceived Benefits of Electric Vehicles

	1st year of first degree	2nd year of first degree	3rd year of first degree	1st year of second degree	2nd year of second degree
Lower carbon emissions	38.30 %	74.36 %	66.20 %	37.84 %	65.52 %
Lower operating costs	61.70 %	50.00 %	36.62 %	93.24 %	32.76 %
Quieter operation	44. 68 %	35.90 %	43.66 %	70.27 %	37.93 %
Government incentives	23.40 %	26.92 %	29.58 %	22.97 %	24.14 %
Reduced dependency on fossil fuels	40.43 %	67.95 %	60.56 %	32.43 %	94.83 %
Other	91.49 %	44.87 %	63.38 %	43.24 %	44.83 %

Table 3 presents student responses to the question of whether electromobility is viewed as an essential component of sustainable transport in the future. The results indicate a generally positive attitude throughout all years of the study, with the majority of respondents affirming the relevance of electromobility, either by selecting "strongly agree" or "agree." The majority of students across all levels agreed with the statement, with the highest overall support observed in the 2nd year of the master's program, where 44.83 % strongly agreed and 25.86 % agreed. In contrast, 1st year of first degree showed the most polarised responses, with the highest rate of strong agreement (36.17 %) but also the greatest level of disagreement (21.28 %), indicating a mix of enthusiasm and uncertainty at the beginning of their studies. As students progressed through their studies, agreement tended to become more moderate and stable, while neutral and negative responses generally declined. As students progressed through their studies, agreement tended to become more moderate and stable, while neutral and negative responses generally declined.

Table 3: Student Perceptions of Electromobility as a Key Element of Sustainable Transport

	1st year of first degree	2nd year of first degree	3rd year of first degree	1st year of second degree	2nd year of second degree
Strongly agree	36.17 %	25.64 %	23.94 %	25.68 %	44.83 %
Agree	23.40 %	57.69 %	49.30 %	48.65 %	25.86 %
Neutral	19.15 %	12.82 %	18.31 %	18.92 %	22.41 %
Disagree	12.77 %	2.60 %	7.04 %	5.41 %	3.45 %
Strongly disagree	8.51 %	1.28 %	1.41 %	1.35 %	3.45 %
Total	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %

Table 4 presents students' opinions on the extent to which students in the study field of economics and management can influence the future implementation of electromobility. The responses, broken down by year of study, reflect different levels of perceived ability to influence the transition to sustainable mobility in the future. The majority across all academic years believe they can contribute in some capacity, with the response "Yes, to some extent" being the most common, particularly among 2nd year of bachelor's program (76.92 %). However, confidence in significant influence increases significantly in individual years of study, from 17.95 % in the 2nd year of the bachelor's program to 44.83 % in the second year of the master's program. However, confidence in significant influence increases significantly in individual years of study, from 17.95 % in the second year of the bachelor's program to 44.83 % in the 2nd year of the master's program. Negative responses (“Not much” and “Not at all”) were relatively low overall and disappeared completely in the second year of the master's program.

Table 4: Student Perceptions of Their Potential Influence on the Future Adoption of Electromobility

	1st year of first degree	2nd year of first degree	3rd year of first degree	1st year of second degree	2nd year of second degree
Yes, significantly	29.79 %	17.95 %	28.17 %	35.14 %	44.83 %
Yes, to some extent	59.57 %	76.92 %	53.52 %	43.24 %	46.55 %
Not much	6.38 %	5.13 %	11.27 %	12.16 %	8.62 %
Not at all	4.26 %	0.00 %	7.04 %	9.46 %	0.00 %
Total	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %

Table 5 presents student participation in activities, projects, or initiatives related to sustainable transport or electromobility, divided by year of study. The data indicate a consistently high level of participation across all years, with most students reporting previous experience with these activities. Notably, participation increases with each year of study, peaking among 2nd year of second degree, where 93.10 % confirmed involvement. While 1st year of first degree reported a slightly lower rate (74.47 %), it remains substantial, reflecting early exposure or interest in sustainability topics. The lowest levels of non-participation were recorded in the 2nd year of second degree (6.90 %), whereas 1st year of first degree had the highest non-involvement rate (25.53 %).

Table 5: Student Participation in Activities Related to Sustainable Transport and Electromobility

	1st year of first degree	2nd year of first degree	3rd year of first degree	1st year of second degree	2nd year of second degree
Yes	74.47 %	87.18 %	84.51 %	81.08 %	93.10 %
No	25.53 %	12.82 %	15.49 %	18.92 %	6.90 %
Total	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %

Table 6 summarises students' opinions on what measures would most effectively increase student engagement in the study field of economics and management in the promotion and adoption of electromobility. Among 2nd year of second degree, an overwhelming 75.86 % identified organising workshops, seminars, and conferences as the most effective approach, by far the highest percentage for any single option in the table 6, indicating a strong preference for interactive, applied learning

formats at the master's program. This method also received consistent support from 1st year of first degree (36.17 %) and 1st year of second degree (35.14 %). Conversely, 3rd year of first degree showed the strongest interest in practical industry collaboration (47.30 %), suggesting a shift toward real-world application as students near graduation. The importance of including more electromobility topics in the curriculum was highest among 1st year of first degree (31.91 %). Notably, subjects focused on electromobility solutions were most valued by 3rd year of first degree (28.38 %), likely reflecting a desire for more specialised knowledge.

