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MIKLÓS STOCKER – ÁGNES SZUNOMÁR

# BUSINESS COLLABORATION, DIGITALIZATION, AND INNOVATION REDEFINING SUCCESS IN UNCERTAIN TIMES – A CEE PERSPECTIVE

## FOREWORD TO THE SPECIAL ISSUE

This special issue is dedicated to the 10th Anniversary Conference of the Academy of International Business – Central and Eastern Europe (AIB-CEE) themed *"Navigating New Realms: Business Collaboration, Digitalization, and Innovation Redefining Success in Uncertain Times"*. The 10th conference – held at Corvinus University of Budapest between 18–21 September 2024 – marked a significant milestone in AIB-CEE Chapter's history, with scholars, practitioners, and policymakers convening for the second time in Budapest to explore the evolving landscape of international business in the CEE region and beyond.

Hosted at the university's newly inaugurated Gellért Campus, the event featured a rich and diverse program, including keynote speeches by distinguished scholars such as Roger Strange, Jean-François Hennart, and Rob van Tulder, as well as panels and workshops addressing pressing global challenges. Topics ranged from digital transformation and global value chain disruptions to the role of emerging market multinationals and sustainable corporate governance. The conference also fostered vibrant academic exchange through doctoral workshops, networking sessions, and collaborative panels, reinforcing the AIB-CEE Chapter's commitment to advancing international business scholarship in the region. Meet the editor session hosted several highly ranked journals from global top journals, such as Journal of International Business Policy to regional top journals, such as Budapest Management Review.

We express our gratitude for the possibility to launch this special issue in the Budapest Management Review and extend our appreciation to both junior and senior contributors who submitted their refined manuscripts for our evaluation process. As a result of this joint endeavour, this special issue showcases six high-quality papers selected from the conference submissions, each contribution reflecting intellectual rigor and thematic relevance characteristic of both AIB-CEE and Budapest Management Review.

Anand et al. open the special issue by examining how entrepreneurship in CEE is shaped by persistent uncertainty stemming from institutional fragility, political volatility, and recurring external shocks. Synthesizing 42 peer-reviewed studies published between 1990 and 2025, their systematic integrative review identifies how entrepreneurs operating in transitional economies navigate instability through adaptive behaviours, trust-based networks, and pragmatic innovation strategies. Using a transparent and reproducible methodology grounded in Scopus-based literature searches, qualitative thematic synthesis, and iterative coding, the authors categorize the existing knowledge into several thematic pillars: institutional and political nexus, structural-economic shocks and resilience, technological and ecosystem transformation, social and cultural entrepreneurship, institutional reforms and policy adoption, and regional and spatial dynamics. Their findings show that entrepreneurship in CEE develops not only as a response to weak institutions and ongoing shocks, but also as a force to reshape the region's political, social, and economic paths. Events such as the COVID-19 pandemic and the war in Ukraine have exposed systemic vulnerabilities, but they have also highlighted entrepreneurial resilience, including new forms of digital engagement and refugee entrepreneurship. Anand et al. contribute to the conceptual understanding of how uncertainty becomes a condition under which innovation and adaptation are not only possible but often necessary, thereby providing a theoretical foundation for the subsequent articles in the special issue that examine crisis responses, transformation patterns, and organizational adjustments from more specific empirical perspectives.

Employing the same regional perspective, Túry et al. investigate how multinational subsidiaries in Hungary integrated – or, in some cases, retained – digital solutions introduced during the COVID-19 pandemic. Focusing on 15 foreign-owned automotive and electronics firms, building on the information gathered during semi-structured interviews, their study analyses whether pandemic-driven digitalization represents a temporary acceleration or a lasting transformation of organizational practices. Drawing on crisis-innovation theories (such as forced and adaptive innovation), the authors analyse the continuity of remote work, online communication, digital training, and supply chain digitalization three years after the pandemic. Their findings demonstrate a differentiated pattern: digital tools that clearly increased efficiency, such as online meetings or digital workflow systems, were widely retained, while practices tied to physical production environments

– especially remote work – depended heavily on the nature of tasks and the organizational culture of both parent and local subsidiaries. The study also reveals the unevenness of digital transformation across firms, with differences emerging not only based on sectoral characteristics but also firm size, digital maturity, and corporate culture. Túry et al. thus shed light on how organizations in CEE internalize digital change in the aftermath of disruption, providing a concrete empirical counterpart to the broader uncertainty framework introduced by Anand et al.

Continuing the theme of regional transformation, Burucs et al. examine how financial integration initiatives unfold in Southeastern Europe (SEE) by analysing the effects of the SEE Link virtual trading platform on participating stock exchanges. Motivated by the persistent underdevelopment of capital markets in the region, their study asks whether virtual integration can enhance liquidity, deepen capital markets, and increase cross-border investment flows. Using a difference-in-differences (DiD) approach supported by logarithmic return calculations, the authors compare three SEE Link participants (Slovenia, Croatia, Bulgaria) with a matched control group of non-participating CEE EU members. Despite policy ambitions and EBRD support, the empirical results reveal only modest improvements relative to the control group: stock market capitalization to GDP and total value traded to GDP showed no statistically significant changes in SEE Link countries, but turnover ratios exhibited a small but significant increase in relative trading activity. Burucs et al. show that virtual cooperation alone cannot overcome entrenched limitations without broader institutional harmonization, highlighting a theme consistent with Túry et al.: in the CEE/SEE region, technological frameworks can facilitate but cannot substitute for deeper organizational and institutional reforms.

Shifting from financial markets to organizational behaviour, Poór et al. analyse how firms navigate crises such as the COVID-19 pandemic, inflation, and the Russia–Ukraine war – focusing specifically on the strategies of HR managers and organizational leaders in Czechia, Hungary, and Slovakia. Their study draws on survey data, secondary sources, and institutional and contingency theory to examine how companies responded to overlapping shocks. Poór et al. explore how firms adjusted working arrangements, preserved workforce capabilities, and redefined priorities relating to communication, employee well-being, and talent retention. They find that while initial pandemic responses emphasized rapid digitalization and remote work adoption, subsequent crises shifted managerial attention toward cost containment, supply chain stabilization, and mental health support. HR functions increasingly adopted pragmatic, crisis-driven innovations, such as flexible work policies, redesigned training systems, and strategic workforce planning. Yet the findings also show uneven adaptation capacities: firms with strong pre-crisis digital and managerial infrastructures navigated disruptions more effectively. This article naturally connects to both Túry et al.'s organizational analysis and Anand et al.'s broader thematic framework by demonstrating how crisis conditions compel firms to adopt new practices, while revealing systemic vulnerabilities that persist in CEE.

Oleksiuk adds a complementary perspective by examining digital transformation not in organizations themselves but in global marketing strategies. The article investigates how artificial intelligence (AI) reshapes global marketing campaigns, focusing on the balance between automation, personalization, and human creativity. Using a structured literature review and nine international case studies, Oleksiuk develops a four-level typology of AI–human collaboration, ranging from fully human-led campaigns to fully AI-assisted strategic execution. The research asks whether AI can deliver effective global marketing communication without undermining cultural sensitivity or creative differentiation. The key finding is that while AI excels in the areas of automation, optimization, and mass personalization, it remains limited in its ability to address cultural nuance, context-specific messaging, and emotionally resonant storytelling. The study identifies a tension between the efficiency that AI promises and the risk of excessive standardization in global branding. For marketing professionals, Oleksiuk proposes guidelines emphasizing hybrid approaches that combine algorithmic capabilities with human insight. In the context of the special issue, this article broadens the discussion of digitalization by illustrating how frontier technologies intersect with creative, cultural, and strategic decision-making in a global environment marked by uncertainty and rapid technological change.

The issue concludes with Hentz's article, which shifts the empirical lens to sports economics and consumption behaviour in one of the major CEE capitals, Budapest. Using survey data from 1000 respondents, Hentz focuses on the differences between formal and informal recreational athletes in their leisure sports habits, and analyses how do these patterns relate to the balance between demand for organized sports participation and the availability of sports clubs and enterprises across Budapest's districts and whether gender, educational attainment, and place of residence significantly influence the level of expenditure on sports. The findings show that coached athletes spend significantly more compared to self-guided individuals, confirming that structured engagement increases expenditure. Hentz also identifies a moderate positive relationship between the popularity of specific sports and the number of available facilities. Interestingly, the research finds no statistically significant link between the supply of sports clubs and actual rates of organized participation, suggesting that demand for sports consumption is shaped more by individual preferences, financial capacity, and lifestyle factors rather than by institutional availability. However, according to the results, gender, educational attainment, and place of residence seem to significantly affect the level of spending on sports. As the closing article, Hentz introduces a micro-level

perspective on behavioural patterns and economic decision-making, complementing the earlier contributions' focus on regional integration, organizational transformation, and digital innovation.

We truly hope this issue serves not only as a record of the conference's academic achievements but also as a catalyst for future research and dialogue in international business.

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Ágnes Szunomár, Ph.D. Habil.
Habil. Associate Professor
Corvinus University of Budapest
Institute of Global Studies;
Senior Research Fellow
Institute of World Economics
Centre for Economic and Regional Studies

Miklós Stocker, Ph.D. Habil.
Habil. Associate Professor
Corvinus University of Budapest
Institute of Strategy and Management

AMITABH ANAND – ŠEJMA AYDIN – IVAN RADEVIĆ – EMIL KNEZOVIĆ

# ENTREPRENEURIAL UNCERTAINTY IN CENTRAL AND EASTERN EUROPE – A SYNTHESIS AND AGENDA

# VÁLLALKOZÓI BIZONYTALANSÁG KÖZÉP- ÉS KELET-EURÓPÁBAN – SZINTÉZIS ÉS KUTATÁSI IRÁNYOK

Entrepreneurship in Central and Eastern Europe (CEE) has long been shaped by institutional instability, political volatility, and repeated shocks. This paper synthesizes findings from 42 studies to examine how entrepreneurs in this region navigate uncertainty. The systematic coding process revealed recurring themes, including institutional fragility, political involvement, responses to external shocks, digital innovation, migrant and cultural entrepreneurship, long-term reforms, and regional development. Evidence shows that entrepreneurs in CEE rely less on formal institutions and more on trust-based networks, pragmatic approaches to innovation, and practices rooted in identity. Events such as pandemics and the Ukraine war have exposed existing vulnerabilities, but also highlighted the adaptive strategies, including increased digital engagement and refugee entrepreneurship. Overall, entrepreneurship serves as both a coping mechanism amid crises and a catalyst for transformation in transitional economies. Based on these insights, the paper proposes strategies for institutional reforms, digital skills enhancement, and inclusive support systems.

Keywords: **uncertainty, entrepreneurial activity, entrepreneurial identity, Central and Eastern Europe**

A közép-kelet-európai vállalkozói szférát régóta jellemzi az intézményi instabilitás, a politikai bizonytalanság és az ismétlődő sokk. Ez a cikk 42 tanulmány eredményeit összegzi, megvizsgálva, hogy hogyan kezelik a vállalkozók a bizonytalanságot ebben a régióban. A szisztematikus kódolási folyamat során olyan ismétlődő témákat lehetett azonosítani, mint az intézményi törékenység, a politikai részvétel, a külső sokkokra adott válaszok, a digitális innováció, a migráns és a kulturális vállalkozók, a hosszú távú reformok és a regionális fejlesztés. A bizonyítékok azt mutatják, hogy a CEE-régió vállalkozói kevésbé támaszkodnak a formális intézményekre, és inkább a bizalomra épülő hálózatokra, a pragmatikus innovációs megközelítésekre és az identitásban gyökerező gyakorlatokra építenek. Az olyan események, mint a világjárványok és az ukrajnai háború, feltárták a meglévő sebezhetőségeket, de kiemelték az alkalmazkodási stratégiákat is, többek között a fokozott digitális elkötelezettséget és a menekült vállalkozói tevékenységet. Ezek alapján intézményi reformokra, a digitális készségek fejlesztésére és inkluzív támogatási rendszerekre vonatkozó stratégiák javasolhatók.

Kulcsszavak: **bizonytalanság, vállalkozói tevékenység, vállalkozói identitás, Kelet-Közép-Európa**

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**Authors/Szerzők:**
Amitabh Anand[a,d] (ananda@excelia-group.com) full professor; Šejma Aydin[b] (saydin@ius.edu.ba) associate professor; Ivan Radević[c] (radevic@ucg.ac.me) assistant professor; Emil Knezović[b] (eknezovic@ius.edu.ba) associate professor

[a]Excelia Business School La Rochelle (Excelia Üzleti Főiskola La Rochelle) France (Franciaország); [b]International University of Sarajevo (Szarajevói Nemzetközi Egyetem) Federation of Bosnia and Herzegovina (Bosznia-Hercegovina); [c]University of Montenegro (Montenegrói Egyetem) Montenegro (Montenegró); [d]Corvinus University of Budapest (Budapesti Corvinus Egyetem) Hungary (Magyarország)

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In contrast to Western Europe, where firms, institutions, and entrepreneurship have maintained a high degree of stability, Central and Eastern Europe (CEE) has a different story (Pugh et al., 2024; Vaduva et al., 2024; Rozkwitalska-Welenc et al., 2025; Meyer & Peng, 2005). The CEE region has been navigating a complex landscape marked by democratic backsliding, political unrest, and an uneven economic recovery (Hanley, 2024; Dimitrova, 2018). Over recent decades, shifting global and business trends have further contributed to an atmosphere of uncertainty (Kropiński, 2024).

Today, success in CEE depends increasingly on a region's resilience, adaptability, and innovative approaches across government, business, and societal spheres (Pascariu et al., 2021; Tokar et al., 2025). As the region faces these multifaceted challenges, it becomes crucial for businesses and policymakers alike to understand how the interplay of political, economic, and social factors influences the evolving landscape of CEE (Brada, 2021). While it is challenging to define CEE precisely, several authors refer to it within the context of politics, economy, and business. For instance, CEE is primarily a historical and geopolitical region distinguished by its delayed development, a distinct social structure, and a complex political history, compared to Western Europe (Berend, 2005).

CEE is often referred to as an interconnected region shaped deeply by geography and shared historical trajectories, described as a "complex and fraught community of fate" (Okey, 1992). The core of this region typically refers to the post-communist EU member states, including Poland, the Czech Republic, Slovakia, and Hungary (the Visegrád countries), as well as Romania and Bulgaria, alongside Slovenia and Croatia as former Yugoslav republics and the Baltic states of Estonia, Latvia, and Lithuania (Piotrowski et al., 2020; Turuk, 2021; Głodowska & Wach, 2022). Broader definitions extend beyond EU borders to include other transition economies characterized by similar institutional and economic environments, such as those in the Western Balkans (Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia), as well as Ukraine, Moldova, and Belarus, which continue to grapple with post-socialist legacies (Wright, 2006; Petrunenko et al., 2020). However, in this study, we adopt the concept of CEE in the context of international trade and international entrepreneurship, referring to those countries that are typically grouped as the European nations that transitioned from centrally planned economies under Soviet influence to market economies after the late 1980s (Turuk, 2021; Petrunenko et al., 2020; Głodowska & Wach, 2022; Wright, 2006).

Moreover, we argue that exploring and understanding the international and regional dimensions of entrepreneurship in CEE is crucial for understanding how firms and individuals navigate environments characterized by weak or contested formal institutions, where success relies on improvisation, trust, and adaptive networks. Moreover, entrepreneurship in CEE provides a unique insight into how businesses adapt, flourish, and redefine what success means in environments characterized by several challenges (Cieślik & van Stel, 2011).

The relevance of this review article is further highlighted by the region's recurring exposure to major shocks, including the 2008 global financial crisis, the COVID-19 pandemic, and the war in Ukraine, all of which have revealed both structural vulnerabilities and unexpected resilience among entrepreneurs (Brada et al., 2021). In these situations, entrepreneurship teaches us how societies recover, how companies devise new ideas under pressure, and how local communities respond when traditional growth methods no longer work (Yeshi et al., 2024; Fares et al., 2022). Additionally, the uncertainty involved makes entrepreneurship more than just a means to earn a living; it becomes a tool for resilience, change, and social progress. For policymakers, this is particularly important because entrepreneurship can help support democracy and promote fair growth, or it can be exploited by political leaders to exacerbate inequality (Farè et al., 2023).

This article aims to offer a novel perspective by shifting away from the conventional Western notions of what constitutes an entrepreneur's success. Additionally, this research differs from existing reviews on entrepreneurship in CEE with the following dimensions. First, our "focus" is in entrepreneurial uncertainty and based on our knowledge and assessment of the literature, there has been no comprehensive review done of entrepreneurial uncertainty specific to CEE (See Głodowska, & Wach, 2022). On the other hand, most reviews focused on internationalization (i.e., how CEE firms expand abroad) (see Caputo et al., 2016; Ipsmiller & Dikova, 2021). Throughout this review, we use the term "entrepreneur" in a broad sense to include both opportunity- and necessity-driven actors. This includes small and medium-sized enterprises (SMEs), family businesses, migrant and refugee ventures, farms, and locally owned service and manufacturing firms. Our focus is on the real-world aspects of keeping businesses running, maintaining steady cash flow, and creating jobs, rather than solely on high-growth startups. By examining how these entrepreneurs manage risks, build networks, and navigate weak institutions while remaining creative, the study reveals what resilience entails in these contexts. This is important for researchers because CEE is a key example of how entrepreneurship works in the face of systemic uncertainty–conditions that are becoming increasingly common around the world due to globalization, crises, and geopolitical tensions that cause instability even in previously stable markets.

## Methodology

In line with the principles of rigor, transparency, and reproducibility (Vajda et al., 2024; Anand et al., 2025b), we adopted a structured and auditable methodology to search for and review literature on entrepreneurial uncertainties in CEE. A systematic integrative review approach was followed (Snyder, 2019; Tranfield et al., 2003; Anand et al., 2025a, 2025b). Systematic integrative reviews are designed to comprehensively document, evaluate, and

synthesize existing research while identifying conceptual and empirical gaps in the literature (Snyder, 2019). This method is especially suitable for consolidating current knowledge and developing new theoretical insights across diverse research traditions. First, we conducted a database search for scholarly publications. Consistent with prior systematic reviews (Anand et al., 2025b), Scopus was chosen as the primary database because it provides extensive coverage of peer-reviewed research and is increasingly preferred for systematic and bibliometric reviews due to its breadth and citation reliability (Anand et al., 2025a).