Table 6: Preferred Educational Methods to Increase Student Involvement in Promoting and Implementing Electromobility

	1st year of first degree	2nd year of first degree	3rd year of first degree	1st year of second degree	2nd year of second degree
Including more topics on electromobility in the curriculum	31.91 %	19.72 %	9.46 %	17.57 %	10.34 %
Subjects related to electromobility solutions	14.89 %	19.72 %	28.38 %	14.86 %	1.72 %
Organising workshops, seminars, and conferences on sustainable	36.17 %	35.21 %	14.86 %	35.14 %	75.86 %
Offering opportunities to participate in practical projects with industry	17.02 %	25.35 %	47.30 %	32.43 %	12.07 %
Total	100.00 %	100.00 %	100.00 %	100.00 %	100.00 %

5. Discussion and Conclusion

The findings in the article demonstrate a generally high and gradually increasing level of awareness, engagement, and perceived relevance of electromobility among students in the study field of economics and management over the course of their studies. Students' knowledge of electromobility deepens with each year of study, with the highest level of awareness recorded among 2nd year bachelor's and master's students. This trend was mirrored in their understanding of the benefits of electric vehicles, where environmental and economic advantages were increasingly recognised with academic maturity. While the understanding of environmental benefits such as reduced emissions and lower fossil fuel dependency is broadly shared, knowledge of policy incentives remains limited. Students also express a strong consensus that electromobility plays a vital role in achieving sustainable transport goals, with agreement becoming more stable and confident in higher academic years.

In parallel, the perceived capacity of students to influence the adoption of electromobility increases with academic maturity. While most respondents across all years believe they can contribute in some way, students in the final year of their master’s studies express the highest confidence in their potential impact. Participation in sustainability-related initiatives is also high across the student body, further supporting the notion that practical involvement reinforces students' sense of agency. Preferences

regarding how to foster deeper engagement vary with study level: bachelor's students favour curricular integration and industry collaboration, while master's students overwhelmingly prefer interactive learning formats such as workshops and conferences. Strengthening both theoretical and experiential dimensions of electromobility education can empower future professionals in economics and management to actively shape sustainable transport transitions.

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Measuring the Impact of Digital HRM Practices on Operational Efficiency: Systematic Literature Review.

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Abstract: This systematic literature review synthesizes 62 studies (2000-2025) examining digital HRM's microeconomic impacts on organizational cost structures, operational efficiency, and performance outcomes. Digital HRM tools achieve significant efficiency gains: 42% hiring cost reductions, 90% cycle time improvements, and 72% workforce analytics accuracy. Performance impacts include turnover reduction from 27.5% to 18.7%, satisfaction improvement by 35.6%, and 39.8% quality-of-hire improvements. However, measurement heterogeneity limits cross-study comparisons, with financial metrics showing £1M+ savings versus moderate perceptual improvements. Findings support resource-based view positioning digital capabilities as strategic assets, with advanced organizations achieving 70% automation rates. Results necessitate integrated digital HR strategies and standardized evaluation frameworks for sustained operational efficiency enhancement .

Keywords: digital human resource management, artificial intelligence in human resources, organizational performance, digital transformation, workforce analytics.

JEL classification: M210, M5, E210

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1. Introduction

Digital Human Resource Management (HRM) has emerged as a strategic imperative amid intensified competition and efficient human capital demands. Organizational resilience increasingly depends on technological integration capabilities (Chugunova & Danilov, 2023), with COVID-19 amplifying transformation urgency. Despite global HR technology spending exceeding $40 billion annually, understanding of microeconomic implications remains limited. Research examines individual tools rather than integrated systems, uses inconsistent metrics, and neglects longitudinal analysis (Driessen et al., 2015; Amash, 2023). Key gaps concern how HRM maturity influences digital investment impacts (Wang et al., 2022), while meta-analyses show only moderate effects (Theres & Strohmeier, 2023; Mihai et al., 2023). This systematic literature review (SLR) synthesizes 62 studies (2000-2025) tracing digital HRM evolution from early automation to AI-driven platforms.

2. Research Aim

This systematic literature review aims to address the fragmented understanding of digital HRM's microeconomic impacts on organizations. Despite annual HR technology spending exceeding $40 billion, empirical evidence remains scattered across inconsistent metrics and isolated tool assessments, limiting strategic decision-making. This review systematically synthesizes empirical

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evidence to reveal how digital HRM transformation affects organizational cost structures, operational efficiency, and performance outcomes. By analysing 25 years of research (2000-2025) spanning three technological evolution phases from foundational systems (2000-2010), cloud integration (2010-2020), to AI acceleration (2020-2025), this study aims to provide consolidated evidence on digital HRM impacts and identify measurement gaps that constrain comparative analysis. To accomplish this aim, the following research questions guide the systematic review:

RQ1: What digital HRM technologies most affect organizational cost structures?

RQ2: How does HRM digitalization influence operational efficiency?

RQ3: What quantifiable performance outcomes associate with digital HRM implementation?

3. Literature Background

This section highlights the empirical evidence on digital HRM transformation across the three phases of the digital transformation. The review establishes theoretical foundations for understanding digital HRM as a strategic capability while identifying measurement approaches employed in the literature.

3.1. Digital HRM Evolution, Adoption, and Strategic Implementation

Digital HRM exhibits three phases. Phase 1 (2000-2010) achieved 15-25% cost reductions (Udomphol & Siengthai, 2016; Driessen et al., 2015). Phase 2 (2010-2020) delivered 30-40% efficiency gains via cloud automation (Bondarouk et al., 2017; Vedriš et al., 2016). Phase 3 (2020-2025) demonstrates AI analytics adoption (Chugunova & Danilov, 2023). These systems reduce workloads, standardize reporting, and enable strategic focus (Bondarouk et al., 2017; Almasradi et al., 2022). Contemporary adoption spans centralization to AI (Almasradi et al., 2022; Amash, 2023; Mitrofanova, 2019). Large firms deploy integrated HRIS while SMEs adopt simpler systems (Amash, 2023). Privacy concerns impede adoption in emerging markets (Chugunova & Danilov, 2023; Vedriš et al., 2016). This positions digital HRM as resource-based asset (Bondarouk & Ruel, 2009).

4. Methodology

This section outlines the SLR methodology to identify, screen, and analyze empirical studies examining digital HRM's microeconomic impacts, ensuring transparent and replicable processes.

4.1. Research Design and Systematic review protocol

This study employs a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) based SLR methodology to identify, evaluate, and synthesize empirical evidence on digital HRM's microeconomic impacts, ensuring transparent and replicable processes across identification, screening, and analysis phases. The SLR was conducted in three sequential stages:

Stage 1 – Identification: Literature was identified through Web of Science, Scopus, Google Scholar, and citation tracking. Search queries targeted HRM, Digital technology/tools and financial impacts. Inclusion/exclusion criteria (Table 1) ensured relevance and quality.

Table 1: Inclusion Exclusion criteria

Sl No	Criteria	Include	Exclude
1	Topics	Digital HRM Systems, Practice's, and Tools.	Unrelated Topics
2	Date	Published from the year 2000 to 2025	before Year 2000
3	Main Source	Scopus, web of science. Google Scholar	Other journals
4	Area of Research	Business Management Economics	Other disciplines
5	Language	English language studies were considered	other languages

Source: Authors

Stage 2 – Screening: This stage systematically evaluated articles against set inclusion/exclusion criteria. Titles, abstracts, and keywords underwent multi-stage screening to remove irrelevant or ambiguous records. Two researchers independently conducted reviews to minimize bias, resolving any disagreements through discussion.

Stage 3 – Inclusion: The final stage rigorously assessed full texts for methodological quality, theoretical value, and relevance, ensuring only high-quality studies informed the analysis.

Analytical Approach: The selected articles underwent thematic content analysis to explore three areas: (I) mapping studies by performance impact, (II) identifying deployed digital HRM tools and technologies, and (III) examining reported outcomes on cost, efficiency, and performance. This approach provided a comprehensive view of the research topic.

5. Results

Empirical analysis demonstrates quantifiable impacts across cost structures, operational efficiency, and performance metrics through systematic evidence synthesis.

5.1. Data Extraction

Our Systematic Literature Review using PRISMA 2020 flow diagram yielded n=62 articles & reports published between 2000 and 2025 that met all inclusion criteria as detailed in fig .1

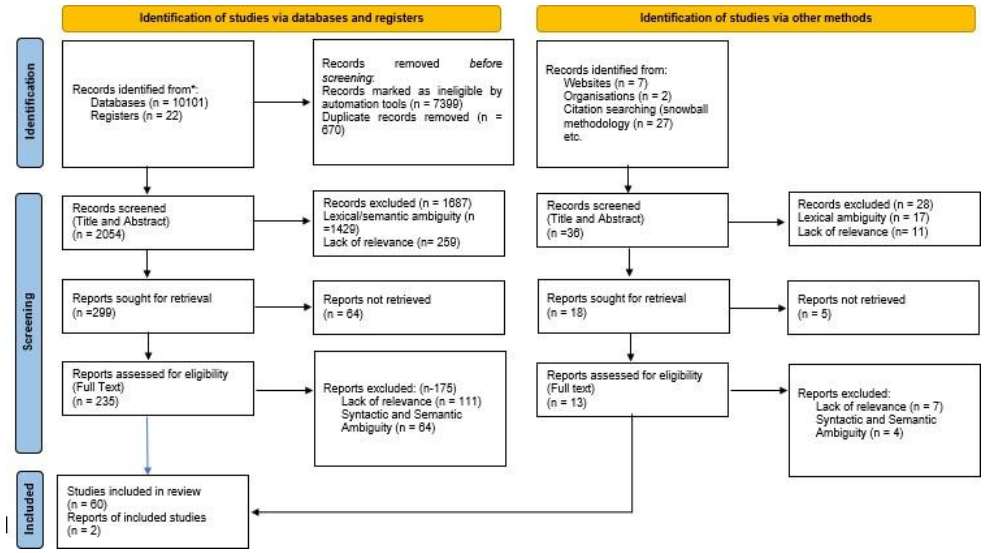

Figure 1: PRISMA 2020 flow diagram

Template Source: Page MJ, et al. BMJ 2021;372:n71. https://doi.org/10.1136/bmj.n71

5.2. Digital Technologies and Cost Structure Impacts (RQ1)

Digital HRM systems demonstrate systematic microeconomic restructuring. Contemporary implementations yield 42% hiring cost reductions (£6k→£3.5k) and aggregate savings exceeding £1M annually (Kayusi, 2025; Nusair, 2025; Beimborn et al., 2014; Driessen et al., 2015). Table 2 details function-specific cost impacts.

Table 2: Digital systems and cost impact

Digital HR Tool	Observed Microeconomic Impact	Study
Recruitment & Talent Acquisition		

AI/ Digital Recruitment Tools	Hiring cost $6k→$3.5k (↓42%), Total savings >£1M, Time-to-hire 45→22d	Kayusi (2025); Nusair (2025)
	Hiring 30→21d (↓30%), 4mo→4wk (↓90%),	Weng & Nanda (2024); Nusair (2025)
	Hiring time ↓42%, Quality-of-hire ↑39.8%	Adias (2025); Kayusi (2025)
Administrative & Strategic Function		
BPM-HRIS	–50% recruiting costs, ~1M CHF saved	Beimborn et al. (2014)
Cloud HRIS	~$1,395 saved/yr, reporting ↓2 mo → <15	Driessen et al. (2015)
HRIS	↓Cost-per-hire, training on Likert ~3.7–3.8	Udomphol & Siengthai (2016)
Web-based payroll	↓Errors, fairness ↑ from 3.4→4.2 Likert	Liang (2011); Ahmed et al. (2018)

Source: Authors

5.3. Operational Efficiency Gains (RQ2)

Digital integration enables substantial process optimization. AI systems achieve 70% automation rates and 90% cycle time reductions (Mwita & Kitole, 2025; Nusair, 2025), while workforce planning algorithms demonstrate 20-30% labor alignment improvements (Sridar, 2023; Chugunova & Danilov, 2023). Table 3 highlights the details on traditional and recent efficiency developments.