Second, to construct our search query, we used a combination of targeted keywords and Boolean operators, derived through an iterative process of peer consultation and preliminary testing (Chabowski et al., 2013; Anand et al., 2020). The final query used was as follows:( TITLE-ABS-KEY ( "International Entrepreneur*" OR "Global Entrepreneur*" OR "Geopolitical entrepreneur" OR "International Ventur*" OR "Entrepreneur*" ) ) AND ( TITLE-ABS-KEY ( "Uncertaint*" OR "Volatility" OR "Crises" OR "Geopolitical Conflict" OR "War" OR "Tariff" ) ) AND ( TITLE-ABS-KEY ( "Central Europe" OR "Eastern Europe" OR "East Europe" ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ).

The search was restricted to peer-reviewed journal articles in English, as suggested by Anand et al. (2025a) and Sinitsyna et al. (2024), to ensure methodological rigor. The data search query included articles between 1990 and 2025, and it was collected in October 2025. Conference proceedings, dissertations, and non-academic sources were excluded due to concerns regarding quality and replicability. Third, recognizing that keyword-based searches can yield documents unrelated to the focal topic (Sinitsyna et al., 2024), the author(s) independently screened the abstracts to ensure relevance to the inclusion. The inclusion criteria required that studies (1) explicitly focus on international or geopolitical entrepreneurship in CEE contexts; (2) examine uncertainty, volatility, crises, or related constructs; and (3) be empirical, review, or conceptual in nature.

When abstracts were ambiguous, the full texts were reviewed to confirm eligibility. After several deliberations and agreements among the authors, we selected 42 publications out of 55 for final analysis. Fourth, we applied qualitative thematic synthesis to analyze the selected publications (Anand et al., 2025a). Thematic synthesis is an iterative process that involves coding, categorizing, and synthesizing information to identify emergent patterns and insights. All papers included were read and inductively coded, focusing on how entrepreneurial uncertainties are conceptualized, the mechanisms by which they affect international ventures, and the contextual factors specific to the CEE region. Finally, the coded data were further synthesized into a narrative framework that integrates themes and relationships between concepts. This synthesis process followed the principles of establishing qualitative review standards (Anand et al., 2025b), ensuring that the findings are both analytically robust and conceptually coherent.

## Findings

To better understand how entrepreneurs in CEE adapt to environments that often face instability and shocks, we reviewed 42 peer-reviewed studies published between 1990 and 2025. We carefully examined each article, first identifying key ideas, then grouping these into broader themes, and finally organizing everything into main categories to gain a broader perspective. This coding approach enabled us to move beyond fragmented evidence and to construct a coherent picture of entrepreneurial navigation under uncertainty. The resulting thematics capture institutional fragility and political entanglements, responses to exogenous shocks, strategies of digitalization and innovation, the social and identity-driven dimensions of entrepreneurship, and long-term structural and regional dynamics. In the following sections, we present the findings organized around these themes, illustrating how entrepreneurship in CEE both reflects and reshapes the systemic uncertainties of transitional contexts (see Figure 1).

### Political-Institutional Nexus

The landscape of entrepreneurship in CEE is influenced by fragile institutions and ongoing uncertainties. Moreover, informality & instability, political entrepreneurship and institutional trust in formal institutions is relatively rare, primarily due to a history marked by corruption and unclear reforms in countries such as Georgia, Ukraine, and Kazakhstan (Khlystova et al., 2022). As a result, investors often rely more heavily on informal signals when making their investment decisions. For example, business angels typically focus on an entrepreneur's personality and trustworthiness, rather than just financial numbers, considering personal credibility crucial in closing deals (Skalická et al., 2023). This situation shows not only the weak institutional structures but also the delicate nature of the investment environment.

Political connections frequently serve to bolster entrepreneurs, yet they can also distort markets by granting privileged access to capital while restricting debt finance for independent firms, especially in contexts marked by high corruption (Belitski & Grigore, 2022). Such distortions tend to favor political loyalty over genuine innovation, skewing the competitive landscape to benefit insiders. Additionally, entrepreneurship itself can be instrumentalized by political actors. These practices reveal that entrepreneurship is not merely an economic activity but also a potent ideological tool in contested political arenas.

Even well-established companies face operational uncertainties due to institutional weaknesses. Strong institutional and corporate governance are crucial for survival during crises. On a macro scale, transparent public governance reduces uncertainty and combats corruption, while at the company level, following governance principles boosts legitimacy and accountability (Sergi et al., 2025). Improving corporate disclosures and reducing

risks like theft and vandalism strengthen firms' resilience to regional crises (Sergi et al., 2025). These governance reforms go beyond managerial tactics; they are vital for effective crisis prevention.

The political climate significantly shapes the entrepreneurial values and democratic tendencies in the region. In the Visegrad Four, self-employed individuals tend to be highly responsive to changing political and economic conditions. Research indicates that a vibrant entrepreneurial culture, along with evolving incentives, can lead self-employed people to favor liberal democratic principles more strongly than other groups. This dynamic suggests that entrepreneurs may act as a stabilizing force against democratic decline, emphasizing the complex and reciprocal relationship between entrepreneurship and political development in Central and Eastern Europe (Eisenkraft, 2025). Thus, the institutional settings in CEE play a significant role in shaping entrepreneurial activity, offering both challenges and opportunities. Entrepreneurs find themselves in a landscape where corruption, weak enforcement, and political involvement significantly influence access to resources and their perception. In these settings, achieving success often depends more on the skill to navigate informal networks, stay aligned with political trends, and adapt to the unpredictable nature of governance, rather than solely relying on formal institutional stability systems.

### Structural-Economic Shocks and Resilience

When unexpected events, such as financial crises, pandemics, or wars, occur, they reveal both the weaknesses and strengths of businesses in Central and Eastern Europe. For example, the COVID-19 pandemic caused big problems for small and medium-sized farms across the region, disrupting their production and supply chains. It also demonstrated the fragility of food markets (Imran et al., 2023). Similarly, small logistics and transportation firms encountered significant challenges; however, many responded promptly by devising innovative solutions (Klein et al., 2022). Support systems within local communities often faced difficulties under strain. For example, Zielony, a local currency in Poland intended to promote community trade, proved ineffective during lockdowns, indicating that such systems require a stable economy to operate efficiently (Stępnicka et al., 2021). On a positive note, crises may occasionally stimulate the emergence of new businesses. In Romania, the persistence of companies during periods of economic adversity was correlated with the presence of numerous active enterprises in proximity, a growing population, and increased foreign investment. These factors collectively elucidate how local business ecosystems can enhance resilience (Goschin, 2020).

Broader evidence suggests that external shocks can stimulate the recognition and development of entrepreneurial opportunities. In the Czech Republic, Hungary, Poland, and Slovakia, entrepreneurial activity increased after the COVID-19 pandemic, particularly in the information and communication sectors, demonstrating that crises can accelerate structural shifts and digital adoption (Dvouletý, 2024). Wartime settings arguably present the starkest exemplification of resilience. Ukrainian women refugees who found safety in Poland during the 2022 war often turned to entrepreneurship, not primarily for financial gain, but to survive, become part of the community, and achieve self-sufficiency. Local women played a caring role through acts of 'sisterhood solidarity,' supporting these women beyond just immediate needs and helping them settle in for the long term (Gaweł et al., 2025). These stories remind us that even in difficult times, starting businesses can serve both economic needs and bring heartfelt support and solidarity.

Education transformation across different contexts frequently encounters similar obstacles. For instance, while post-communist countries have implemented entrepreneurial and vocational training programs inspired by Western models, these efforts often fall short of adequately addressing local realities, as noted by Mitra and Matlay (2004). Similarly, attempts to transform universities into entrepreneurial entities have faced significant challenges, primarily due to weak linkages between industry and government, as noted by Peshkopia (2014). Despite these difficulties, some initiatives demonstrate promise. Notably, EU-supported competence-building projects in Poland have shown positive outcomes, particularly in fostering resilience among students. Such skills are crucial for adapting to adversity, highlighting the importance of targeted programs that go beyond traditional academic curricula, as evidenced by Multan and Sobotka (2022).

Entrepreneurs across CEE have shown remarkable resilience and flexibility, even during challenging times. For example, Fogarasi (2011) highlights how fluctuations in Hungary's exchange rates actually benefited agricultural exports, demonstrating that agri-food entrepreneurs capitalized on market changes to expand their businesses, rather than solely focusing on stability through eurozone integration. Likewise, in Romania, tools like forfaiting have been vital for business owners to manage macroeconomic and political risks, effectively separating transaction risks from larger systemic issues (McKibbin & Pistrui, 1997). These stories suggest that while crises can seem unsettling, entrepreneurs in CEE often see them as chances to adapt and innovate. In the end, succeeding in these times depends less on avoiding ups and downs and more on using uncertainty as a springboard for growth and new opportunities for survival.

### Technological and Ecosystem Transformation

The strategies of innovation and digitalization have become crucial for managing uncertainty across the CEE region. The COVID-19 pandemic accelerated the adoption of digital technologies across many enterprises. These businesses began leveraging tools such as remote work systems, online shopping platforms, and various digital applications to maintain operations and avoid layoffs (Khan, 2025). This push towards digitalization has not only increased operational flexibility but has also enabled companies to develop new products and improve existing processes. In times of economic and social upheaval, such

as during the pandemic, digitalization has helped stabilize sales, demonstrating its importance as a resilience factor. Interestingly, sectors in information and communication technology experienced rapid growth amid these challenges, highlighting how crises can sometimes serve as catalysts for broader technological adoption by both individuals and organizations (Dvouletý, 2024).

The adoption of innovation has extended beyond digital technologies, encompassing broader technological upgrades across various industries. For instance, firms in the transport and logistics sector in countries such as Sweden, Germany, and Poland have notably increased their reliance on such upgrades as a strategy to counter the impacts of the pandemic. This pattern highlights the vital role that innovation plays in maintaining the competitiveness of these sectors (Klein et al., 2022). Conversely, eco-innovation efforts aimed at environmental management encounter significant obstacles. Entrepreneurs often face uncertain demand and financial risks, which discourage many from investing in sustainable practices–even when policy measures are in place to support such initiatives (Ociepa-Kubicka & Pachura, 2017). This contrast highlights the complex landscape of innovation during challenging times, where opportunities and barriers coexist, shaping how industries adapt and evolve.

Regional innovation systems (RIS) play a crucial role in enhancing resilience, particularly by facilitating key collaborations and resource sharing. In Poland, RIS demonstrated a mix of strengths and vulnerabilities during times of crisis. For instance, resilience was notably supported by R&D collaborations, investments in new equipment, and supply chain partnerships. Yet, challenges persisted due to some degree of isolation from scientific institutions and limited external funding, which could hinder adaptive capacity (Świadek & Gorączkowska, 2024). These observations underscore the significance of the "Triple Helix" model–encompassing industry, government, and academia–in shaping a region's capacity to respond to shocks. Furthermore, the proximity of universities and active knowledge sharing have been pivotal in the emergence of startups, especially in the uncertain and rapidly evolving sectors, such as the chemical and biotech industries, within the Visegrad countries (Krankovits et al., 2024). This interplay of collaboration, institutional presence, and knowledge exchange emphasises the multifaceted nature of regional resilience and innovation.

Diaspora networks also serve as essential channels for innovation and rebuilding. In Ukraine's case, diaspora communities have provided not only financial remittances but also knowledge sharing and the promotion of democratic values, supporting the country's recovery and boosting its innovative capacity (Adema et al., 2023). This shows how entrepreneurial ecosystems extend beyond geographic borders and are influenced by transnational connections.

At the micro-level, resilience also depends on managerial capabilities. Corporate governance reforms in Eastern Europe highlight the importance of transparent management practices and business disclosure for both economic growth and the fostering of social entrepreneurship (Sergi et al., 2025). Meanwhile, entrepreneurial education in the region is increasingly emphasizing the development of "entrepreneurial graduates" who can support innovation ecosystems and bridge the gaps between academia and industry (Peshkopia, 2014). These findings underscore the importance of embracing technology, fostering ecosystem cooperation, and reforming governance as essential strategies for managing uncertainty. Innovation is not just about creating new products; it's about reshaping relationships and institutional capabilities to better withstand shocks and turn challenges into opportunities.

## Social and Cultural Entrepreneurship

Entrepreneurship in CEE is also deeply social, serving as a way of shaping identity, building connections, and ensuring survival. Refugee and migrant entrepreneurship highlight these ideas most clearly. Ukrainian women displaced by war in 2022 used entrepreneurship in Poland as a path to independence, integration, and dignity, often motivated by solidarity with local women rather than market opportunity alone (Gaweł et al., 2025). Likewise, Chinese migration into Eastern Europe has historically led to entrepreneurial communities that sustained themselves through kinship and information networks, adjusting to the region's unstable migration policies (Nyíri, 2003). Immigrant entrepreneurship has long played a major role in regional economies. In Greece, immigrant-owned businesses experienced rapid growth following the fall of communism, serving as avenues for social mobility and economic progress (Skandalis & Ghazzawi, 2014). These examples demonstrate that entrepreneurship is a vital means for marginalized groups to achieve independence and stability in uncertain conditions.

Cultural entrepreneurship adds an inspiring layer, blending identity and heritage to reach both economic and social goals. In post-conflict Serbia, creative cultural actors embraced "self-stakeholderisation," using intangible cultural heritage to foster community resilience and promote reconciliation (Ćuković & Milenković, 2023). Similarly, Berlin's "culturepreneurs" showcase innovative hybrid paths that combine cultural production with vital survival strategies during tough socio-economic times (Lange, 2005). These stories highlight how cultural entrepreneurship in CEE is truly flexible and a powerful way to celebrate and strengthen identity, redefining what success means beyond just financial gain terms.

Beyond culture, entrepreneurship serves as a mechanism for community resistance and continuity. Studies in Poland demonstrate that small-scale farmers prioritize autonomy and a secure existence over growth, highlighting the deep entanglement of entrepreneurship with values of identity and sustainability (Szumełda, 2019). Likewise, entrepreneurial activities in Estonia's art and museum sector illustrate how neoliberal imaginaries of resilience and survivalism permeate cultural fields (Saar, 2019). Thus, migrant and cultural entrepreneurship in CEE demonstrates that entrepreneurial action is not only about opportunity exploitation but also about survival, solidarity, and

identity preservation. Success is often redefined in terms of social embedding, autonomy, and cultural continuity rather than profit.

### Institutional Reforms and Policy Adoption

The legacies of socialism and systemic transition continue to shape entrepreneurship in CEE. Early reforms in Hungary, Poland, and the Soviet Union attempted to blend bureaucratic control with market mechanisms, yet performance anomalies persisted, revealing the difficulty of institutional transformation (Palánkai, 1990). Subsequent systemic entrepreneurs capitalized on these reforms, redistributing transformational gains while externalizing costs and embedding inefficiencies in the system (Dallago, 2000). Policy frameworks often lag the realities of entrepreneurship. Taxation in Bulgaria and Croatia was found to have a direct influence on growth trajectories, linking fiscal policy to entrepreneurial vitality (Glykou & Siokorelis, 2013). Similarly, high taxation in Romania constrained SME development, limiting their capacity to act as engines of growth and innovation (Balu, 2015). These findings emphasize how state policy continues to shape entrepreneurial opportunities.

Tourism and cultural policies also illustrate the connection between entrepreneurship and political legacies. For example, Eastbound tourism during the Cold War was a pragmatic balancing act between ideology and profit, demonstrating how entrepreneurial efforts adapted to political limits (Pedersen, 2018). Likewise, in Berlin, socio-spatial strategies illustrated how entrepreneurs navigated urban transformations driven by crises through creative, hybrid practices (Lange, 2005). Overall, long-term reforms in policy and education present both opportunities and challenges. While systemic changes have created new avenues for entrepreneurship, ongoing legacies and policy inconsistencies still pose obstacles, urging entrepreneurs to remain adaptable actors.

These insights help us understand how entrepreneurs creatively respond to inconsistencies in institutions and policies by finding practical solutions. When faced with high taxes or slow reforms, many turn to informal partnerships, cross-border collaborations, and reinvestment efforts to sustain their businesses and support local jobs, despite systemic hurdles (Balu, 2015; Glykou & Siokorelis, 2013). Others adapt by diversifying their activities across different sectors or tapping into informal networks to access credit and resources, showing that entrepreneurial spirit thrives even within challenging policy environments (Dallago, 2000; Forst, 1996). In this way, long-term reforms and government policies are not just rules that shape entrepreneurial outcomes, they create a dynamic landscape where entrepreneurs continually negotiate and redefine their strategies.

To deal with institutional reforms that take too long, new data reveals that entrepreneurs are seeking out hybrid business models and other ways to find stability. In recent years, digital solutions have been used to help small businesses deal with the complexity of rules by making compliance processes easier, improving tax reports, and opening new sources of funding (Khan, 2025; Sergi et al., 2025). Innovation and education programs that get money from the European Union are also being used by young business owners. The goal of these programs is to encourage a resilient and flexible attitude (Multan & Sobotka, 2022). These patterns show that enterprising people in CEE are actively turning limitations on reform into chances to build capacity and make small changes, even when old structures stay in place.

### Regional and Spatial Dynamics

Finally, regional disparities and structural models of development continue to define entrepreneurial landscapes in CEE. Foreign Direct Investment (FDI) was once heralded as a driver of growth; however, evidence from Hungary suggests that its benefits remain geographically concentrated, exacerbating regional inequalities and limiting long-term GDP growth (Gál & Gyimesi, 2025). Similarly, while FDI inflows supported firm survival in Romania during crises, their uneven distribution deepened regional disparities (Goschin, 2020).