Table 3: Digital tools and efficiency gains

Efficiency Domain	Quantified Improvement	Study
Recent AI-Enhanced (2020-2025)		
Recruitment Process	Hiring difficulty ↓0.31-0.38 SD ($p<0.05$), 75% efficiency gains	Chugunova & Danilov (2023); Bhuiyan (2025)
Cycle Optimization	Time-to-fill ↓52-36 days Hiring 4mo→4wk	Sridar (2023); Nusair (2025)
Workforce Planning	Labor alignment ↑20-30%, Overtime ↓18%	Sridar (2023)
Training Efficiency	81→92%, Time-to-competency ↓25-35%	Kayusi (2025); Sridar (2023)
Traditional Systems (2000-2020)		
Process Speed	Faster hiring cycles, Subprocess reduction	Beimborn (2014)
Reporting	Administrative time 2mo→<15min	Driessen (2015)

Source: Authors

5.4. Measurable Performance Outcomes (RQ3)

Performance outcomes demonstrate quantifiable organizational enhancement. Financial savings reached £1M (Nusair, 2025), while retention improved from 72.5% to 81.3%, turnover reduced from 27.5% to 18.7%, and quality-of-hire increased 39.8% (Kayusi, 2025; Saha, 2020; Bhuiyan, 2025). Table 4 details comprehensive performance metrics.

Table 4: Measurable performance outcomes

Performance	Measurable Outcome	Study
Financial Performance		
Cost Savings	>£1M saved, $6k→$3.5k per hire	Nusair (2025); Kayusi (2025)
Talent Management		
Retention	72.5→81.3% (+8.8pp), ↑ 48.3%	Saha (2020); Weng & Nanda (2024)
Turnover	↓20-30%, 27.5→18.7%, 22%→15%, 19→14%	Kaplan & Haenlein (2019); Saha (2020); Adias (2025); Kayusi (2025)

Quality of Hire	↑15-20%, ↑39.8%	Sridar (2023); Kayusi (2025)
Employee Experience		
Engagement	3.1→4.2, Absenteeism ↓36%	Weng &Nanda (2024); Adias (2025)
Satisfaction	Employee ↑35.6%/↑51.3%, Recruiter ↑40.6%	Kayusi (2025); Weng & Nanda (2024)
Performance	Appraisal ↑ 50.8%, Feedback ↑ 224%	Kayusi (2025)
Operational Excellence		
Productivity	↑5%	Nocker & Sena (2019)
Training Outcomes	Engagement ↑30%, Sentiment accuracy 70→85%	Mitrofanova (2019); Weng & Nanda (2024)

Source : Authors

6. Discussion

Convergent evidence reveals digital HRM's transformative impacts while exposing methodological constraints that limit theoretical generalizability and comparative assessment.

6.1. Cost and Efficiency Insights Aligned with Strategic Theory

Digital HR architectures fundamentally restructure organizational cost functions through process optimization and resource reallocation. Contemporary evidence demonstrates 41% recruitment cost reductions and 17% attrition reduction (Kayusi, 2025; Sridar, 2023), validating transaction cost theory's predictions regarding technological intermediation. Uganda’s reduction in reporting time from two months to fifteen minutes supports the resource-based view that digital capabilities confer sustained competitive advantage (Driessen et al. 2015).

6.2. Fragmentation in Measurement Approaches

Methodological heterogeneity constrains comparative analysis across digital HRM impact assessments. Financial metrics demonstrate 42% hiring cost reductions and £1M+ savings (Nusair, 2025; Kayusi, 2025), while perceptual instruments yield moderate Likert improvements (3.7-4.2 scale). This measurement fragmentation spanning objective financial audits to subjective satisfaction surveys undermines meta-analytical synthesis and theoretical generalizability, necessitating standardized evaluation frameworks.

6.3. Emerging Themes: Maturity, trust, Strategic alignment, Contextual factors.

Digital maturity determines implementation success, with advanced organizations achieving 70% automation (Mwita & Kitole, 2025). AI platforms demonstrate 90% recruitment time reduction, 39.8% quality improvements, and 72% predictive accuracy (Nusair, 2025; Kayusi, 2025; Bhuiyan, 2025), though transparency deficits create barriers. Performance impacts increase in satisfaction increases and reduction in attrition (Kayusi, 2025; Adias, 2025), necessitating deeper evaluation frameworks.

6.4. Temporal Evolution and Exponential Acceleration.

The 25-year analysis reveals three phases with accelerating trajectories. Phase 1 (2000-2010) established foundational HRIS achieving 15-25% cost reductions (Udomphol & Siengthai, 2016). Phase 2 (2010-2020) delivered 30-40% efficiency gains via cloud automation (Bondarouk et al., 2017; Beimborn et al., 2014). Phase 3 (2020-2025) demonstrates exponential advancement: AI systems achieve 70% automation with 90% cycle time reductions representing 2.8-fold automation improvement and 3.6-fold processing acceleration (Mwita & Kitole, 2025; Nusair, 2025). Hiring cost

optimization improved from 15-25% to 42% with 68% acceleration. Predictive accuracy reached 72% attrition forecasting, while turnover reduced from 27.5% to 18.7% (Kayusi, 2025; Bhuiyan, 2025). Post-2020 implementation timelines contracted from 8-10 years to 2-3 years, with COVID-19 compressing 5-year roadmaps into 6-month deployments. However, measurement heterogeneity persists in financial audits documenting £1M+ savings versus moderate Likert improvements (3.7-4.2). Contemporary AI extends foundational HRIS infrastructure rather than replacing functions, representing capability expansion within existing architectures.

7. Conclusion

Analysis of 62 studies (2000-2025) reveals digital HRM's transformative microeconomic impacts. HRIS, AI recruitment tools, and analytics platforms achieve 42% hiring cost reductions, £1M+ aggregate savings, 70% automation rates, and significant performance gains: sales (+5.2%), cash flow (+16.3%), and retention improvements (72.5%→81.3%), supporting resource-based view positioning digital capabilities as strategic assets. However, limitations constrain generalizability: geographic concentration in Western contexts, predominance of cross-sectional designs restricting causal inference, measurement heterogeneity preventing meta-analytical synthesis (financial metrics versus Likert-scale perceptions), and potential publication bias. The 25-year scope encompasses technological variance from foundational HRIS (15-25% improvements) to contemporary AI systems (70% automation) complicating direct comparisons. Future research priorities include developing standardized measurement frameworks enabling cross-organizational comparisons, conducting 5–10 year longitudinal studies tracking sustained Return on investment (ROI), investigating algorithmic bias and fairness in AI-driven recruitment, examining adoption barriers across emerging economies, and developing sector-specific cost-benefit models for heterogeneous regulatory environments. Digital HRM has evolved from operational necessity to strategic imperative, requiring integrated architectures, organizational readiness, and ethical frameworks addressing algorithmic transparency and privacy governance.

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Innovation Activity of Companies as a Tool of Strategic Management

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Abstract: Innovation has increasingly become a key factor in shaping business strategy and maintaining competitiveness in dynamic markets. This paper presents the findings of a quantitative survey conducted among 218 enterprises operating in various sectors and of different sizes. The research aimed to investigate the relationship between innovation activity and strategic management practices. The results reveal that enterprises with a systematic and proactive innovation approach are significantly more likely to implement formal strategic planning and align their innovation efforts with long-term business goals. Statistical methods, including correlation analysis and hypothesis testing, were used to confirm the significance of these relationships. Furthermore, sector-specific and size-related differences were examined, highlighting varying innovation behaviours across company types. The paper discusses the implications of these findings for strategic decision-making and resource allocation in both small and large enterprises. Overall, the study supports the argument that innovation should not be viewed merely as a technical process but as a core element of strategic business thinking.

Keywords: Innovation Strategy, Strategic Management, Business Planning, Organizational Performance, Competitive Advantage.

JEL classification: L21, L26, M19, O31

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1. Introduction

The innovative activity of enterprises represents a multidimensional phenomenon of process and product changes and becomes an integral part of the comprehensive strategic management of the enterprise in a changing business environment and dynamic market changes. The ability of enterprises to systematically create, implement and develop innovations directly affects their sustainability, growth and ability to achieve strategic goals. Innovations also allow them to respond flexibly to external challenges and actively shape the competitive environment. Innovative activity as a tool of strategic management of enterprises creates the prerequisites for long-term increase in competitiveness, adaptability and effective use of internal and external resources.

2. Knowledge base on innovation

The current business environment is undergoing dynamic and fundamental transformations that significantly affect traditional approaches to business growth and development. The gradual depletion of conventional growth factors, such as low labor costs, availability of natural resources, and stability

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of the market environment, is forcing businesses to redefine their strategies and seek innovative activities to maintain and strengthen their competitive advantage.

"Innovation is the key mechanism through which businesses respond to changing market conditions. Creative destruction leads to the demise of outdated technologies and processes and the creation of new ones, thereby enabling businesses to adapt to change" (Schumpeter, 2006).

In order for these companies to grow, survive and remain on the market, it is necessary to develop strategies, implement systems and processes that will support the creation of new products, help improve existing products and services that are necessary for the growth and development of the organization (Lowe & Marriott, 2006). Continuous innovation, automation, digitalization, cybersecurity, introduction and investment in new technologies that protect the environment are essential, because such technologies not only reduce the costs of companies, but can also fundamentally affect the competitiveness of the company (Sedláčková & Buchta, 2006). Favorable results of companies are conditioned by high-quality ideas/inventions; high-quality implementation of the invention - innovation; high-quality and successful commercialization of the innovation, when the innovative idea or concept becomes a real product or service and will have value for customers, bring the company a profit or expand its market share; high-quality repetition of the entire process at an ever-higher level, because this process rises in a spiral.

Despite the above facts, the entire process, or rather its result, despite all possible efforts and the highest quality, is never absolutely perfect or world-class and therefore needs to be constantly examined. Innovations achieve “long-term growth and success of a company in a changing business environment,” (Day & Schoemaker, 2016), therefore innovative “companies will have to create new concepts of strategy” (Hart, 1995) and ensure their “sustainability.” (DAngelo & Magnusson, 2021; Denicolai, Zucchella & Magnani, 2021).

Emerging innovative businesses can achieve strategic sustainability through “key success factors” (Saura, Palos-Sanchez & Grilo, 2019; Ceaușu, Marquardt, Irmer & Gotesman, 2017), which are prerequisites for a sustainable business (Ghezzi, 2020; Shepherd & Gruber, 2020; Bortolini et al., 2018; Schwaninger & Scheef, 2016) “being viable and sustainable in the long term” (Etim, 2020).

Some experts explain that “innovation moves a company forward and in this logic they openly talk about the positive impacts of innovation strategies that pose specific challenges for the company” (Dahlander, O’Mahony & Gann, 2014). Innovation processes in companies “do not need to be managed in isolation, as external partnerships also play an important role and can be beneficial for them” (Dahlander & Gann, 2010; Love, Roper & Vahter, 2013; Bouncken, Fredrich & Gudergan, 2022; Hutter, Gfrerer & Lindner, 2020).

The development of innovative businesses can improve the living standards of the Slovak population. “The process of integrating sustainability into business strategy varies depending on the company, and is particularly challenging in established companies that are trying to renew their business models to achieve sustainability and circularity” (Frishammar & Parida, 2019; Rovanto & Bask, 2020; Kaipainen, Aarikka-Stenroos & Ranta, 2020).

However, given the difficulty and gradual implementation of strategic renewal, established businesses are often criticized for acting slowly or for deliberately hindering the diffusion of sustainable innovations in order to maintain their strategic position (Smink, Hekkert & Negro, 2015).

Slovak enterprises often innovate themselves and are aware of the importance of innovation, while their main incentive is external influences. Innovation activities of enterprises are very risky and very expensive, their outcome is uncertain. For this reason, the sustainable development of innovative enterprises requires a continuous flow and overproduction of creative ideas (inventions and innovations).

The National Strategy for Research, Development and Innovation 2030 also includes "the goal of moving Slovak Republic up ten places in the innovation performance rankings, increasing investment in research and development to 2% of GDP, of which 1.2% from private sources, and attracting 25,000 highly qualified people from abroad" (Research and Innovation Authority, 2023).