The case of smart specialization strategies in Southeast Europe offers a nuanced perspective on regional innovation policy, highlighting both their potential and limitations. Although these strategies aim to foster diversification and enhance competitiveness, their effectiveness is often hindered by factors such as weak public governance, inadequate private investment, and limited cooperation among stakeholders (Komninos et al., 2014). Similarly, regional cooperation initiatives in border areas, like the Polish-Czech-German Euroregion "Neisse," demonstrate how localized productive systems can support cross-border entrepreneurship. However, the sustainability and success of such efforts heavily depend on robust institutional frameworks, which are essential to maintaining long-term collaboration (Despiney, 2005). This analysis suggests that while regional policies hold promise, their success largely hinges on strengthening governance structures and fostering deeper cooperation at various levels.

Historical and cultural legacies also shape regional entrepreneurial models. Studies of Hungarian entrepreneurs at the turn of the millennium reveal how family histories and social capital played decisive roles in enabling rapid adaptation during socio-economic transition (Laki & Szalai, 2006). Similarly, early academic spin-offs in Bulgaria and Romania emerged less from innovation ecosystems and more from rent-seeking strategies, reflecting the contradictions of transitional contexts (Tchalakov et al., 2010).

Over time, these structural dynamics converge into broader models of dependent development. Analyses of Romania's dependent market economy demonstrate how reliance on transnational banks and industrial policy creates both vulnerabilities and opportunities for entrepreneurial adaptation (Ban, 2019). In some cases, however, dependency created space for new forms of entrepreneurial internationalization, where firms relied on incomplete knowledge, beliefs, and networks to recognize and exploit

global opportunities in uncertain environments (Židonis, 2007). These findings confirm that entrepreneurship in CEE cannot be understood outside the broader structures of regional development and dependency. Entrepreneurs navigate not only firm-level and sectoral challenges but also the structural constraints of FDI-led growth, uneven institutional capacity, and historically contingent models of development.

Despite the challenges discussed, entrepreneurs in these regions are determined to remain proactive in moving with their venture pursuits. Many have creatively responded to uneven regional policies and the concentration of foreign direct investment by adopting flexible business models, forming local networks, and collaborating across borders to stay competitive (Despiney, 2005; Komninos et al., 2014; Gál & Gyimesi, 2025). In places where institutional support may be lacking, business owners often rely on informal networks or family-based arrangements to maintain stable operations and share risks (Laki & Szalaï, 2006; Weiss & Welsh, 2013). These adaptive approaches show that, even within dependent development models, entrepreneurial spirit is a vital force for resilience and boosting local economies.

## Strategies to Overcome

To foster resilient entrepreneurship in CEE, reforms need to be holistic rather than fragmented. Evidence suggests that vulnerabilities stem from interconnected institutional, technological, and social weaknesses; therefore, effective strategies must address these areas collectively. Below, we highlight the main priorities for policy and practice

### Institutional Revision and Risk Management

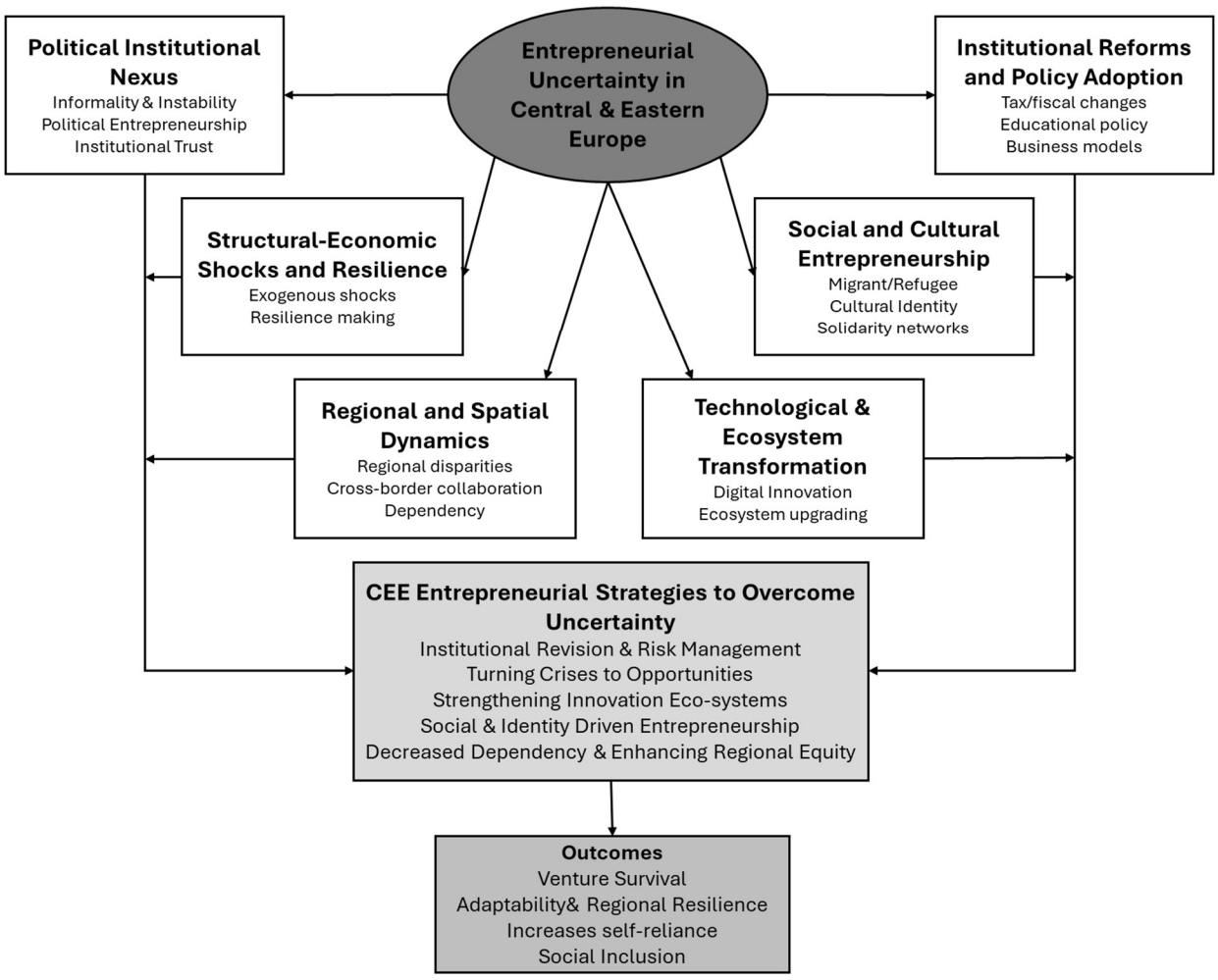
The credibility gap in CEE can only be narrowed through stronger governance and predictable frameworks. This involves transparent corporate practices, more consistent enforcement of contracts, and fiscal regimes that avoid penalizing small firms (Sergi et al., 2025; Balu, 2015; Glykou & Siokorelis, 2013). We should expand innovative financial tools, like forfaiting, which has already proven effective in turbulent markets, to help SMEs safeguard themselves against macroeconomic shocks (McKibbin & Pistrui, 1997).

### Turning Crises into Opportunities

Events such as the COVID-19 pandemic have shown that disruptions can accelerate the identification of new

Figure 1

**Interconnected domains of Entrepreneurial Uncertainties in CEE**



opportunities. Policymakers need to fund initiatives that enable entrepreneurs to view crises as chances for renewal. This involves expanding digital adoption beyond early adopters, aiding micro firms in accessing e-commerce, and making sure technological advancements benefit disadvantaged sectors and communities (Dvouletý, 2024; Khan, 2025; Klein et al., 2022).

### Strengthening Innovation Eco-Systems

Regional innovation capacity should be regarded as a public good. Governments ought to promote collaboration among businesses, universities, and support agencies by establishing platforms for R&D partnerships and supply chain integration. It is also vital to ensure that funding is accessible to smaller entities, avoiding "innovation isolation" that can undermine regional resilience (Świadek & Gorączkowska, 2024; Krankovits et al., 2024). Additionally, utilizing diaspora networks can enhance resilience by reintroducing knowledge and values into local ecosystems (Adema et al., 2023).

Promoting Social and Identity-Driven Entrepreneurship

Policy should broaden its understanding of entrepreneurship beyond profit. Refugees, migrants, and cultural entrepreneurs rely on networks of solidarity and heritage as much as they do on financial support. Programs that provide psychological, relational, and identity-sensitive resources can enhance both integration and resilience (Gaweł et al., 2025; Nyíri, 2003; Ćuković & Milenković, 2023). Rural entrepreneurs similarly need policy environments that respect their pursuit of autonomy and secure livelihoods (Szumełda, 2019). Supporting these diverse forms of entrepreneurship contributes to social stability and democratic legitimacy (Eisenkraft, 2025).

### Decreased Dependency and Enhancing Regional Equity

Finally, it is essential to enhance internal growth factors to decrease systemic reliance. Excessive dependence on FDI has deepened regional disparities, highlighting the need to develop local capabilities and support fairer regional ecosystems (Gál & Gyimesi, 2025; Ban, 2019). Strategies such as smart specialization and cross-border collaboration can promote more inclusive growth, provided that robust governance and accountability are established (Komninos et al., 2014; Despiney, 2005).

## Discussion

This review highlights that entrepreneurship in CEE is inextricably linked to the systemic fragility it faces. It develops not only as a response to weak institutions and ongoing shocks, but also as a force to reshape the region's political, social, and economic paths. Events like COVID-19 and the war in Ukraine served as catalysts, prompting digital adoption, market adaptation, and refugee entrepreneurship that might not have occurred under stable conditions. This demonstrates how disruption can reorganize opportunity structures rather than merely destroying them (Dvouletý, 2024; Gaweł et al., 2025). Success may no longer be solely measured by profit. Refugees, small farmers, and cultural entrepreneurs are also valuing independence, their sense of identity, and community strength. Because of this, studies on international entrepreneurship should consider these factors as just as important as making money. Additionally, resilience differs depending on the environment. Places connected to universities, supported by diaspora communities, or with good governance tend to adapt better. On the other hand, those relying on outside funding or with weak institutions struggle more. This indicates that entrepreneurship in CEE is closely tied to broader social and political factors.

This study builds on previous reviews of entrepreneurship in CEE (e.g., Caputo et al., 2016; Ipsmiller & Dikova, 2021; Turuk, 2021) by highlighting how uncertainty is a complex, multi-layered factor that actively influences entrepreneurial behavior. Unlike earlier works that made attempts to highlight the regions importance through conceptual and empirical works and that mainly focused on institutional transitions or market entry (Petrunenko et al., 2020; Glodowska & Wach, 2022; Mets et al., 2018; Palalic et al., 2020; Efendic et al., 2022), this review sees uncertainty as a dynamic and ongoing interaction among institutional fragility, geopolitical shifts, structural dependencies, and pressures related to identity. By examining 42 studies, this research illustrates how entrepreneurs manage these intertwined challenges, whether through informal networks and political connections, turning crises into opportunities, driving digital and ecosystem innovation, leveraging migration and identity as strategic assets, or adapting to structural constraints shaped by reforms and uneven development. Therefore, this review presents entrepreneurship not just as a response to instability, but as a dynamic process that actively reshapes the political, social, and economic landscape region.

### Impact on CEE Countries

Uncertainty continues to play a significant role in shaping the economies and politics across the CEE region. Instead of encouraging new ideas and growth, entrepreneurship sometimes reveals deeper systemic issues, making a country's development feel more fragile. Often, markets prefer well-known insiders, which limits healthy competition and slows down independent innovation (Belitski & Grigore, 2022). This situation not only stifles economic energy but also widens the gap between different firms and regions, as established entrepreneurs enjoy profits while passing on the costs to others (Dallago, 2000).

On a national level, relying heavily on foreign capital and external demand can make economies more susceptible to global shocks. Although foreign direct investment can offer quick benefits, it sometimes highlights regional differences and can slow down the growth of strong local systems that support development from within (Gál & Gyimesi, 2025; Ban, 2019). Areas with weaker institutions or less cooperation among businesses, universities, and policymakers often struggle to recover from crises, risking long-term stagnation (Świadek & Gorączkowska, 2024; Komninos et al., 2014).

When institutions fail to provide stability, problems in society and politics can spill over. People turn to entrepreneurship as a way to survive and express their frustrations. Some groups utilize business to support their livelihoods and maintain independence when the government is unable to offer any assistance, while others use it to spread divisive ideas that erode trust in democracy. Farmers, migrants, and cultural entrepreneurs see how they defend their livelihoods and identities through their entrepreneurial efforts. But their struggles also show that without enough systemic support, vulnerable groups remain marginalized and left behind. Entrepreneurship plays a crucial role in how countries address crises, share opportunities, and foster trust with their citizens. It has a two-way impact: it helps communities recover and become stronger, but it also shows where institutions and development plans may be weak (Eisenkraft, 2025; Goschin, 2020).

## Implications for Future Research

Future research should focus on the comparative analysis of 1) *crisis-driven digitalization*. While existing studies confirm that digitalization has helped boost resilience during the COVID-19 pandemic (Khan, 2025; Dvouletý, 2024), it is vital to explore whether this rapid adaptation can be sustained over time. Scholars are encouraged to investigate how the advantages of enterprise digital transformation vary across different sectors and regions in CEE. Additionally, understanding how factors such as institutional quality and access to skilled labor influence these benefits can provide valuable insights into outcomes.

Another important avenue for research is mapping 2) *systemic uncertainty and political entrepreneurship.* Broader qualitative studies are necessary to understand the mechanisms of transformational redistribution and how political entrepreneurship operates in environments characterized by uncertainty and other factors, such as corruption, bribery, instability, and low levels of trust (Dallago, 2000; Khlystova et al., 2022). This also includes examining the long-term consequences of 'memory entrepreneurship' (who, with their anti-communist narratives and activism, promote a revisionist interpretation of history that delegitimizes Albania's anti-fascist national liberation war while rehabilitating Nazi-fascist collaborators as victims of communism) and its influence on public policy and democratic stability in the region (Kolasi et al., 2025).

It is also crucial to pay closer attention to how *3) social networks support vulnerable forms of entrepreneurship.* The concept of "sisterhood solidarity," which inspires migrant entrepreneurship (Gaweł et al., 2025), prompts us to consider future entrepreneurship models in CEE, particularly during humanitarian crises. These models should focus not just on financial or human resources but also on relational and psychological strengths, which are often even more critical for helping entrepreneurs thrive and survive integration.

4) *Resilience mechanisms in innovation systems* present another important research direction. It is essential to examine more closely how resilience factors, such as research and development cooperation and supply chain linkages, interact with institutional trust (Świadek & Gorączkowska, 2024; Khlystova et al., 2022). Identifying interventions that strengthen collaboration between industry and science institutes is particularly important in CEE countries, where low resilience has been observed (Świadek & Gorączkowska, 2024).

Future research should delve into the concept of *5) political elasticity within entrepreneurship.* According to Eisenkraft (2025), the political values of the self-employed are highly susceptible to their social and geopolitical environments. This suggests that significant geopolitical events, such as the war in Ukraine and the ensuing refugee movements, may have profound impacts on how the entrepreneurial class in the Visegrad Four aligns politically and commits to democratic principles. Understanding these dynamics is crucial for comprehending the evolving landscape of entrepreneurship in a geopolitically unstable context.

## Implications for International Entrepreneurship and Business

The CEE demonstrates that entrepreneurship in uncertain conditions is quite common and is gaining popularity worldwide. In places where official rules and institutions are weak or unclear, entrepreneurs find other ways to build trust and credibility. In examining the dynamics of international entrepreneurship, it becomes evident that entrepreneurs often rely on their personal reputation, informal networks, and adaptable management practices, rather than solely on the stability of government institutions. For researchers delving into this field, it is crucial to look beyond official channels and recognize the importance of personal relationships and unconventional strategies as fundamental elements influencing how business is conducted across different contexts and venture performance (Troilo et al., 2024).

Global shocks make international business more complex and broaden its scope. The pandemic and the Ukraine war demonstrated how disruptions can accelerate digital upgrades, remote teamwork, and global connections, with diaspora groups playing a crucial role in recovery and knowledge sharing (Dvouletý, 2024; Khan, 2025; Adema et al., 2023). These events demonstrate that crises do not just hinder internationalization; they often redirect its paths by creating new opportunities for engagement.

The CEE context really highlights how internationalization is deeply rooted in social connections. Migrant and cultural entrepreneurs demonstrate that mobility, solidarity, and identity lend entrepreneurial efforts a richer meaning–one that extends beyond mere financial gain (Gaweł et al., 2025; Nyíri, 2003). For international business, this means that resilience, integration, and cultivating a strong sense of identity are just as important as traditional goals, such as profit and growth, especially in uncertain environments.

### Limitations and Future Studies

The study has few limitations to acknowledge. For example, although we examined 42 studies, the research primarily focuses on specific countries, such as Poland and Romania. Adding more sources, such as Web of Science, Google Scholar, books, and trade journals, could improve future research. Additionally, most of the data is based on a single point in time, making it challenging to observe how resilience evolves over time. Most data are qualitative, so more studies using quantitative methods, comparative case studies, and longitudinal data are needed. Future research should also examine how global issues, such as climate change, migration, and politics, impact entrepreneurship in the CEE region, and identify lessons from this region that can inform international business practices.

### Concluding Remarks

This study provided a review on how entrepreneurship in CEE is shaped by institutional, political, and regional uncertainties. While pursuing economic opportunities, entrepreneurs built their success around adaptability, identity, and social value. Our findings contribute to a broader understanding of international entrepreneurship by demonstrating how resilience develops in contexts that are repeatedly exposed to shocks and systemic challenges. In such cases, uncertainty is not a thing to avoid but a catalyst for renewal, fostering innovation, inclusiveness, and long-term social resilience across diverse contexts.

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## Notes

1 Throughout this paper, the terms uncertainty, fragility, and resilience are used in ways that are related but have distinct meanings. Uncertainty describes the ongoing and unpredictable conditions in the political, economic, and institutional environments of Central and Eastern Europe (Kropiński, 2024; Dimitrova, 2018). Fragility reflects how these uncertainties manifest in unstable systems, such as weak institutions, uneven markets, or social divisions, which limit entrepreneurial activity (Khlystova et al., 2022; Belitski & Grigore, 2022; Dallago, 2000). Resilience refers to entrepreneurs' ability to adapt, reorganize, and succeed despite these fragile conditions (Brada et al., 2021; Fares et al., 2022; Dvouletý, 2024). Thus, uncertainty underpins the environment, fragility shows its systemic expression, and resilience is the strategic response entrepreneurs develop within this context.

2 The Outcomes domain in Figure 1 captures the results that emerge when entrepreneurs in CEE navigate uncertainty through adaptive strategies. In particular, the outcomes can be manifested at six interrelated levels, which reflects how entrepreneurs adapt, strengthen communities, and build autonomy amid instability.

3 For example, Institutional Resilience–as the capacity to operate effectively in the face of weak governance and corruption by leveraging informal institutions, political networks, or community-based governance (Belitski & Grigore, 2022; Khlystova et al., 2022). Economic Resilience–referring to the ability to withstand shocks from financial crises, conflicts, or pandemics through diversification, strategic resource management, and local cooperation (Imran et al., 2023; Goschin, 2020)–and Socio-Cultural Resilience–the process of rebuilding identity, solidarity, and a sense of belonging through cultural and migrant entrepreneurship (Gaweł et al., 2025; Čuković & Milenković, 2023).

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MAGDOLNA SASS – ANDREA S. GUBIK – GÁBOR TÚRY

# THREE YEARS LATER – THE INTEGRATION AND CONTINUITY OF DIGITAL SOLUTIONS AT SUBSIDIARIES IN HUNGARY AFTER THE COVID-19 PANDEMIC

# HÁROM ÉVVEL KÉSŐBB – A DIGITÁLIS MEGOLDÁSOK INTEGRÁCIÓJA ÉS FOLYTONOSSÁGA A MAGYARORSZÁGI LEÁNYVÁLLALATOKNÁL A COVID-19 PANDÉMIA UTÁN

The COVID-19 pandemic precipitated widespread adoption of digital solutions, including applications, intranets, social media, online communication platforms, and other online and remote business solutions. While some of these practices persisted in the post-COVID era, others were modified or abandoned. This study investigates the digital practices of six automotive and electronics subsidiaries in Hungary during the pandemic and over the subsequent three years. The authors' findings indicate that practices beneficial to companies, such as technological innovations, online training, or meetings, remained integral to operations even after the pandemic. However, the continuity of other practices, such as working from home or remote work, depended on the nature of the position (whether it is related to physical production) and the company's organizational and business culture (in both home and host countries).

Keywords: **multinational companies, Covid-19 pandemic, corporate digitalisation, resilience, Hungary**

A COVID-19 világjárvány felgyorsította a digitális megoldások széles körű elterjedését, beleértve az applikációkat, intranet megoldásokat, közösségi médiát, online kommunikációs platformokat és egyéb online és távoli üzleti megoldásokat. Bár e gyakorlatok közül néhány a COVID utáni korszakban is fennmaradt, másokat módosítottak vagy elhagytak. Ez a tanulmány hat magyarországi autóipari és elektronikai leányvállalat pandémia alatti és az azt követő három évben alkalmazott digitális gyakorlatait vizsgálja. Az eredmények azt mutatják, hogy a vállalatok számára előnyös gyakorlatok, mint például a technológiai innovációk, az online képzés vagy az értekezletek, a pandémia után is szerves részét képezték a működésnek. Más gyakorlatok, így az otthoni munka vagy a távmunka azonban a pozíció jellegétől (fizikai termeléssel kapcsolatos-e) és a vállalat szervezeti és üzleti kultúrájától függött (mind az anyacég, mind a leányvállalat országában).

Kulcsszavak: **multinacionális vállalatok, COVID-19 világjárvány, vállalati digitalizáció, ellenálló-képesség, Magyarország**

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**Authors/Szerzők:**
Dr. Magdolna Sass[a] (sass.magdolna@krtk.elte.hu) senior researcher; Dr. Andrea S. Gubik[b] (andrea.gubik@uni-miskolc.hu) associate professor; Dr. Gábor Túry[a] (tury.gabor@krtk.elte.hu) senior researcher

[a]Institute of World Economics, ELTE Centre for Economic and Regional Studies (ELTE KRTK, Világgazdasági Intézet), Hungary (Magyarország); [b]University of Miskolc (Miskolci Egyetem) Hungary (Magyarország)

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The impact of transformative changes on company operations has been a longstanding subject in economic and business theory and empirics. Schumpeter (1942) introduced the concept of creative destruction as central to capitalism. He argues that "(t)hose revolutions are not strictly incessant; they occur in discrete rushes which are separated from each other by spans of comparative quiet. The process as a whole works incessantly however, in the sense that there is always either revolution or absorption of the results of revolution, both together forming what are known as business cycles" (Schumpeter, 1942, p. 83).

The effects of digital transformation and automation are continuous (Brynjolfsson & McAfee, 2014). However, various crises and other discontinuous changes have significantly accelerated this process. Technological innovations that would have spread more slowly under normal circumstances are rapidly integrated into everyday life and economic functioning during crises, with lasting effects on organizations and societies. The literature refers to the anticipation of external influences as crisis-driven innovation (Archibugi et al., 2013; Hausman & Johnston, 2014) and forced innovation and adaptive innovation (Roe & Wood, 1975; Kirton, 1976).

Like other crises, COVID-19 triggered these changes (Amankwah-Amoah et al., 2021), but due to company closures, additional special changes appeared, primarily in connection with the actual physical presence (or absence) of the labour force. These affected the place of work, means of communication, business trips and many other fields (Zou et al., 2020; Obrenovic et al., 2020; Andrews et al., 2021; Foss, 2021; Khan et al., 2023;). These kinds of actions had a significant influence on how businesses operated on a daily basis, and it was assumed that some of these solutions would be there to stay. In this article, we examine the enduring impact of the pandemic-induced digital transition. Through the analysis of the practices of six automotive and electronics subsidiaries during COVID-19 and then three years later, we evaluate whether the pandemic acted as a temporary accelerator or a long term catalyst for digitization.

The aim of this article is to examine the extent to which digital practices adopted during the COVID-19 crisis–such as online communication, remote work, digital supply chains, and training–have persisted three years later in foreign-owned automotive and electronics subsidiaries operating in Hungary. The study seeks to identify the organizational, cultural, and functional factors that have shaped the retention or discontinuation of these practices, thereby contributing to a better understanding of long-term digital transformation processes in a post-crisis context.

We address the issues if these digital solutions are really here to stay now that the pandemic is over. Are these digital solutions still integral to these companies? Is digitization an ongoing tendency in Hungary, accelerated by the pandemic, or was it just a temporary solution, invoked by the special circumstances of the pandemic? Thus our research question is: how have digital solutions introduced during the COVID-19 pandemic been integrated and sustained in the operations of foreign-owned electronics and automotive manufacturing subsidiaries in Hungary, and what factors influence their continuity or abandonment in the post-pandemic period?

The article is structured as follows. First, we present the background to our analysis: the impact of the pandemic on firms in terms of using digital tools. Then our methodology is briefly presented, followed by the results of our investigation, discussion and conclusion.

## Background

During the COVID-19 pandemic, firms resorted to various types of digitization in order to overcome the challenges caused by the pandemic (Almeida et al., 2020; Bürgel et al., 2023; Zia et al., 2023). Nearly all businesses used digital solutions (Apedo-Amah et al., 2020; Kuriakose & Tran, 2020; Pla-Baber, 2021; Sass et al., 2021; Mont et al., 2021; Hassoun et al., 2023), but the degree of adoption varied by industry, company size and location (Apedo-Amah et al., 2020; Kim, 2020). Similar developments have been identified in Hungary (see e.g. Sass et al., 2021; Endrődi-Kovás & Stukovszky, 2022; Kiss-Dobronyi et al., 2024; Kőműves et al., 2024).

The pandemic increased the amount of work done from home (Foss, 2021; Zou et al., 2020; Sass et al, 2021), established models for remote business negotiations and hiring (Zou et al., 2020), and increased e-commerce usage (Andrews et al., 2021). Everyday business routines included the use of applications, intranets, social media, online communication platforms, and other online solutions (Obrenovic et al., 2020; Andrews et al., 2021; Foss, 2021; Khan et al., 2023).

In addition to digitization, many companies were forced to innovate and transform their business models due to the impacts of the pandemic (Heinonen & Strandvik, 2021). However, while basic technologies were widely implemented, more advanced tools, like Big Data analytics and Artificial Intelligence (AI), saw limited adoption (Bettiol et al., 2021). Factors influencing these transitions included the company's digital infrastructure, managerial mindset and historical innovation practices (Archibugi et al., 2013).

Companies mainly used technologies that were already available, already in use but to a limited extent in the firm, or that could be easily and quickly obtained and adopted (Bai et al., 2021). So, the changes were not without precedent. The pandemic-related crisis only accelerated those changes by removing managers' hesitation and preventing employees' resistance regarding introducing new technology (Amankwah-Amoah et al., 2021).

Digitization was an important part of crisis handling measures and firms with digitization experience could manage the crisis more efficiently. Previous experience with and increased use of digital solutions increased the crisis resilience of companies not only in developed nations (Acciarini et al., 2021; Bürgel et al., 2023), but also in less developed countries (Khalil et al., 2022) and not only among large but also among small and medium-sized firms (Marolt et al., 2024). Digitally-enabled firms had a

lower decline in sales (Abidi et al., 2023) and higher business efficiency (Grijalba et al., 2024). The access to digital infrastructure and increased digitization also contributed to higher performance (Fejes & Stocker, 2024; Vo et al., 2022).

In addition to previous experience and infrastructure access, the company's and its managements' way of thinking was also an important influencing factor. Companies that saw the crisis as an opportunity and invested in new industries (Zou et al., 2020) or innovated (Santos et al., 2021) reacted more successfully to the pandemic-related crisis. The resilient operation of companies is influenced by whether the necessary changes can be organically integrated into the company's operation, and path dependency (Pavitt et al., 1989) can play a major role here. A company that was innovative in the past will be so in the future (Archibugi et al., 2013), so changes are part of its learning process and are not alien to its corporate operation. This partly explains why companies in Hungary, demonstrated varying degrees of resilience during the pandemic depending on their prior digital capabilities (Sass et al., 2021; Khalil et al., 2022; Kiss-Dobronyi et al., 2024). Digital transformations during COVID-19 also highlighted inequalities in digital infrastructure. In countries like Hungary, where infrastructure and skills were moderately developed, firms faced challenges in scaling digital solutions. Despite this, organizations with pre-existing digital tools adapted more effectively, showcasing the value of prior investment in IT capabilities (Acciarini et al., 2021).

As for the long-term effects, during the pandemic, employee collaboration (teamwork, team size), performance evaluation and reward systems were heavily impacted by remote work. Remote work might have diminished loyalty, together with the rise in the employment of contract labourers and part-timers (Foss, 2021). A decrease in business travel and an increase in online meetings were predicted to be two universal and lasting changes, which would remain with the firms even after the pandemic was over (Dyba & Di Maria, 2024). Additionally, the emergence of new digital products and services based on the principle of flexibility was predicted (Almeida et al., 2020).

As we saw, the COVID-19 pandemic served as a powerful catalyst for digital transformation across industries, compelling companies to reconfigure their operational models, technology infrastructure, and strategic priorities. But it is rarely analysed, what happened in this field after the pandemic? Have firms continued to use the digital tools adopted during the pandemic in their operations? There are few studies comparing the pre- and post-pandemic era in that respect. Studies emphasize that digital transformation in the post-pandemic context is not merely an emergency response, but a strategic necessity deeply tied to organizational resilience, innovation, and long-term performance (Cardoso et al., 2025). While firms adopted remote work, e-commerce platforms, and cloud-based tools to ensure continuity, the effectiveness of these efforts hinged on digital maturity, leadership commitment, and dynamic capabilities (Ben-Zvi & Luftman, 2022; Madzík & Sieber, 2024). For Hungarian SMEs, the role of management is also emphasized (Gyimesi & Fejes, 2023). Empirical research reveals that, particularly in emerging and digitally constrained markets like Ghana and China, the crisis accelerated the adoption of mobile applications, blockchain, and innovative marketing strategies, which were there to stay even in the post-pandemic era (Fodouop Kouam, 2025; Jibril et al., 2024). Furthermore, digital transformation has evolved beyond technological deployment to encompass sustainability, agility, and stakeholder-centric innovation, positioning IT as a core enabler of both competitiveness and resilience in the post-pandemic economy (Ben-Zvi & Luftman, 2022; Soto-Acosta, 2023). Despite uneven progress, especially among SMEs and in developing contexts, the literature converges on the view that digital transformation must be treated as a continuous, strategic, and multidimensional endeavor and that firms tend to keep the digital solutions they introduced during the COVID-pandemic even in the post-pandemic era.

## Methodology

Our research involved semi-structured interviews with managers of 15 foreign-owned automotive and electronics subsidiaries operating in Hungary, during the pandemic (for more details on the interview and analysis procedures, see Sass et al. (2021)) and short follow-up interviews with the representatives of six of these firms three years later. (Convenience sampling was applied, whereby we have selected participants who were most readily available from the previous sample of 15 firms.) The initial inquiry explored the pandemic's impact on operations, the role of state subsidies in helping firms coping with this impact, and the company's crisis management strategies (Sass et al., 2021). The follow-up focused on the persistence of digital practices and the rationale behind their retention or discontinuation. The follow-up interviews were conducted online, with the same managers, who were interviewed in the first round. The online interviews took place between February and March 2024 and lasted between 20 to 30 minutes. Participants were informed about the nature of the research and gave their voluntary consent before participating. The research ensured the confidentiality of participants' and their companies' identities. No identifiable information is disclosed in the study about the firms involved. Responses were anonymized during both data collection and analysis to protect privacy.

The follow-up sample was made up of four automotive companies and two electronics firms (See Table 1), encompassing both medium-sized and large organizations. Among them, five were established through greenfield investments and one was an acquisition. This targeted selection allowed for a detailed exploration of industry-specific dynamics. The data collection aimed to capture variations in practices based on organizational size, production processes, and corporate culture.

To ensure rigour, the study triangulated findings from interviews with internal company reports and publicly

available data, including articles in economic dailies and weeklies. The analysis involved coding interview transcripts to identify recurring themes, such as the adoption, modification or abandonment of digital practices.

## Results

The most important findings concerning the companies, which took part in the interview round, are summarized in Table 1.

Table 1

**Results of the interviews**

| | Company A | Company B | Company C | Company D | Company E | Company F |
|---|---|---|---|---|---|---|
| **Sector** | electronics | electronics | automotive | automotive | automotive | automotive |
| **Headquartered in** | Switzerland | USA | China | Germany | Germany | Austria |
| **Number of employees** | | | | | | |
| *A/ during the pandemic (2020)* | 10 | 3400 | 2100 | 1400 | 2300 | 600 |
| *B/ after the pandemic (2023)* | 50 | 3900 | 1600 | 1450 | 2500 | 450 |
| **Received government support during the pandemic?** | No | Yes | Yes | Yes | Yes | No |
| **Increase in the number of employees after COVID** | continuous growth (each year) | continuous growth (each year) | continuous decrease (each year) | steady increase but last year decrease | continuous growth (each year) | first year growth then steady decline |
| **Online training** | | | | | | |
| *A/ during the pandemic* | Yes | Yes | Yes | Yes | Yes | Yes |
| *B/ after* | Yes | Yes | Yes | Yes | Yes | Yes |
| **Remote work** | | | | | | |
| *A/ during the pandemic* | Yes | Yes | Yes | Yes | Yes | Yes |
| *B/ after* | No | Yes | Yes | Yes | Yes | Yes |
| **DSN** | | | | | | |
| *A/ during the pandemic* | Yes | Yes | No | No | Yes | No |
| *B/ after* | Yes | Yes | Yes | Yes | Yes | No |
| **Other digital solutions** | | | | | | |
| *A/ during the pandemic* | Yes | Yes | Yes | Yes | No | No |
| *B/ after* | Yes | Yes | Yes | Yes | No | No |

*Source: compiled by the authors based on the company interviews*

*Note: 'A/during the pandemic' refers to digital solutions, which were introduced during the pandemic; number of employees rounded to keep the anonymity of the respondents*

As Table 1 shows, the companies in our sample show a high similarity in introducing and keeping digital solutions. Differences can be explained by the special position of the company in question or by the nature of its products, markets or activities. Company A is in the process of establishing itself in Hungary, in the phase of a quick growth from basically zero during the COVID-related crisis. Furthermore, due to the special nature of its product, it was affected positively by the COVID-related economic crisis with continuous and quick growth in sales. In spite of this, various measures were taken to both prevent the spread of the virus and ensure the increased use of digital tools in the firm. This is the only firm in the sample, where remote work was not introduced, the reason is its smallness in terms of the number of employees and the low number of white-collar workers.

Company B retained most of the routines established during the COVID-19 pandemic, as they proved to be effective, and the company continuously increased the number of employees during the period under review. As for continuing the practices established during the COVID-19 pandemic, remote work or home office options were maintained. The company management decided in which areas remote work was possible (this obviously affected areas not directly related to production, such as finance), but then the middle management level could determine if they wanted to apply it to their team. As our interviewee stated, "*The most important thing is that the work gets done*". This also raises the issue of traceability. Despite the above, our interviewee considers on-site work a sign of loyalty and believes that the extent to which people expect the home office option compared to on-site work may play a role, even during layoffs. A substantial proportion of personal meetings shifted towards online meetings, and online training has become more prominent. The threat of the pandemic was given greater weight in the emergency plan; thus, it also enhanced the company's responsiveness, which can be considered a long-term benefit.