3. Aim

The aim of this research paper is to analyse the level and nature of innovation activity of small and medium-sized enterprises (SMEs) in Slovak Republic and to assess its importance as a strategic management tool. The research focuses on identifying factors that influence the ability of enterprises to innovate products and processes, and on assessing the internal readiness and external environment of enterprises for implementing innovations. The intention is to contribute to a better understanding of innovation as a part of strategic decision-making in the context of SMEs in the Slovak Republic.

4. Methods and methodology

The research was carried out in the form of quantitative data collection through a structured questionnaire, which was filled out by 218 small and medium-sized enterprises operating in the Slovak Republic. A micro-enterprise has fewer than 10 employees, a small enterprise has fewer than 50 employees, and a medium-sized enterprise has fewer than 250 employees. In the case of affiliated and partner enterprises, the share values of other enterprises are also included in the calculation, according to their ownership and control relationships. The collected data were analysed using descriptive statistics, while the following categories of variables were monitored:

- Level of innovation in products and processes by the share of products/processes with extraordinary, moderate or no innovation (in %).
- Sociodemographic and organizational characteristics of enterprises by the age of the enterprise, work and management experience, number of employees, prevailing age in the collective.
- Internal factors influencing innovation activity by internal cooperation, team adaptability, management support, innovation culture, access to resources, talent and skills, collaboration and networking.
- External factors and business environment by the phase of the industry life cycle, market growth rate, competitive conditions, predictability of development, public and state support, external impulses for innovation.
- Strategic attitudes and orientation by the importance of innovation for growth, entrepreneurial ambitions, attitude to risk, innovation orientation.

- Talent involvement and cooperation with external partners by the efficiency of talent work, cooperation with external generators of ideas and inventions.

The analysis was focused on describing the occurrences and distribution of values of individual variables, identifying trends, as well as on comparing companies with different levels of innovation activity. The results provide the basis for the next analytical phase of the research focused on testing the relationships between variables (e.g. regression or correlation analysis).

5. Results and discussion

The results of a quantitative analysis conducted on a sample of 218 small and medium-sized enterprises (SMEs) in Slovakia point to several significant findings regarding the level of innovation activity and its determinants within the framework of strategic management. The analysis showed that innovation activity in the area of products and processes is limited in many cases. In the case of product innovations, the median share of extremely innovated products was 20%, as was the share of moderately innovated products. On the contrary, according to the respondents, up to 40% of products did not undergo any innovation change at all, which points to a relatively high share of stagnant product portfolios.

The situation in the area of processes is even less favourable. The results show that the median share of extremely innovated processes is only 5%, while moderately innovated processes represent 20%. Up to 55% of processes were not innovated at all, which is a rather alarming figure, indicating insufficient efforts by companies to modernize their internal activities and streamline their operations through innovations.

In terms of company characteristics, a relatively high median age of organizations was found, reaching 46 years, which indicates their market establishment. The median work experience of respondents was 21 years, while managerial experience was lower, with a value of 15 years. These data indicate that the research group consists of companies with experienced workers and a stable organizational background. The number of employees showed an extremely high dispersion (standard deviation 423.95), which may indicate significant variability in the size structure of companies - from very small to larger medium-sized enterprises.

As for internal prerequisites for innovation performance, the highest values were achieved by indicators of internal cooperation and team adaptability, where the median was at level 4 (from a 5-point scale), which indicates the ability of teams to cooperate and respond flexibly to changes. However, other factors such as leadership support, innovation culture or access to resources only reached medians of 2 or 3, which points to the limited capacity of some companies to systematically develop an innovation environment.

External factors and their impact on the innovation activity of companies were perceived with considerable reserve. Although the life cycle phase of the industry in which companies operate reached a higher value (median = 4), which may indicate their involvement in growing or developing market segments, other indicators such as the intensity of competition, macroeconomic conditions or customer needs were rated lower (medians mostly 2 to 3). This suggests that although companies operate in an environment that creates certain impulses for innovation, they do not perceive these impulses as sufficiently motivating or determining.

The situation is particularly critical in the area of public and state support for innovation, where the lowest median (1) was recorded, which may indicate either very limited access to such instruments or their low effectiveness from the perspective of companies. Similarly, the results regarding the use of publicly available innovations, which most respondents do not actively use, were also weak.

Despite these weaknesses, the research also revealed positive signals. Most companies declared that innovations are important for their growth and development (median = 4), and they also rated their entrepreneurial ambitions and willingness to take risks highly. The attitude towards innovation as such was generally positive, with companies perceiving the need to actively innovate as part of their strategy.

Favourable results were found in the area of involving human capital in innovation processes. Respondents reported that talents in companies work effectively on generating and implementing new ideas (in both cases median = 4). Cooperation with external partners such as universities, research institutions or external idea generators occurs at a medium level (median = 3), which may indicate the potential for further deepening cooperation in this area.

Overall, the results show that Slovak small and medium-sized enterprises have a certain innovation potential, but they face barriers, especially in the area of support from the external environment, development of an innovation culture and systematic integration of innovations into strategic management.

6. Conclusion

The research results point to a discrepancy between the potential and the actual implementation of innovation activities in the Slovak SME environment. Although companies declare the importance of innovation for growth, they demonstrate good internal capabilities (collaboration, team flexibility), but real innovation outputs remain low – especially in the area of processes, where more than half of companies do not innovate at all.The low level of support from the external environment is also striking – public support, the use of external innovations or the influence of macroeconomic factors are perceived by companies as minimal. This trend may indicate a weak connection between public policies and the real needs of business practice.

At the same time, it is clear that companies often do not fully utilize available talents and resources, while increasing the innovation culture and developing human capital is one of the key challenges. Nevertheless, there is a basic positive attitude towards innovation, which indicates the possibility of increasing innovation outputs if strategic management is aligned with internal capacities and external opportunities.

An important recommendation for businesses is the need to integrate innovation activities directly into strategic management, increase cooperation with external actors (e.g. universities, research centres), as well as make better use of available public support instruments.