Company C introduced digital practices during the COVID-19 pandemic that were not a priority before or would have been developed without the pandemic but were

accelerated under its pressure. As for solutions affecting employees, some of the practices introduced during the COVID-19 pandemic, such as online meetings and the shift of international partnerships to the online arena, have been maintained due to their apparent benefits (cost reduction), while those practices that are exclusively beneficial to the employees, such as remote work or home office, have partially withered in the period after the pandemic (not eliminated, but significantly reduced and have not become automatic). The interviewee highlighted the existence of different practices between subsidiaries of the parent company and the mostly obvious differences according to job roles. Here, too, just as in the case of Company B, the decision-making authority lies with the line manager. The discovered pattern suggests that in areas with greater flexibility (and where considering the state of mind is also important), the home office option is more likely to persist.

In the case of Company D, the COVID-19 pandemic has resulted in the expansion of digital solutions, including the introduction of online communication tools. A significant change was the introduction of IT solutions to increase centralization within the company network in response to the pandemic. More and more activities are moving to the online space, where there is less need for personal presence. In the product segment represented by the company, demand has not fallen, so the biggest problem has been maintaining day-to-day production, with a shortage of blue-collar workers. Decisions previously taken exclusively at local level were increasingly taken at the parent company, to solve the problems arising from COVID-19. This has been maintained after the pandemic. Following the pandemic, digital solutions have been maintained, and working from home two days a week has been preserved for certain white-collar jobs, and may even be increased where justified. In contrast to the other companies in the sample with the exception of company F, the number of employees has decreased over the past year due to reduced demand in the market segment served by the company.

At Company E, the COVID-19 pandemic has brought significant changes to the company's operations using digital solutions. During the COVID-19 period, the company created as much as possible the conditions for attendance, not only for blue-collar workers but also for white-collar workers. At the same time, the pandemic has accelerated the introduction of digital solutions. It has enabled some white-collar jobs to be made permanently through remote work. In addition, the company has moved from the previous form of on-site presence for both meetings and training courses to online solutions. During the pandemic, a number of IT solutions were introduced (such as mobile applications, information email and feedback email) and maintained, which not only replaced face-to-face communication but also contributed greatly to increasing the efficiency of the production line (in the case of blue-collar work).

In the case of Company F, during the COVID-19 pandemic, online meetings and remote work were introduced. At the same time, the interviewee reported a significant drop in production, as most of the workers are blue-collar and involved in production, and for them the introduction of digital solutions was not an alternative. The digital solutions that were introduced were maintained in the post-pandemic period. Digital supply chains were not built as production relies on fewer partners, thus no complex supply system is deployed. Furthermore, the relatively small size of the Hungarian plant does not require such solutions. At the same time, existing digital solutions were used to a greater extent than previously. In terms of inventory, up-to-date information was shared between the offshore plants, which, with the help of inter-plant logistics, solved the shortage of parts resulting from supply chain disruptions. The number of employees in this company has also decreased in the last two years, like in company D, due to a significant drop in demand and thus in sales in their market segment.

Overall, we found that digitalization and IT capability were key determinants of the crisis resilience of the firms in the sample (Sass et al., 2021). However, there were also differences according to the nature of production (advantages of higher added value), according to company size (advantages of larger companies) and according to the age of the company (new companies were more flexible). The follow-up indicated different behaviors in terms of keeping or abandoning digital tools. We shall examine the fate of the different digital solutions one by one.

All interviewed companies introduced online training courses during the pandemic and after three years they all still carry out their trainings online. Three years later, these programs remained fully digital, yielding significant savings in both cost and time. This continuity underscores the economic advantages of remote learning solutions. Employees and managers alike cited increased accessibility and flexibility as key benefits. The shift to online training also enabled companies to standardize content delivery across geographically dispersed teams. Similarly, online meetings are now common in the sample, as one interviewee (Company C) put it: "*We are holding Teams meetings, the company has a culture of this by now, the company even introduce rules for "conference working."*

Another long-term solution is remote work or working from home, which was introduced during the pandemic by all six companies in the sample. Five companies maintained flexible remote work arrangements, ranging from two days per month to two days per week. (The sixth company offers remote work on a case-by-case basis in special circumstances only and for one working day per month.). The survival of the "home office" practice is a multifactorial issue. The nature of the job is crucial. In positions closely tied to physical production, remote work practices have declined in the surveyed companies. On the other hand, it is easier to maintain home office practices in jobs such as research and development or various administrative functions, which are not bound to a specific location and often involve international teams. This has led to a situation where  where two-days-a week and two-days-a-month remote work practices can be observed within the same company. Furthermore, the direct manager's consent

is also required. Therefore, a situation may arise where a worker will not be permitted to work from home, despite the fact that the company practice and the position allow it. As an additional factor, company culture is another significant factor. Company culture also played a critical role, with flexible and employee-centric companies more likely to sustain remote work options. Furthermore, companies that perceived remote work as a threat to team cohesion reduced its prevalence, while those emphasizing employee well-being integrated remote work into their standard policies. This divergence highlights the interplay between corporate priorities and external pressures in shaping post-pandemic practices. The interviewee from Company C also emphasized that the current state of the labour market plays a significant role in corporate decisions. The excess demand of labour has been favorable for the survival of remote work practices after COVID-19, as home office has proven to be attractive for workers. However, the change in market conditions has also been accompanied by a decrease in company flexibility, which has also impacted the development of home office practices since these practices are important mainly for the employees (and not for the company), as it could be seen from the interviews.

As a third solution, digital supply chains/networks (digital development; synchronized planning; smart supply; smart factory; dynamic performance; connected customer) were used during the pandemic by four of the six firms, and all six had adopted these practices by the study's conclusion. The firms that introduced this solution later indicated that the business environment – all of their partners apply these solutions – and not the pandemic induced them to implement these digital tools. Thus, these advancements have been driven by broader industry trends rather than the pandemic alone. Companies reported increased efficiency, reduced lead times, and enhanced collaboration with suppliers, which is confirmed by their performance indicators.

A uniform during-pandemic development that has remained in place in all firms in the sample is within-company communication, which has been mainly transferred online, except for those companies where production processes need personal communication. Higher efficiency, cost savings, and advantages related to traceability are the results of the enhanced use of this tool. On the other hand, given the importance of internal communication in maintaining or even enhancing employee loyalty (Sinitsyna et al., 2024), keeping this digital tool is an indicator of companies' strategic commitment to sustaining employee engagement and cohesion, even in hybrid or remote work settings, thereby reinforcing organizational culture and long-term workforce stability. As one interviewee (Company F) put it: *"the retention of staff is very important, helped by small organization, where personal relationships dominate and corporate culture; it is very important to have little movement among the employees…"*

Furthermore, the increase in online communication has enabled a higher level of centralization in decision-making, which meant in the case of two of the six companies in the sample a higher level of coordination and involvement in subsidiary-level decisions from the headquarters. This shift suggests that the pandemic-induced transition to digital communication has not only improved operational efficiency but also facilitated tighter organizational control and integration. As a result, firms have been able to strengthen corporate governance and align subsidiary actions more closely with headquarters' strategic objectives, indicating possibly a long-term structural change in multinational management practices. However, this finding cannot be generalized and requires further investigation due to the low number of firms in the sample.

Other retained innovations included online production data tracking, supplier portal enhancements, and critical queue notification systems. These solutions reflected both pandemic-specific adaptations and pre-existing innovation trajectories. Companies emphasized the importance of tailoring digital tools to their operational needs, ensuring alignment with production processes and strategic goals. All these solutions have been kept after the pandemic. These depend to a great extent on the nature of the actual production activities.

However, challenges persisted, particularly for firms with legacy systems. Transitioning to digital supply chains required significant investment in infrastructure and employee training. Firms that successfully navigated these challenges leveraged partnerships with technology providers and government-supported digitalization programs. Furthermore, as one interviewee (Company A) emphasized, problems with the Hungarian education systems represent one of the major challenges from the point of view of digitalization: *"…tackling the education crisis would be key for Hungary's development, schools are passing on less and less knowledge and attitudes to children, both secondary and higher education are almost unambitious, and dual training is not efficient."*

Regarding these practices, some of them (solutions for remote access) were introduced due to COVID-19, while others that were not a priority before the pandemic were given higher importance or implemented more quickly than they might have been otherwise. In many cases, however, we can see advancements that would have happened even without the pandemic. Companies need to keep up with the adoption of digital solutions. Thus, the pandemic acted as a catalyst for the introduction and practical application of these digital tools. Regardless of the reason, the managers interviewed considered all technical progress and development beneficial.

## Discussion

The findings of this study reveal that the COVID-19 pandemic served as a significant catalyst for digital transformation among the examined firms in Hungary. Despite differences in company size, sector, market positioning, and the nature of their products and operations also highlighted in the literature (Apedo-Amah et al., 2020; Kim, 2020), a high degree of convergence can be observed in the adoption and retention of digital solutions.

The findings underscore the dual role of crises as accelerators and disruptors of technological innovations and their adoption. While the pandemic expedited the adoption of digital solutions, the sustainability of these practices depended on organizational readiness and various internal and external factors. Companies with robust digital infrastructures and proactive leadership were better positioned to capitalize on the opportunities presented by the pandemic.

The transition to online internal communication, which is often mentioned in the literature (Obrenovic et al., 2020; Andrews et al., 2021; Foss, 2021; Khan et al., 2023), was one of the most uniform developments, with all firms–regardless of size or structure–maintaining this practice even in the post-pandemic years. The strategic commitment to digital communication not only enhanced efficiency and cost-effectiveness but also contributed to stronger organizational cohesion and employee engagement. In certain cases, it also enabled greater centralization of decision-making, signaling a possible shift in corporate governance practices toward tighter headquarters control.

In line with previous research (Foss, 2021; Zou et al., 2020; Sass et al., 2021) remote work emerged as another widely adopted solution, though its extent varied. Five out of six companies retained some form of remote work, shaped by job characteristics, managerial discretion, and corporate culture. The variations within firms suggest that while remote work has become more accepted, its implementation remains context-dependent, reflecting a nuanced approach to flexibility and control. The digitalization of training programs was unanimously retained, underscoring the clear cost, accessibility, and standardization benefits of online learning. Similarly, digital production monitoring tools and supply chain solutions–though not initially driven solely by the pandemic–became integral to company operations. Their adoption was accelerated either by pandemic-induced needs or broader industry developments, with firms reporting performance improvements as a result.

Our results show that not only company-level attitudes, such as whether companies perceive the crisis as an opportunity or a threat (Zou et al., 2020; Santos et al., 2021), or how they think about employee loyalty (Foss, 2021), but also individual attitudes are decisive. Local managers use the room for maneuver provided by subsidiaries according to their own beliefs, for example by allowing more or less remote work for employees under their control. We also highlighted the role of situational factors, such as the current state of the labour market, which may influence the use of remote work.

The persistence of digital practices also highlights the interplay between employee preferences and organizational objectives. For instance, the continuity of remote work reflected a balancing act between productivity concerns and workforce satisfaction. Similarly, the widespread retention of online training underscored its dual benefits of cost efficiency and skill development (Castillo & Shah, 2020).

However, our study revealed disparities in digital adoption across firms. Smaller companies and those with limited pre-pandemic digital capabilities faced greater challenges in sustaining innovations. These findings align with existing literature on the digital divide, emphasizing the need for targeted support to bridge gaps in infrastructure and skills (Vo et al., 2022). Furthermore, in spite of the small sample, our results stress the importance of the nature of the activity itself in the company as a factor in the inclination to adopt and retain digital solutions.

It is important to note that while some of the innovations were direct responses to the crisis, others reflected broader strategic trajectories, in line with the findings of other articles (Cardoso et al., 2025). The pandemic often acted as an accelerator rather than an originator of digital adoption. The continuation of these practices suggests a deeper transformation in operational models, with long term implications for competitiveness, employee management, and global coordination in multinational firms.

## Conclusion

Overall, our results indicate that the COVID-19 pandemic acted as a catalyst for the acceleration of digitalization processes in Hungary–a mid-developed country where the necessary infrastructure and skills were largely in place, yet the widespread adoption of digital solutions had not fully materialized prior to the crisis. Our findings confirm that digital practices offering clear and measurable benefits to companies–such as online training, digital communication tools, and supply chain digitalization–were more likely to persist over time. These practices were retained due to their efficiency, cost-saving potential, and positive impact on collaboration, especially in geographically dispersed and international company environments.

However, not all digital solutions experienced the same level of continuity. Practices more oriented toward employee convenience and work-life balance–most notably remote work–showed greater variability and were more contingent upon organizational culture, job characteristics, managerial attitudes and external factors (tightness of the labour market). This suggests a tension between organizational efficiency and employee-centered flexibility in the post-pandemic era, especially in sectors where physical presence and on-site coordination remain critical.

The results also highlight the unevenness of digital transformation across firms, with differences emerging not only based on sectoral characteristics but also firm size, digital maturity, and corporate culture. While some of these differences align with established findings in the digital divide literature, our research may point to the particular role of path dependency and prior innovation orientation as key determinants of whether crisis-induced solutions became permanent. Firms with a history of innovation and openness to change were more likely to embed new digital practices into their routines, turning crisis responses into long-term organizational assets – an area, which deserves further investigations due to the limitations of our study.

Furthermore, we observe that digitalization in the context of crisis management is not only a technical or infrastructural issue but also a strategic and cultural challenge. Organizational willingness to invest in employee training, adapt management practices, take into account work-life balance and redesign workflows plays a vital role in determining whether digital tools will be sustainably integrated. In this sense, the pandemic has served not only as a technological inflection point but also as a test of organizational learning and adaptability.

An important limitation of our study is the low number of analysed firms and their specific characteristics: in our sample, there are only foreign-owned subsidiaries operating in the automotive and electronics industries. The study focuses primarily on firms operating in a particular industry context, and practices may differ substantially across sectors. Furthermore, our research is rooted in a single-country setting, whereby regulatory aspects, cultural factors, differences in digital infrastructure and digital readiness may affect the results. Due to the convenience sampling method, selection bias may also be present. Thus our conclusions cannot be generalized and transferred directly to other industries or economies. Furthermore, we could not analyse certain information, e.g. the link between whether the company received government support and if it kept the digital solutions introduced during the pandemic. At the same time, we had information about the companies in the sample at two points in time, which was helpful for tracking developments over time. Thus, still, we think, our results based on a longitudinal analysis, serve as a good basis for further works in the area.

Looking ahead, the continuity of digital solutions will depend on how firms can balance the pressures of global competitiveness, cost efficiency, and employee satisfaction. Policymakers and industry stakeholders should take note of the specific barriers faced by small and medium-sized firms in sustaining digital innovations, particularly in the areas of infrastructure investment and digital skills development. Targeted support mechanisms, such as training subsidies, IT infrastructure programs, and knowledge-sharing platforms, could enhance resilience and digital maturity across the business sector.

Finally, future research areas can be determined based on the limits of the methodology applied. Thus, future research should explore the long-term organizational consequences of digitalization beyond efficiency metrics. Questions related to employee well-being, employee loyalty, organizational identity, workplace cohesion, attractiveness of the workplace and managerial control merit deeper investigation. Broader comparative studies across industries and national contexts could also shed light on the global dynamics of post-crisis digital transformation. Especially important would be to conduct comparative country case studies in the Central and Eastern European region, given the similarities in context, heritage, development path and level of development of the market economies. As crises may be becoming more frequent and interconnected, understanding how firms internalize and institutionalize change will be crucial for shaping resilient, adaptable, and inclusive economic systems. Furthermore, based on our research results, future research should delve deeper into the organizational determinants of digital continuity, as our study highlighted substantial variation in the persistence of digital solutions across firms, even within the same industry. For instance, while digital communication platforms and online training were widely retained due to their measurable benefits, remote work practices remained inconsistent and appeared strongly shaped by organizational culture, managerial attitudes, and the production-related nature of job roles. Comparative case studies that explicitly examine these cultural and managerial dimensions–both across firms and between home and host country headquarters–could offer richer insight into the micro-level factors influencing digital path-dependency. Additionally, our findings suggest that digital maturity before the crisis played a key role in whether firms could embed new tools as long-term practices. Thus, future studies might explore how pre-pandemic innovation orientation, IT infrastructure, and HR practices affected the speed and depth of digital adaptation. Investigating whether companies with prior investment in digital skills or workflows experienced more successful or more lasting transformations would enhance understanding of digital absorptive capacity. Another promising research direction concerns the role of subsidiary–HQ relations in shaping digital continuity. Our results hint at an increasing trend toward centralized decision-making in digital matters during and after the pandemic, which raises questions about the autonomy of subsidiaries in shaping their own digital practices. Longitudinal research could trace how this centralization evolves and what impact it has on subsidiary initiative, performance, and employee engagement. Furthermore, our article pointed to sector-specific constraints, such as the physical presence required in manufacturing, which limited the applicability of remote work. Future research should therefore compare digital transformation processes in production-intensive versus knowledge-intensive firms, helping to determine where hybrid models are feasible and sustainable. Finally, given the observed concerns about skills shortages and the education system's inability to keep pace, further research should examine how external constraints–such as labour market readiness, vocational training, and policy interventions–either enable or inhibit firm-level digital transitions. This is particularly important for Central and Eastern European countries where structural challenges in education and training may undermine digital progress.

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JUDIT BURUCS – FANNI DUDÁS

# DID THE VIRTUAL INTEGRATION OF STOCK MARKETS IMPACT THE STOCK EXCHANGES IN SOUTHEASTERN EUROPE

# A RÉSZVÉNYPIACOK VIRTUÁLIS INTEGRÁCIÓJA HATÁSSAL VOLT-E A DÉLKELET-EURÓPAI TŐZSDÉKRE?

This study investigates the impact of the SEE Link trading platform on capital market development and financial integration in Southeastern Europe (SEE). Established in 2016 with support from the European Bank for Reconstruction and Development, SEE Link sought to enhance market depth, liquidity, and cross-border connectivity among relatively small regional stock exchanges. Using a difference-in-differences framework complemented by correlation and cointegration analysis over a ten-year horizon, the paper evaluates the platform's effects on market performance and integration. The findings reveal only modest outcomes: turnover ratios increased marginally, while market capitalization to GDP, traded value to GDP, and portfolio equity net inflows showed no significant changes. Short-term return correlations among member exchanges remain weak, and long-run cointegration was absent both before and after the platform's introduction. Persistent structural, regulatory, and technical barriers–including market fragmentation, heterogeneous legal frameworks, high transaction costs, unlinked central securities depositories, and limited visibility–continue to hinder meaningful integration.

Keywords: **stock market co-movements, Southeast Europe, difference-in-differences model, co-integration model**

A 2016-tól működő SEE Link egy regionális kereskedési platform, amely hat kis ország – Bulgária, Bosznia-Hercegovina, Horvátország, Észak-Macedónia, Szlovénia és Szerbia – tőzsdéit köti össze vállalati egyesülés nélkül. Ennek a cikknek az a célja, hogy feltárja a SEE Link hatását a részt vevő tőzsdékre, különös tekintettel a kereskedési volumenre és a hozamok kointegrációjának szintjére 2012 és 2022 között. A kointegráció tesztelésére a DCC-modellt és a Johansen-modelleket alkalmazták a szerzők. Emellett elemezték a kulcsfontosságú makrogazdasági tényezőket, hogy nyomon követhessék a befektetési feltételek alakulását. Eredményeik azt mutatják, hogy a részvénypiacok közötti korrelációk idővel csökkentek, kivéve a COVID-19 időszakot. A SEE-Link önmagában nem elegendő a forgalom és a piaci kapitalizáció növeléséhez. A gazdasági környezet javulása ellenére, a tartós strukturális, szabályozási és technikai akadályok továbbra is korlátozzák az érdemi integrációt.

Kulcsszavak: **tőzsdei együttmozgások, Délkelet-Európa, DID (difference-in-differences) módszer, cointegrációs modell**

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**Authors/Szerzők:**
Judit Burucs[a] (judit.burucs@uni-corvinus.hu) senior lecturer; Fanni Dudás[a] (fanni.dudas@uni-corvinus.hu) PhD student

[a]Corvinus University of Budapest (Budapesti Corvinus Egyetem) Hungary (Magyarország)

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An essential driver of economic growth is a well-developed financial system composed of specialized organizations and institutions that facilitate payment transfers and intermediate the flow of savings and investments. As emphasized by Demirgüç-Kunt et al. (2012), the role of financial markets becomes increasingly important relative to banks as economies advance. However, factors such as market size significantly influence the efficiency of capital markets. For instance, an IFC survey found that "the stock markets do not seem to grow in countries with a GDP below 20 billion" (Demekas & Nerlich, 2020, p. 5). One way to mitigate this constraint is through partial or full market integration, which can generate economies of scale. A specific form of such integration is virtual integration of stock exchanges, defined as the establishment of a technological and regulatory framework that enables investors and brokers to access and trade securities across multiple national stock exchanges through a single platform, without merging the exchanges into a single legal entity. An integrated capital market broadens the spectrum of available financial instruments, thereby enhancing portfolio diversification opportunities and improving the risk–return trade-off for investors. For issuers, integration facilitates access to new markets and investor bases, increases demand for shares, and can potentially lower financing costs while boosting firm value (Espinosa-Méndez et al., 2017).

Capital market integration is also a central concern for policymakers in the European Union. The Capital Markets Union Action Plan, adopted in 2015, emphasizes the need to deepen capital markets, particularly in countries with significant catching-up potential such as those in Central, Eastern, and Southeastern Europe (CESEE). The Report on Capital Market Union, prepared by the European Bank Coordination Initiative, outlined additional measures to increase cross-border cooperation. These include facilitating foreign listings and market access, fostering cooperation between stock exchanges, establishing "cross-border links between local market infrastructures (such as central securities depositories (CSDs) and central counterparties (CCPs)), and harmonizing legislation at the regional level" (EBCI, 2018, p. 1).

The countries of CESEE are small open economies with strong economic ties to larger EU members but relatively underdeveloped capital markets. In response, three cross-border stock market cooperation clusters have emerged, each differing in its level of integration as well as its legal and operational structures. The most advanced is the Nasdaq Baltic Market, which integrates the stock exchanges of Estonia, Latvia, and Lithuania under a unified framework. Another example was the CEE Stock Exchange Group (CEESEG). This unique integration brought together the stock exchanges of Prague, Ljubljana, Budapest, and Vienna as subsidiaries of equal standing within the holding company CEESEG AG. However, in 2015, the Ljubljana and Budapest exchanges were sold, leading to their withdrawal from the group (EBCI, 2018). SEE Link represents a virtual form of cooperation and connection, an innovative regional platform supported by the European Bank for Reconstruction and Development (EBRD). Established in 2016, SEE Link connects the stock exchanges of six countries–Bulgaria, Bosnia and Herzegovina, Croatia, North Macedonia, Slovenia, and Serbia–by facilitating cross-border trading while preserving the independence of local markets.

While policy interest in SEE Link has increased, empirical evidence on its effectiveness in promoting integration across small and emerging CESEE capital markets remains limited. Existing studies primarily examine volatility transmission and short-term linkages, but there is little systematic evidence on how these exchanges have evolved following integration.

This study addresses the gap in the literature by analysing the impact of the SEE Link trading platform on the characteristics of stock exchanges in small and less developed participating countries, as well as the degree of integration achieved.

Our first research question (RQ1) asks: *How have the SEE Link stock exchanges evolved since their integration?* To answer this, we employ a difference-in-differences (DID) research design over 10 years. DID is widely used for causal inference in policy evaluation, particularly when a subset of units is exposed to an intervention while comparable units serve as controls (Angrist & Pischke, 2009; Stata.com, 2022a). In our study, Croatia, Bulgaria, and Slovenia constitute the treated group (SEE Link participants), while Romania, Hungary, and Poland serve as control countries. All selected countries are EU members with accessible and comparable yearly capital market data (such as stock market capitalization to GDP), which strengthens the validity of the counterfactual comparison. *We hypothesize that the treated group experienced greater improvements in these indicators following the introduction of the SEE Link.*

Financial integration indicators can be categorized into three main types: price-based, quantity-based indicators, and regulatory or institutional measures (Park, 2013; Billio et al., 2017). The stock exchange literature employs a range of methodologies to evaluate integration levels, volatility spillovers, and diversification dynamics before and after the introduction of integration initiatives. For example, Espinosa-Méndez et al. (2017), studying the Latin American Integrated Market (MILA), found that integration produced short-term benefits but that these gains tended to dissipate in the longer term. Similarly, Jiang et al. (2017) analysed interdependence and lag–lead relationships among ASEAN trading link participants between 2009 and 2016, underscoring the complex dynamics of regional stock market integration. Within the SEE region, several scholars have analysed the degree of integration among stock markets of SEE Link countries (Zdravkovski, 2016; Stoykova & Paskaleva, 2018; Pirgaip et al., 2021).

Park (2013, p. 15) emphasizes that "the greater the degree of financial integration, the more closely correlated the movements of prices of assets of similar risk profiles." Consistent with this view, Espinosa-Méndez et al. (2017) assessed financial integration through time-varying

correlations of market returns, employing the dynamic conditional correlation (DCC) model–a widely recognized approach for capturing evolving co-movements.

Accordingly, our second research question (RQ2) is addressed through two complementary perspectives:(i) *RQ2a: Have stock index returns become more closely correlated following the participation of exchanges in SEE Link in the short term? (ii) RQ2b: Have the values of stock indices exhibited stronger long-term cointegration since the participation of exchanges in SEE Link?*

To investigate these questions, we examine stock market co-movements among the six SEE Link member countries over the period 2011–2019. For RQ2a, we focus on natural logarithmic returns of stock indices, using a combination of statistical approaches: static Pearson correlation to capture general relationships and Engle's (2002) DCC model to analyse short-term dynamics. For RQ2b, we retain the index levels in natural logarithms and apply the Johansen cointegration framework to assess long-term equilibrium relationships among the markets. *Our hypothesis is that, following SEE Link participation, markets with the return of similarly risk-profiled indices have become more closely correlated in the short run, and index levels in natural logarithms demonstrate stronger long-term co-movement, reflecting a higher degree of financial integration in the region.*

The remainder of this article is organized as follows. Section 2 reviews the relevant literature, focusing on the relationship between capital markets and economic growth, the degree of stock market integration, and the SEE Link trading initiative. Section 3 provides an overview of the participating countries and introduces the SEE Link project. Section 4 describes the data and variables used in the analysis. Section 5 presents the empirical methodology and results, beginning with the DID analysis, followed by correlation and cointegration tests between the return and the natural logarithm level of indices of participating stock exchanges. Finally, Section 6 concludes by summarizing the key findings, discussing implications for policymakers and future research, and highlighting the study's limitations.

## Selected Literature Review

### Relationship between Capital Market and Economic Growth

Scholars have long examined the relationship and causality between financial system development and economic growth. Levine (2004) reviewed research on the links between financial system operations and economic growth. His study also addressed the debated question of the relative merits of capital market-based systems, characteristic of Anglo-Saxon economies, versus bank-based systems. During economic development, the respective functions of banks and securities markets are subject to structural evolution. "As countries develop economically, (1) the size of both banks and securities markets increases relative to the size of the economy, (2) the association between an increase in economic output and an increase in bank development becomes smaller, and (3) the association between an increase in economic output and an increase in securities market development becomes larger" (Demirgüç-Kunt et al., 2012, p. 1).

More recently, Molnár & Csiszárik-Kocsir (2022) found that stock markets can serve as leading indicators of economic activity. Empirical results indicate that the growth of the BUX index Granger-caused the expansion of the Hungarian economy. The literature also examines the relationship between varying degrees of capital market integration and economic growth. The deeper integration of capital markets in the European Union is necessary to support accelerated economic growth (Orlowski, 2020).

### The Degree of Financial Integration and Its Benefits

Park (2013) notes that financial integration lacks a universally agreed-upon definition or unique quantitative metric, yet it is commonly associated with financial openness and the mobility of capital. De jure measures capture legal restrictions, whereas de facto measures are commonly classified as either price-based or quantity-based: the latter capture actual financial flows and cross-border asset holdings, whereas the former rely on the "law of one price," under which greater integration is reflected in stronger correlations among asset prices with comparable risk profiles. Billio et al. (2017) add a third category: regulatory or institutional measures.

Both short-term and long-term welfare improvements may arise from financial integration. Higher integration enhances risk-sharing, allows for more efficient consumption smoothing, lowers trading costs, diversifies investor portfolios, and can stabilize consumption patterns (Espinosa-Méndez et al., 2017; Park, 2013). Financial integration also enables domestic investment to be funded externally, directing capital from surplus to deficit countries and, in principle, raising returns in the latter. However, increasing global integration reduces the benefits of international portfolio diversification due to stronger cross-country correlations and may limit the effectiveness of domestic policy (Billio et al., 2017).

Park (2013) identifies two main reasons capital does not always flow to capital-scarce countries. First, capital market imperfections and differing stages of financial development cause flows to respond to risk-adjusted rather than nominal returns; higher perceived risk in capital-scarce countries reduces actual flows. Second, institutional factors such as property rights protection, corruption, government stability, and bureaucratic quality further impede capital movement. Integration also increases risk through asset price volatility and potential abrupt reversals in capital flows (Martin & Taddei, 2013).

### Integration via Trading link

Several cross-border stock market initiatives provide insights into the effects of integration on market co-movement and diversification opportunities. The Latin American Integrated Market (MILA), created by the exchanges of Colombia, Chile, and Peru in 2009 and

joined by Mexico in 2014, officially began operations in 2011 as the second-largest market in Latin America. Espinosa-Méndez et al. (2017) used a dynamic conditional correlation (DCC) model and found that MILA increased return correlations among member countries, primarily due to higher trading volumes in the least developed markets. While short-term benefits were evident, long-term gains in returns and risk metrics dissipated over time, and trading volumes were negatively affected.

Similarly, the Shanghai-Hong Kong Stock Connect led to greater financial liberalization and increased volatility spillovers from Shanghai to Hong Kong, improving integration but reducing diversification benefits (Huo & Ahmed, 2017). The ASEAN Trading Link, launched in 2012 among Malaysia, Singapore, and Thailand, operated until 2017. Jiang et al. (2017) found that interdependence among ASEAN markets was strongest in the short term, especially following external shocks, and co-movement effects diminished within approximately two years.

In Europe, the CEE Stock Exchange Group (CEESEG) integrated the Budapest, Ljubljana, Prague, and Vienna exchanges, mainly through shared IT systems, branding, and data dissemination. Following the sale of the Budapest and Ljubljana exchanges in 2015, co-movement among the remaining exchanges continued to be high, thereby limiting diversification opportunities (Reboredo et al., 2015).

The South-Eastern Europe Link (SEE Link) connects six regional stock exchanges to facilitate cross-border trading. Pirgaip et al. (2021) employed various methodologies, including dynamic correlation models and regression analyses, utilizing daily returns from the Zagreb and Bulgarian exchanges (2005–2019). They found decreasing correlations over time, indicating the existence of diversification opportunities. Stoykova & Paskaleva (2018) examined the interactions among Bulgaria, Serbia, Slovenia, Romania, Montenegro, North Macedonia, Banja Luka, and Sarajevo, along with three reference markets, over the period 2005–2015. Through the application of VAR methodology, supported by variance decomposition and impulse response functions, evidence was found of weak to moderate positive linkages between the capital markets of Turkey, Greece, and Croatia and the other markets analysed. The results additionally indicate that the Bulgarian equity market is highly correlated with other Southeast European markets, notably Serbia, Romania, and Croatia. Similarly, Zdravkovski (2016) investigated the short- and long-term linkages among the Macedonian, Croatian, Slovenian, Serbian, and Bulgarian stock markets from 2005 to 2015, with a particular focus on the impact of the 2008 financial crisis. The study segmented the period into three phases: pre-crisis, crisis, and post-crisis. Johansen's co-integration test revealed evidence of co-integration during the 2008 financial crisis; three co-integration vectors emerged. These findings suggest that the global financial crisis (GFC) and the subsequent euro crisis strengthened the interconnection among the examined Balkan stock markets.

## SEE LINK

### Overview of the SEE Link Countries

The SEE Link countries share a common legacy of transitioning from command to market economies during the 1990s. Prior to the GFC, these markets attracted substantial foreign investment. By 2008, foreign banks- predominantly Western European institutions- controlled over 80% of banking sector assets (Arakelyan, p. 42018). Foreign portfolio investors, mainly from Europe and the United States, were also active and dominated the stock markets. This inflow of foreign capital contributed to financial development, facilitated technology transfer, and enhanced financial literacy across the region.

However, the 2008 financial crisis exposed the vulnerability of these markets. Foreign investors experienced substantial losses and reduced exposure by selling assets, which contributed to a decline in stock exchange indicators. Market growth prior to the crisis largely reflected speculative activity rather than fundamental economic improvements (Rakocevic, 2016). Based on data from the World Bank Development Indicators Database, portfolio equity net inflow– particularly in equities–declined sharply following the global financial crisis. In Serbia, for instance, foreign participation in the stock exchange fell from about 50% before the crisis to just 10% in 2021. By contrast, foreign direct investment (FDI) has remained relatively stable and even increased during the COVID-19 pandemic. In 2021, Serbia recorded the highest inflows (USD 4.07 billion), while Bosnia and Herzegovina and North Macedonia received the lowest (approximately USD 0.6 billion each). Unlike portfolio equity investment, FDI plays a crucial role for non-financial corporations by providing long-term capital and managerial expertise.

Despite improvements in macroeconomic indicators over the past decade, structural challenges persist in the region. Real GDP growth has remained positive, averaging above 2%, and GDP per capita has increased, with Croatia and Slovenia achieving the highest levels (USD 17,700 and USD 29,100, respectively, in 2021). Institutional indicators, such as the Rule of Law and the Corruption Perceptions Index, have shown modest progress; however, non-EU countries continue to lag behind EU benchmarks. Credit ratings for EU member states (Bulgaria, Slovenia, and Croatia) are generally within the investment-grade category, whereas those for non-EU countries remain below investment grade.

Capital markets in the region stay underdeveloped, with only a limited number of Initial Public Offerings (IPO) conducted annually. Non-financial corporations continue to rely predominantly on bank financing. Market capitalization as a share of GDP is well below the EU average of 54.2%, ranging from 33% in Croatia to 10% in Serbia and 13% in Slovenia. Market liquidity is low, with annual turnover as a share of capitalization below 10% in most markets, creating a self-reinforcing cycle of limited investor participation (Reininger & Walko, 2020). The pension fund to GDP indicator was relatively high in

Croatia (33.79%), Bulgaria (14.42%), and Slovenia (8%), but in the case of Serbia, it was 0.85% in 2020.

Currency volatility generally has a restricted effect on stock markets, except in Serbia and, historically, in Croatia. Several countries exhibit de facto or de jure euroization: Bosnia & Herzegovina and Bulgaria peg their currencies to the euro; Croatia adopted the euro in 2023; North Macedonia's denar is pegged to the euro; and Serbia operates a managed floating regime with central bank interventions (Országhova, 2015).

Overall, while the SEE Link countries have experienced macroeconomic and institutional improvements over the past decade, capital markets remain shallow, illiquid, and highly dependent on foreign investors.