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The Impact of Culture on the Development of Business Relationships

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Abstract: Culture, a significant determinant of an organization's success in business, plays a crucial role in adapting to a dynamically changing external environment. In the present research, we delve into the specificities of business behaviors resulting from different cultures among companies in Hungary and Slovakia, under the assumption that cultural differences in the power distance index between the two countries will lead to differences in business practices. Based on our empirical online survey results, although we found significant differences in certain business practices, the value of the power distance indicator did not prove to be a decisive factor.

Keywords: corporate culture, business relations, adaptability, business success, power distance

JEL classification: M14, M16, C83

1. Introduction

Culture is one of the critical determinants of business success and drives people to work. It also plays an essential role in knowledge acquisition, experience acquisition, and decision-making (Liu & Almor, 2016). Although there are different perspectives on the definition of organizational culture, most refer to guiding principles and values that influence all behaviors, actions, and working relationships (Arayesh et al., 2017). In the context of trust, loyalty, and participation through teamwork, organizational culture encourages employees to conform to corporate norms and traditions (Parent & Lovelace, 2018). Thus, organizational culture promotes unity and cohesion and stimulates employee enthusiasm and innovation to improve the company's economic efficiency (Li, 2015). Organizational culture is an intangible yet significant force in a community of people working together that influences the behavior of the members of that group. As a result, cultural elements significantly impact individual performance, contributing to overall performance and helping employees achieve organizational goals for productivity and efficiency (Adeoye & Hope, 2020). In addition, organizational culture is a critical success factor for implementing and succeeding quality improvement programs (Carvalho et al., 2023). It is clear that culture is a complex concept, and there is no universally accepted definition of culture in the literature (Tian et al., 2018). The relationship between corporate culture and employee performance has received increased academic attention. The results are compelling, as the two variables are closely related (Febrina et al., 2021). Although some scholars have concluded that the

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effect of culture on performance is insignificant (Sapta et al., 2021), most available studies have reported a positive and significant effect of culture on performance in organizations (Meher et al., 2022). Organizations operating in a dynamic working environment strive to improve their performance by changing their culture and reacting quickly to external influences. For this reason, corporate culture is vital in achieving greater organizational effectiveness and performance (Korda & Rachmawati, 2022). Corporate culture has also improved firm value and competitiveness (Hernández et al., 2020). Firms with strong cultures tend to perform better than weak ones (Polychroniou & Trivellas, 2018). Polychroniou and Trivellas (2018) also noted the significant impact of culture on internal performance (innovative competence and human relations), as well as on organizational growth, profitability, and reputation. Overall, the relationship between business and culture is profound and complex. Culture and business are intertwined, bringing benefits and challenges for businesses. Organizations that understand and effectively manage cultural influences are more likely to succeed in the global marketplace and achieve long-term sustainability.

2. Theoretical background

Whether digital or non-digital, negotiation is a communication and decision-making process. The outcome of the negotiation process is a compromise, in case a consensus is reached. Negotiation is communication and decision-making (Schoop et al., 2013; Schoop, 2021). A good negotiator is, therefore, someone who can communicate clearly, appropriately, and persuasively and is empathic because he or she is aware that negotiators are interdependent. In addition, a good negotiator can make the right decisions, choose the best alternatives, offer the right deals, and make concessions when necessary (Schoop et al., 2013; Schoop, 2021). In their study, Sigurdardottir and colleagues (2018) argue that a communication perspective is needed to support business-to-business (B2B) negotiations. Negotiation is a widespread social phenomenon affecting many countries, institutions, and individuals (Steele & Beasor, 2017). Business negotiation is integral to social and economic life and a fundamental means of information exchange and business-to-business relationships. In this way, business negotiations are essential for everyday bargaining, cooperation between businesses and legal entities, and economic and technological exchange between countries (Baber & Fletcher-Chen, 2020). In essence, negotiation is a complex interactive process and a highly sophisticated communication. The topic of business negotiation has attracted considerable interest within the field of organizational behavior and management science over the past fifty years (Åge & Eklinder-Frick, 2017).

There are many applications of negotiation as a primary human activity, and it is used in many and varied contexts in everyday life. Negotiation skills are among the most essential for dealing with organizational challenges in today's highly competitive and rapidly changing environment. In addition, negotiation is characterized as a frontline skill (Jacks, 2018). As a result, skilful negotiators are seen as essential assets that enhance a firm's financial performance (ElShenawy, 2010). Negotiators' ability to cope effectively with uncertainty can increase their power and strengthen their position in the negotiation process (Vojvodić et al., 2020).

International and cross-cultural negotiations have become vital for business (Caputo et al., 2019). Culture influences how individuals think, value, and behave, and over the past 25 years, numerous studies have examined the effects of interactions between individuals from different cultures on their business activities (Rozkwitalska et al., 2017). Cross-cultural business communication and cross-cultural business negotiations have become essential research areas due to the growth in the number

of large international corporations and international business relationships, as well as the globalization of the economy. This phenomenon is also evidenced by the increasing number of academic publications and research (Hofstede, 2011; Tompos, 2014). Engaging in business negotiations is not simple, even when the participants have the same cultural background. However, the situation becomes even more complicated when the business actors are culturally diverse (Tompos, 2014). To successfully bridge cultural differences in the negotiation process, it is crucial to continuously develop one's cultural intelligence, see beyond nationality, and adapt to the social norms of the negotiating partner (Gu, 2023). Negotiating across cultural divides adds a whole dimension to any negotiation, encompassing language barriers, differences in body language and dress, and alternative ways of expressing pleasure or displeasure with elements of the deal.

3. Research objective, methodology and data

The research aimed to present and compare how cultural differences, particularly in the management of intercompany relationships during negotiations, influence business behavior. The focus of our study was companies in Hungary and Slovakia. Based on the above, we formulated our research question: What characteristics can be identified in developing business relations between Slovak and Hungarian companies? Our hypothesis related to our research question is the following*:*

H0: Cultural differences, according to power distance indicators, do not result in significant differences in business practices between the two countries.

H1: Cultural differences according to power distance indicators result in significant differences in business practices between the two countries.

Slovakia has an exceptionally high power distance index of 100, practically unique worldwide. On the other hand, Hungary has a power distance index of 46. This difference between the two countries raises possible differences in business life, business ethics and etiquette, and everyday business practices.

In our empirical research, we conducted an online questionnaire survey among companies in Hungary and Slovakia. To collect the data, we needed to create a database of companies operating in Slovakia and Hungary. The size of the companies and the industry could have been more decisive. The address list compiled using the collection pages contained contact details of 938 companies. Our online questionnaire was sent out in the spring of 2023. Due to invalid, non-functional email addresses, we received 22 replies. After data cleansing, we had 257 completed questionnaires, resulting in a response rate of 28.05% over a three-month period. 103 respondents from Hungary and 154 from Slovakia participated in our survey. Our empirical research was carried out in a more extensive international study. Within the framework of an international project - Marketing in Asia Group, New Zealand - Slovakia, and Hungary were studied from the perspective of business communication, ethics, and etiquette. The questionnaire was developed and tested with the participants by Professor Kim-Shyan Fam and Dr James E Richard, the research leaders from Victoria University, Wellington.

4. Results and discussion

4.1. Differences in general business relations

On the questions concerning general business relations, respondents in Hungary and Slovakia do not tend to have the same views. The results of the t-test show that there are significant differences

between the two countries regarding certain statements on long-term business relationships (e.g., focus on long-term goals, expected duration of cooperation). However, there is no significant difference in strengthening supplier relationships.

Table 1: Differences between Slovakia and Hungary in general business relations (N=241). Source: own research

	Slovakia	Hungary	Difference	p-value of t-statistic
In the long term, we expect the relationship with suppliers to be profitable	5.13	5.60	-0.47	0.030
If possible, we will try to strengthen the relationship with suppliers	5.37	5.67	-0.30	0.153
Maintaining long-term relationships with suppliers is essential for us	5.33	6.05	-0.71	0.001
We focus on long-term goals in our relationship with suppliers	4.13	5.69	-1.56	0.000
We only care about the outcome of our relationships with suppliers	4.56	3.98	0.59	0.011
We expect suppliers to work with us for a long time	4.53	5.33	-0.81	0.000
Our concessions to help suppliers will pay off in the long run.	5.69	5.05	0.64	0.000

In statistical terms (Table 1), Hungarian respondents are statistically significantly more likely to say that they expect the relationship to be profitable in the long term, that maintaining the relationship is crucial to them, that they focus on long-term goals, and that they expect long-term cooperation. On the other hand, respondents in Slovakia are more likely to say that they are only interested in the outcome of the relationship with the supplier and that the concessions will be balanced in the long term. It remains unclear whether the identified differences can be attributed to variations in power distance. Instead, they may indicate broader cultural or institutional differences between the two countries.

4.2 Differences in business commitment and trust

A country's business practices are fundamentally influenced by its commitment and trust towards partner companies. Thus, respondents in Hungary and Slovakia were asked to answer several sets of questions that covered some aspect of this topic. The results of the first set of questions by country show that similar opinions emerged in the two countries on one or two issues, while significant differences can be found on other issues. The statistical analysis and formal test of the differences between Hungary and Slovakia can be done using a t-test (Tab.2). The t-test results indicate that the intention to stay in the business network is crucial in Slovakia and Hungary, and to a statistically almost equal extent. There is also no significant difference in the perception of whether the respondents expect to continue the business in the long term.

Table 2: Differences in business commitment and trust between Slovakia and Hungary (N=185). Source: own research

	Slovakia	Hungary	Difference	p-value of t-statistic
We want to remain part of the business network because we enjoy its relationship.	5.03	5.05	-0.02	0.904
Our positive feelings towards the business are one of the main reasons why we continue to work together.	4.41	5.02	-0.61	0.002
We expect to continue this business for the long term.	5.16	5.46	-0.31	0.151
Renewing our relationship with the company is virtually automatic.	5.63	4.98	0.65	0.002
It is unlikely that our company will still be doing business with this firm in two years.	4.61	3.52	1.10	0.000
This company keeps its promises.	4.91	5.34	-0.43	0.070

In Hungary, however, it is considered more typical at a significance level of 10% that the partner company keeps its promises. Hungarian respondents are also more likely to share positive feelings about future cooperation. In the Slovakian sample, a significantly more frequent characteristic response is that the renewal of the relationship with the partner company is automatic and that it is unlikely that business will be concluded after two years. Although these differences can be observed, it is unclear to what extent they stem from power distance as a cultural dimension. Given that the partner companies operate as equals, the results should be interpreted as descriptive contrasts rather than evidence of cultural causality.

Conclusion

One of the most important results of the research is that it has highlighted the complexity of business and corporate culture and its impact on Slovak and Hungarian business practices. Even though there is considerable international literature on the study of individual nations and cultures, relatively little attention has been paid to this field in Slovakia and Hungary, and no comparative analysis of the two countries has been carried out so far. Understanding cultural differences can help bridge the gaps between the negotiating parties and lead to more fruitful negotiations.

Based on the analyses performed, our research should be interpreted as a descriptive comparison rather than a causal examination of cultural mechanisms. Although there are differences between their business practices, these cannot be clearly attributed to the variations in the power distance indices. Based on our results, we were not able to unequivocally support hypothesis H1, as the pattern of differences does not follow the predictions derived from the power distance index. Other cultural or institutional factors are likely to play a more significant role. Therefore, the study does not provide causal evidence for the effect of power distance (PDI), but rather shows how business attitudes and practices in Hungary and Slovakia differ within their broader cultural contexts.

While our research provides valuable insights, it is not without limitations. The possibility of increasing the sample size is a potential avenue for future research, which would allow us to include more organizations and thus increase the applicability of our findings. Furthermore, extending our research to the V4 countries and even conducting a comparative analysis of Eastern and Western Europe could yield exciting and valuable insights for those interested in the profession and the subject.

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