### SEE Link Platform

Since the transition to market economies, the European Bank for Reconstruction and Development (EBRD) has played a key role in supporting the development of financial markets in the Western Balkans (EBRD, 2016). Despite these efforts, capital markets in the region remain underdeveloped. To address these challenges, the EBRD supported regional integration efforts through its "Local Currency and Capital Markets Initiative", which led to the establishment of the SEE Link platform. The EBRD provided a €540,000 grant to implement an electronic order routing system, enabling trading across multiple markets and improving access to integrated capital markets for investors and local brokers (SEE LINK, 2025c). SEE Link was initially established in 2014 by three stock exchanges: Bulgaria, Croatia, and North Macedonia. The company, SEE Link d.o.o., is headquartered in Skopje, with each founding exchange holding 33.33% of the €80,000 share capital. Governance has included representatives from the Bulgarian, Croatian, and Macedonian exchanges, with subsequent participation by the Belgrade (Serbia), Ljubljana (Slovenia), Banja Luka, and Sarajevo exchanges in 2015. The Zagreb Stock Exchange later acquired full ownership of the Ljubljana Stock Exchange and nearly 30% of the Macedonian Stock Exchange (ZSE,2015).

Operations began in March 2016, alongside the launch of two regional indices, SEE LinX and SEE LinX EWI, which track the ten most actively traded companies from participating exchanges. The indices initially included companies from Croatia, Bulgaria, Macedonia, Slovenia, and Bosnia & Herzegovina (EBRD, 2016). In May 2020, SEE Link launched the Listed SME Research Hub, funded by the Taiwan-Business EBRD Cooperation Fund, to enhance research coverage of small and medium-sized enterprises.

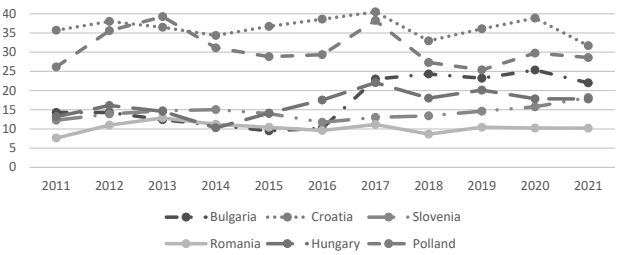
As of 2021, SEE Link connects seven stock exchanges, with a combined market capitalization exceeding USD 50 billion and over 1,200 listed securities. Cross-border transactions are executed through authorized brokers, while central securities depositories remain unlinked; settlement and clearing are facilitated by brokers. The platform aims to support investor diversification in Southeast Europe by increasing cross-border visibility and investment options. In 2018, SEE Link entered a strategic partnership with Raiffeisen Bank International, whose GSS Operations Centre provides settlement services for trades executed on the platform (SEE Link, 2025a). *As of September 2025, the latest available monthly statistics remain those of June 2023 (*SEE Link, 2025b)*; no subsequent data have been released*. Moreover, no information is available regarding the indices, including SEE LinX and SEE LinX EWI.

## Dataset

This study addresses two main research questions. The first is: "*How have the SEE Link stock exchanges evolved since their integration?*" To answer this, we rely on annual indicators of financial market development: (i) stock market capitalization to GDP (DM1), (ii) total value traded to GDP (DM2), (iii) stock market turnover ratio (EM1), and (iv) portfolio equity, net inflow (Portfolio). Annual data for DM1, DM2, and EM1, covering the period from 2011 to 2021, were obtained from the World Bank's Global Financial Development Database (World Bank, 2022). Portfolio equity net inflow data were sourced from the World Development Indicators Database (World Bank Group, 2025). Where gaps existed–such as stock turnover, capitalization, or IPO activity–supplementary information was collected from stock exchange annual reports, Trading Economics, and CEIC. These annual series provide harmonized, cross-country measures of long-term capital market development and were essential for the application of the difference-in-differences (DID) methodology. Figure 1 presents the most important indicator of the stock market, namely, stock market capitalization to GDP, for the period 2011–2021.

Figure 1

**The Stock Market Capitalization to GDP from 2011 to 2022**




*Source: World Bank Group (2022), own elaboration*

Two complementary perspectives are employed to examine the second research question. The short-term perspective asks whether stock index returns have become more closely correlated following the participation of exchanges in SEE Link. The long-term perspective investigates whether the values of stock indices exhibit stronger cointegration since the exchanges joined the platform. To examine these questions, we use daily closing price indices from Refinitiv/Eikon for seven markets: Serbia (BELEX15), Croatia (CROBEX), Bulgaria (SOFIX), Slovenia (SBI TOP), Bosnia and Herzegovina (SASX 10

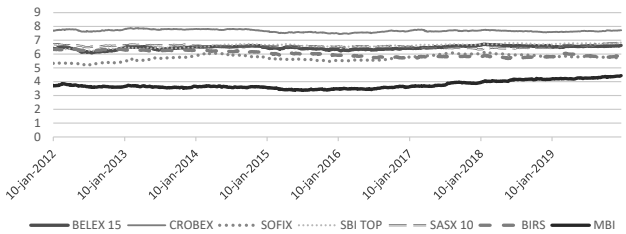
and BIRS), and North Macedonia (MBI). Basic information on Southeastern European stock markets is provided in Table 7 in the Appendix. National stock indices typically comprise large, liquid companies across diverse sectors, including telecommunications, banking, utilities, mining, oil and gas, and pharmaceuticals. The number of firms included in these indices is relatively small in most countries, ranging from approximately 9 to 22 (Horvath & Petrovski, 2013). The sample period spans 2012–2019, providing consistent, high-frequency data that capture market dynamics without major external disruptions such as the COVID-19 pandemic.

For RQ2a, we calculate logarithmic returns, defined as the first differences of the natural logarithms of the index values. This transformation produces stationary series that are suitable for correlation analysis and reveal short-run co-movements among markets. For RQ2b, we retain the index levels in natural logarithms to assess long-term equilibrium relationships through Johansen cointegration tests. This approach allows us to investigate whether SEE Link participation strengthened structural integration across regional stock markets.

Daily observations are particularly valuable, as they capture both short-term interactions and the potential for long-run linkages. Figure 2 illustrates the natural logarithmic daily returns of SEE Link member stock indices from January 2012 to December 2019.

Figure 2

**Natural Logarithms of the Stock Exchange Indices of SEE Link members, from 2012 to 2019.**




*Source: Refinitiv/Eikon, own elaboration*

A key challenge was ensuring the consistency and high quality of cross-country data, which required supplementing official sources with databases and annual reports. Combined, the datasets offer complementary insights: annual indicators (2011–2021) capture the structural evolution of the market, while the daily series (2012–2019) reveal short-run interdependencies and long-run integration.

## Methodology and Empirical Results

### The impact of SEE Link Development on the Stock Exchanges

To address the first research question– *"How have the SEE Link stock exchanges evolved since their integration?"* –we employ a difference-in-differences (DID) framework, comparing temporal changes between SEE Link participants and a control group of comparable CEE EU member states. The treatment group consists of Slovenia, Croatia, and Bulgaria, selected based on their participation in the SEE Link, EU membership, and the availability of complete data. The control group includes Hungary, Poland, and Romania, which, although not members of the SEE Link, share EU membership as well as comparable historical and institutional characteristics. The primary outcome variables are stock market capitalization to GDP (DM1), total value traded to GDP (DM2), the stock market turnover ratio (EM1), and portfolio equity net inflow (portfolio). The analysis is divided into two periods: the pre-SEE Link period (2011–2015) and the SEE Link period (2016–2021), with 2016 marking the start of SEE Link operations. The dataset is compiled from multiple sources, and descriptive statistics for the variables are presented in Table 1.

Table 1

**Descriptive Statistics of Stock Market Indicators**

| | Observation | | Mean | | St. Deviation | |
|---|---|---|---|---|---|---|
| | Before 2016 | After 2016 | Before 2016 | After 2016 | Before 2016 | After 2016 |
| **Treated group** | | | | | | |
| DM1 | 18 | 15 | 20.8 | 24.1 | 11 | 10.1 |
| DM2 | 18 | 15 | 0.9 | 0.48 | 0.38 | 0.23 |
| EM1 | 18 | 15 | 4.4 | 2.5 | 2.3 | 1.8 |
| Portfolio | 18 | 15 | -1.0 | 1.0 | 2.38 | 1.69 |
| **Controlled group** | | | | | | |
| DM1 | 18 | 15 | 18.8 | 19.1 | 10.3 | 8.7 |
| DM2 | 18 | 15 | 7.0 | 6,1 | 5 | 4.6 |
| EM1 | 18 | 15 | 34.1 | 26.1 | 22 | 13.0 |
| Portfolio | 18 | 15 | -3.53 | 3.66 | 7.39 | 6.51 |

*Source: World Bank (2022), own elaboration*

For the treated group, the stock market capitalization-to-GDP ratio (DM1) increased on average from 20.8% in the pre-2016 period to 24.1% after 2016. By contrast, the stock market total value traded-to-GDP ratio (DM2) declined from 0.9% to 0.48%. Similarly, the stock market turnover ratio (EM1) decreased from 4.4% to 2.5%, indicating a reduction in market liquidity. Portfolio equity net inflow, however, improved, shifting from a negative average value (–1.0) before 2016 to a positive value (1.0) in the subsequent period. In the control group, DM1 remained broadly stable (18.8% to 19.1%), while DM2 declined from 7.0% to 6.1%. Market turnover (EM1) also fell sharply, from 34.1% to 26.1%. Portfolio equity net inflow rose markedly, increasing from –3.53 to 3.66. These preliminary findings are partly consistent with our hypothesis that integration through the SEE Link exerts a positive influence on market capitalization and "portfolio equity net inflow" in the treated countries.

We first estimate DID models using the raw levels of each indicator to assess the absolute effects of SEE Link integration. To capture proportional changes, we then measure relative growth dynamics using the natural log differences of the indicators (LDM1, LDM2, and EM1). Finally, to account for macroeconomic conditions, we extend the DID specifications by including GDP growth as a control variable, isolating the effect of SEE Link from broader economic fluctuations. All models incorporate country and time fixed effects to absorb unobserved heterogeneity and common shocks, with standard errors clustered at the country level to address serial correlation. This sequential approach–levels, log-differences, and GDP controls–ensures robustness and allows evaluation of both absolute and relative changes in market development associated with SEE Link integration.

To verify the credibility of the DID design, we conduct a placebo (falsification) test by assigning a fictitious pre-treatment period before the actual introduction of SEE Link. If the parallel trends assumption holds, the interaction term in this placebo specification should be statistically insignificant, indicating that treated and control countries evolved similarly prior to SEE Link integration. We employed Stata 18. Although relatively small (66 observations, six clusters), the dataset is well-suited for DID estimation using Stata's didregress command. The panel structure enables the exploitation of both cross-country and temporal variation, providing meaningful insights; however, caution is warranted when interpreting cluster-robust standard errors with a small number of clusters.

Formally, the DID specification is given by:

$$Y_{it}=\alpha+\beta(Treated_i\times Post_t)+\gamma Treated_i+\delta Post_t+X_{it}+\mu_i+\lambda_t+\varepsilon_{it} \quad (1)$$

- $Y_{it}$: outcome of interest (DM1, DM2, EM1, Portfolio) for country i at time t.
- $Treated_i$: binary indicator equal to 1 if country i belongs to the treatment group (β: effect of SEE Link integration), zero otherwise.
- $Post_t$: binary indicator equal to 1 for periods after the introduction of SEE Link, and 0 for pre-integration periods (γ: pre-existing level differences between groups).
- $Treated_i \times Post_t$: DID interaction term, capturing the effect of SEE Link integration( δ: common time shocks after integration).
- $X_{it}$: vector of control variables (GDP growth).
- $\mu_i$: denotes country fixed effects, absorbing time-invariant heterogeneity across countries.
- $\lambda_t$: denotes time fixed effects.
- $\varepsilon_{it}$: idiosyncratic error term.

Table 2 presents the DID estimates for key financial indicators, both in their original levels and log-transformed forms, with and without controlling for GDP growth. Overall, the results provide mixed evidence, with several outcomes being sensitive to model specification, particularly the inclusion of GDP as a control variable. For *market capitalization to GDP (DM1)*, both the level and log specifications yield small, positive coefficients, but none reach statistical significance ($p > 0.16$). This suggests that while the point estimates indicate a modest upward effect, there is no robust evidence that the treatment has a material influence on market capitalization. Turning to *the total traded value to GDP (DM2) ratio*, the level specification initially shows a positive and statistically significant effect ($p < 0.001$) when GDP is not controlled for. However, once GDP is included, the effect weakens and loses significance ($p = 0.28$). The log specification consistently produces minor, non-significant effects across models. These patterns indicate that the initial significance in DM2 is likely attributable to GDP-related confounding rather than a genuine treatment effect.

For the *turnover ratio (EM1)*, the level specification suggests a significant positive effect in the absence of GDP controls ($p < 0.001$). However, the effect becomes non-significant when GDP is included, with considerably larger standard errors. By contrast, the log specification shows consistent positive effects, with statistical significance achieved once GDP is controlled ($p = 0.034$). This provides relatively more robust evidence among the outcomes: EM1 appears to increase meaningfully in percentage terms, and this effect remains robust under the preferred log specification. For the portfolio, we do not report a log specification; the level results are unstable–positive but non-significant without GDP ($p = 0.22$) and negative with GDP, remaining highly uncertain with wide

Table 2

**DID Results**

| Outcome | Type | DID Coefficient (No GDP) | Std. Error | p-value | DID Coefficient (GDP controlled) | Std. Error | p-value |
|---|---|---|---|---|---|---|---|
| DM1 | Level | 2.49 | 3.51 | 0.509 | 2.86 | 3.47 | 0.448 |
| LDM1 | Log | 0.127 | 0.092 | 0.272 | 0.142 | 0.088 | 0.166 |
| DM2 | Level | 0,47 | 0.69 | <0.001 | 0.547 | 0.448 | 0.277 |
| LDM2 | Log | 0.030 | 0.078 | 0.712 | 0.082 | 0.067 | 0.279 |
| EM1 | Level | 6.4 | 2.82 | <0.001 | 6.72 | 7.53 | 0.413 |
| LEM1 | Log | 0.0549 | 0.0445 | 0.272 | 0.090 | 0.031 | 0.034 |
| Portfolio | Level | 12.69 | 9.07 | 0.221 | -1.5e9 | 3.10e9 | 0.562 |

*Source: World Bank (2022), own elaboration*

confidence intervals. This instability suggests that portfolio outcomes are not reliably affected by the treatment and are highly sensitive to macroeconomic conditions. Overall, the turnover ratio (EM1) emerges as the most reliable indicator of SEE Link's impact. While descriptive statistics show a decline in turnover across both groups, the DID results indicate that integration mitigated this decline among treated countries.

### The Co-movement of the Stock's Return

For our econometric analysis, daily returns are defined as the continuously compounded rate of return for country *i* at time *t* (Horvath &Petrovski, 2013). The sample covers two four-year periods, comprising 865 observations from 2012 to 2015 and 854 observations from 2016 to 2019. Descriptive statistics and preliminary test results for the return series are presented in Table 3.

The results show that index returns are negatively skewed during both periods for BELEX15, SBITOP, SASX10, and BIRS. In both periods, the distributions are leptokurtic, further indicating departures from normality. Stationarity was examined using the Augmented Dickey–Fuller (ADF) test. Across both subperiods, the null hypothesis of a unit root is rejected at the 5% significance level, confirming that all return series are stationary. To assess the presence of white noise, the Portmanteau (Q) statistic was applied. The null hypothesis of white noise is rejected for BELEX, SOFIX, and BIRS during the period 2012–2015 at the 5% significance level, whereas for other cases, the null hypothesis cannot be rejected. This suggests that the series generally do not behave as pure white noise processes. Overall, the evidence confirms that the return series exhibit the standard stylized features of financial time series: non-normality, stationarity, and limited evidence of white noise

Table 3

**Descriptive Statistics of Return**

| | Mean | | Standard Deviation | | Skewness | | Kurtosis | | ADF Test lag 1 | | Portmanteau (Q) statistic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012-2015 | 2016-2019 | 2012-2015 | 2016-2019 | 2012-2015 | 2016-2019 | 2012-2015 | 2016-2019 | 2012-2015 | 2016-2019 | 2012-2015 | 2016-2019 |
| *BELEX15* | -.005 | .032 | 1.00 | .847 | -0.039 | -.183 | 4.66 | 6.155 | -10.719 | -21.175 | 79.4 | 50.5* |
| *CROBEX* | -.019 | .022 | 0.83 | .784 | 0.69 | -.265 | 8.295 | 5.954 | -11.457 | -21.318 | 41.6* | 30.6* |
| *SOFIX* | .027 | .021 | 1.108 | .831 | .058 | -.208 | 6.172 | 6.845 | -11.742 | -19.862 | 64,46 | 38,0* |
| *SBITOP* | .024 | .037 | 1.05 | .633 | -.016 | .171 | 4.997 | 6.342 | -13.658 | -19.692 | 36.3* | 38,7* |
| *SASX 10* | -.019 | .021 | .763 | .935 | -.219 | -.101 | 8.86 | 10.176 | -13.276 | -21.011 | 40,6* | 49.5* |
| *BIRS* | -.050 | -.006 | .972 | 1.089 | -.155 | -.192 | 6.423 | 9.510 | -13.721 | -20.964 | 96,3 | 35.9* |
| *MBI* | -.027 | .108 | .961 | .901 | .612 | .471 | 8.069 | 6.864 | -10.772 | -19.860 | 40.4* | 45,1* |

*Source: own elaboration*

Table 4

**Pearson Correlation**

| 2012-2015 | Belex15 | CROBEX | SOFIX | SBITOP | SASX10 | BIRS | MBI |
|---|---|---|---|---|---|---|---|
| BELEX15 | 1 | | | | | | |
| CROBEX | 0.45*** | 1 | | | | | |
| SOFIX | 0.37*** | 0.43*** | 1 | | | | |
| SBITOP | 0.10 | 0.18 | 0.11 | 1 | | | |
| SASX10 | 0.04 | 0.04 | -0.06 | -0.04 | 1 | | |
| BIRS | 0.09 | 0.10 | 0.89 | 0.016 | 0.054 | 1 | |
| MBI | 0.26 | 0.29 | 0.28 | -0.00 | 0.02 | 0.15 | 1 |
| *2016-2019* | Belex15 | CROBEX | SOFIX | SBITOP | SASX10 | BIRS | MBI |
| BELEX15 | 1 | | | | | | |
| CROBEX | 0.41*** | 1 | | | | | |
| SOFIX | 0.40*** | 0.44*** | 1 | | | | |
| SBITOP | 0.12 | 0.18 | 0.11 | 1 | | | |
| SASX10 | -0.02 | -0.02 | -0.02 | 0.01 | 1 | | |
| BIRS | 0.05 | 0.05 | 0.10 | -0.05 | 0.04 | 1 | |
| MBI | 0.30 | 0.32 | 0.29 | 0.04 | -0.00 | 0.03 | 1 |

*Source: own elaboration *** significant 1%*

behavior. We investigate market co-movements using two complementary approaches: (i) static Pearson correlations, (ii) Dynamic Conditional Correlation (DCC) models. We hypothesize that correlations between stock market returns increased in the latter period, reflecting closer integration following the implementation of the SEE Link.

## Pearson correlations

To examine short-term interdependencies among SEE stock markets, we first compute *unconditional (Pearson) correlations* of daily stock index returns. While the normality assumption is not fully satisfied, the large number of observations (865 in the first period; 850 in the second period) ensures that the Pearson correlation estimates remain robust (Cohen et al., 2009).

Table 4 reports the Pearson correlations for 2012–2015 and 2016–2019. During 2012–2015, correlations were generally weak, indicating limited pre-SEE Link integration. The strongest relationships were observed between BELEX15–CROBEX and CROBEX–SOFIX, whereas MBI exhibited lower-than-average positive correlations with other indices. Following the implementation of the SEE Link (2016–2019), correlations did not increase substantially. BELEX15 correlations weakened, while CROBEX, SOFIX, and MBI showed slight improvements, suggesting a limited impact of SEE Link on unconditional short-term co-movement.

## Dynamic Conditional Correlations

To capture time-varying interdependencies among SEE stock markets, we estimate a Dynamic Conditional Correlation (DCC) model following Espinosa-Méndez et al. (2017), Horváth & Petrovski (2013), and Gjika & Horváth (2013). Table 5 reports the estimated conditional correlations, with statistical significance evaluated using Wald tests (insignificant correlations unmarked).

The results reveal heterogeneous and generally weak short-term linkages. BELEX15, CROBEX, SOFIX, and MBI exhibit several significant conditional correlations, suggesting partial co-movement, whereas SASX10 remains entirely disconnected from the region. SBI TOP and BIRS show only sporadic significant linkages, underscoring the incomplete nature of regional integration. Overall, these findings indicate that short-term co-movements remain fragmented, consistent with the static Pearson correlations, and that the SEE Link has not generated strong convergence in the market's return dynamics.

## Johansen multivariate cointegration test

To investigate long-run interdependence among SEE stock markets, we employ the Johansen multivariate cointegration test within a Vector Error Correction Model (VECM) framework, based on the natural logarithms of the stock indices. The VECM framework allows us to capture both long-term equilibrium relationships and short-term deviations, providing a comprehensive picture of inter-market linkages. Prior to cointegration analysis, we test for stochastic non-stationarity using the Augmented Dickey-Fuller (ADF) unit root test. The results indicate that the natural logarithm level of all stock indices–BELEX15, CROBEX, SOFIX, SBITOP, SASX10, BIRS, and MBI–are non-stationary in levels but stationary in first differences across both periods (2012–2015 and 2016–2019). This confirms that all series follow a unit root process (I(1)), and first differencing is required for VAR modeling. These findings are consistent with Zdravkovski (2016), who documented similar behavior in SEE stock markets.

The VECM is specified as:

$$\Delta Y_t = \Pi Y_{t-1} + \sum \Gamma_i \Delta Y_{t-i} + \mu + \varepsilon_t \quad (2)$$

where

- $\Delta Y_{t:}$ $Y_t - Y_{t-1} \rightarrow$ the first difference of the vector of index returns
- $Y_{t-1:}$ vector of stock index levels at the previous time step.
- $\Pi$: matrix that captures the long-run relationships among the variables.
- $\Gamma_i$ : matrices capturing short-term interactions among the variables. (Zdravkovski, 2016).
- $Y_{t-i:}$ lagged changes in the stock indices.
- $\mu$: vector of constants, accounting for fixed trends or mean levels in the data.
- $\varepsilon_t$: residual or shock term,

The rank of $\Pi$ indicates the number of cointegrating vectors, reflecting the number of long-run equilibrium relationships. Optimal lag length for the VAR component of the VECM was determined using AIC, HQIC, FPE, and

Table 5

**Summary of Conditional Correlations from the DCC model**

| | BELEX 15 | CROBEX | SOFIX | SBI TOP | SASX 10 | BIRS | MBI |
|---|---|---|---|---|---|---|---|
| BELEX 15 | 1.00 | | | | | | |
| CROBEX | 0.45*** | 1.00 | | | | | |
| SOFIX | 0.41*** | 0.48*** | 1.00 | | | | |
| SBI TOP | 0.15*** | 0.19*** | 0.14*** | 1.00 | | | |
| SASX 10 | 0.03 | 0.01 | -0.01 | -0.01 | 1.00 | | |
| BIRS | 0.09*** | 0.11*** | 0.12*** | 0.00 | 0.02 | 1.00 | |
| MBI | 0.32*** | 0.32*** | 0.31*** | 0.06 | 0.03 | 0.12*** | 1.00 |

*Source: owned elaboration Notes: *** significant at 1%*

likelihood ratio tests, consistently suggesting one lag. This indicates that a first-order VAR adequately captures short-term dynamics among the indices, ensuring that the VECM specification is well-posed.

Table 6 presents the results of the Johansen cointegration tests with a constant trend. Both the trace and maximum eigenvalue statistics fail to reject the null hypothesis of zero cointegrating vectors at the 5% significance level in either period (2012–2015 and 2016–2019). This suggests that no stable long-run equilibrium relationships exist among the SEE stock indices over the examined periods.

Table 6

**Result of the Johansen Co-integration Test**

| Panel | Eigenvalue | Trace Test | Critical Value | Max test | Critical Value | Eigenvalue | Trace Test | Critical Value | Max test | Critical Value |
|---|---|---|---|---|---|---|---|---|---|---|
| *Panel 2012-2015* | | | 5% | | 5% | *Panel 2016-2019* | | | | |
| R=0 | | 105* | 124 | 33 | 41 | | 95* | 124 | 24 | 45 |
| R=1 | 0.04 | 73 | 94 | 25 | 36 | 0.03 | 69 | 94 | 21 | 39 |
| R=2 | 0.03 | 47 | 68 | 19 | 30 | 0.02 | 48 | 68 | 20 | 33 |
| R=3 | 0.02 | 28 | 47 | 14 | 23 | 0.02 | 28 | 47 | 12 | 27 |
| R=4 | 0,02 | 14 | 29 | 9 | 17 | 0,01 | 15 | 29 | 10 | 20 |
| R=5 | 0.01 | 5 | 15 | 5 | 11 | 0.01 | 6 | 15 | 6 | 14 |
| R=6 | 0.01 | 1 | 3.7 | 1 | 3 | 0.01 | 0 | 3.7 | 0 | 3.76 |
| R=7 | 0 | | | | | 0 | | | | |

*Notes: R denotes the number of cointegrating vectors. Trace and maximum eigenvalue statistics are compared with 5% critical values. Source: own elaboration*

These results indicate that while SEE stock indices may show weak short-term co-movements (as indicated by Pearson and DCC correlation analyses), they do not share stable long-run relationships. The absence of cointegration suggests that short-term shocks dominate, and long-term market integration remains limited. The introduction of the SEE Link trading platform in 2016 did not materially alter this pattern; neither the number nor the strength of cointegrating relationships increased post-2016.

## Discussion and Conclusion

Harmonized with the EU Capital Markets Union Action Plan, the EBRD supported the creation of the SEE Link trading platform to strengthen local capital markets in Southeastern Europe, where small exchanges, following the Global Financial Crisis (GFC), lacked sufficient depth and resilience to attract foreign investors. This study evaluates the impact of SEE Link on market development and financial integration among its partner stock exchanges.

Regarding market evolution, difference-in-differences analysis indicates that SEE Link member countries (Slovenia, Croatia, and Bulgaria) experienced modest improvements relative to the control group (Hungary, Romania, and Poland). Stock market capitalization to GDP and total value traded to GDP showed no statistically significant changes after SEE Link introduction, even when controlling for GDP growth. By contrast, turnover ratios exhibited a small but significant increase in relative trading activity, suggesting incremental gains in market liquidity. Portfolio equity net inflows remained largely unaffected. Overall, the hypothesis is partially supported: SEE Link appears to have modestly enhanced trading activity but has not generated transformative improvements in market depth or cross-border investment.

Short-term co-movements of returns among SEE stock markets remain weak to moderate. Pearson correlations indicate limited pre- and post-SEE Link integration, with the strongest linkages observed among CROBEX, SOFIX, and BELEX15, whereas SASX10 remains largely isolated. Dynamic Conditional Correlation estimates reinforce this heterogeneity, showing partial co-movement primarily among larger exchanges, while smaller or less liquid markets remain disconnected.

Long-term relationships, assessed via Johansen cointegration tests, indicate that SEE stock indices do not share stable long-run equilibrium relationships in either 2012–2015 or 2016–2019, as trace and maximum eigenvalue statistics fail to reject the null of zero cointegrating vectors. This suggests that short-term co-movements may occur, but long-term interdependence is weak, and the SEE Link platform has not materially strengthened integration. Consequently, the hypothesis that SEE Link participation would enhance both short- and long-term co-movement must be rejected. These findings align with Zdravkovski (2016), who documented temporary cointegration among Balkan markets during the 2008 financial crisis, indicating that systemic shocks can strengthen linkages, whereas structural factors continue to limit long-term integration under normal conditions.

Several factors may explain the limited impact of SEE Link. Key determinants of market attractiveness, including credit ratings, the rule of law, corruption levels, and GDP growth, remain relatively low. Market capitalization is stagnant, and in some markets (e.g., Croatia), free float is limited. Structural and technical barriers–including high transaction costs, fragmented clearing and settlement systems, divergent regulations, and multiple currencies–further constrain integration. Limited visibility, data access,

and maintenance of the SEE Link platform and its associated indices have also reduced practical engagement, with the platform providing no updated information since June 2023.

This study has several limitations. First, the analysis relies on a constrained set of quantitative measures, primarily stock market indices, which may not fully capture broader market dynamics. Second, data availability for smaller SEE exchanges is limited, restricting both temporal coverage and cross-country comparability. Third, the study focuses on relatively short pre- and post-SEE Link periods (2012–2015 vs. 2016–2019), which may not capture longer-term effects or high-frequency dynamics. Finally, qualitative factors such as institutional coordination, regulatory enforcement, and investor sentiment were not directly assessed, potentially overlooking important drivers of market integration.

Future research could address these gaps by incorporating institutional and qualitative dimensions, including interviews, surveys, and case studies with market participants, regulators, and institutional investors, to better understand operational, regulatory, and behavioral barriers to integration.

To strengthen regional integration and attract long-term capital, policymakers should pursue a comprehensive strategy. Regulatory harmonization, aligning clearing, settlement, and listing rules across SEE exchanges, would reduce transaction costs and operational barriers. Enhancing market transparency and visibility can increase platform credibility and participation. Institutional strengthening, including improvements in corporate governance, the rule of law, and investor protection, would bolster foreign investor confidence. Finally, closer integration with broader EU initiatives, particularly the Capital Markets Union, could facilitate cross-border investment and support regulatory convergence, creating a more robust and cohesive regional financial market.

In summary, SEE Link has produced only modest improvements in market activity but has had a limited impact on long-term integration among SEE LINK stock exchanges. Persistent structural, regulatory, and technical barriers, combined with limited operational transparency and the absence of updated information since June 2023, underscore the need for targeted policy measures to achieve meaningful regional financial integration.

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## Appendix

Table 7.

**SEE Link Stock Markets**

| Index name | Country of the Index | Stock exchange name | Year of establishment | Number of constituents | Constituents in 2022 December |
|---|---|---|---|---|---|
| SASX 10 | Bosnia and Herczegovina | Sarajevo Stock Exchange | 2007 | 10 | ASA Banka dd Sarajevo, Badeco Adria Sarajevo JSC, Bh Telecom, Bosnalijek Sa, Centrotrans Tranzit, Elektropriv Bi, Elektropriv Hz, Pobjeda dd Tesanj, Sarajevo Osig Tvornica Cemen |
| BELEX 15 | Serbia | Belgrade Stock Exchange | 2005 | Initially 15, now 10 | Aerodrom Nikol, Alfa Plam Vran, Dunavosiguranj, Energoprojekt, Fintel Energija ad Beograd, Impol Seval, Jedinstvo Sevo, Metalac, NIS AD, Tehnoga |
| CROBEX | Croatia | Zagreb Stock Exchange | 1997 | Initially 22, now 18 | Adris Grupa, Arena Hospitality Group, Atlantic Grupa, Atlantska Plovidba, Ericsson Nikola Tesla, Hpb, Ht ,Ingra, Jadroplov, Koncar, Ftb Turizam, Plava Laguna, Podravka, Valamar, Riviera, Span, Tankerska Next Generation, Brodogradiliste Viktor Lenac, Zagrebacka Banka |
| SBI TOP | Slovenia | Ljubljana Stock Exchange | 2006 | 9 | Cinkarna Celje, Krka, Luka Koper, Nlb, Petrol, Pozavarovalnica Sava, Telekom Slovenije, Unior, Zavarovalnica Triglav |
| SOFIX | Bulgaria | Bulgarian Stock Exchange | 2000 | 15 | Sopharma AD-Sofia, Eurohold Bulgaria AD-Sofia, Allterco AD-Sofia, M+S Hydraulic AD-Kazanlak, Holding Varna AD-Varna, CB First, Investment Bank AD-Sofia, Advance Terrafund REIT-Sofia, CB Central Cooperative Bank AD-Sofia, Chimimport AD-Sofia, Doverie United Holding PLC-Sofia, Telelink Business Services Group AD-Sofia, Neochim AD-Dimitrovgrad, Bulgarian Real Estate Fund REIT-Sofia, Sirma Group Holding AD-Sofia, Elana Agrocredit AD-Sofia |
| MBI 10 | North Macedonia | Macedonian Stock Exchange | 2005 | 10 | Alkaloid Skopje, Stopanska banka Skopje, Granit Skopje, Komercijalna banka Skopje, Makpetrol Skopje, TTK Banka Skopje, Makedonski Telekom Skopje, Makedonijaturist Skopje, NLB Banka Skopje, Stopanska banka Bitola |
| BIRS | Bosnia and Herczegovina | Banja Luka Stock Exchange | 2004 | 14 | Cistoca ad Banja Elektro Doboj Elektro-Bijelj Elektrokrajina Hidroelek Na T Hidroelektrane Na Drini Hidroelektrane Vrbasu Mrkonjic Mtel Banja Luka ad Nova Banka Rafinerija Ulja ad Modrica Rite Gacko Rite Ugljevik Zeljeznice Rs Ztc Banja Vruc |

*Source: Investing.com (2022), own elaboration*

JÓZSEF POÓR – LADISLAV MURA – ERIC J. SANDERS – SILVIA TÓBIÁS KOSÁR – BOTOND GÉZA KÁLMÁN – ZDENĚK CAHA – ERIKA SERES HUSZÁRIK – TIBOR ZSIGMOND – ERIKA VARGA – ILDIKÓ ÉVA KOVÁCS

# MANAGEMENT IN THE SHADOW OF WAR – A COMPARATIVE ANALYSIS OF CZECH, HUNGARIAN AND SLOVAK ORGANIZATIONAL RESPONSES TO CRISES

# MENEDZSMENT A HÁBORÚ ÁRNYÉKÁBAN – CSEH, MAGYAR ÉS SZLOVÁK SZERVEZETEK VÁLSÁGRA ADOTT VÁLASZAINAK ÖSSZEHASONLÍTÓ ELEMZÉSE

In recent years, Central and Eastern European countries have faced significant crises, including the COVID-19 pandemic and the Russian-Ukrainian conflict, which have impacted their social and economic development. This study examines how these events influenced business operations, leadership, and human resources in Czech, Hungarian, and Slovak organizations. A total of 1,370 organizations responded to the questionnaire. The research aimed to explore leadership practices during these challenges by testing five hypotheses. The results clearly demonstrate relationships between a respondent organization's country and its perceptions of crisis-driven opportunities, such as technological developments, organizational renewal, and innovative leadership approaches. Crisis strategies vary by country and organizational context. Larger organizations and foreign-owned companies are more likely to adopt innovative technological or people-centered solutions.

Keywords: **management, human resource management, war, contingency plan, crisis management, organizational change**

A közép- és kelet-európai országok a közelmúltban jelentős válságokkal néztek szembe, beleértve a COVID-19-et és az orosz-ukrán konfliktust, amelyek hatással voltak a társadalmi és gazdasági fejlődésükre. Ez a tanulmány azt vizsgálja, hogy a jelzett folyamatok hogyan hatottak az üzleti működésre, a vezetésre és a humánerőforrásokra a cseh, magyar és szlovák szervezetekben. Kérdőívet 1370 szervezet válaszolta meg. A kutatás célja, hogy feltárják a vezetési gyakorlatokat a jelzett kihívások idején, öt hipotézist tesztelve. Az eredmények egyértelmű összefüggéseket mutatnak az adott válaszadó szervezet országa és a válság által vezérelt lehetőségekről, például a technológiai fejlesztésekről, a szervezeti megújulásról és az innovatív vezetési megközelítésekről alkotott képek között. A válságstratégiák országonként és szervezeti kontextusonként eltérnek. A nagyobb szervezetek és a külföldi tulajdonban lévő vállalatok inkább alkalmaznak innovatív technológiai vagy emberközpontú megoldásokat.

Kulcsszavak: **menedzsment, humánerőforrás-menedzsment, háború, vészhelyzeti terv, válságkezelés, szervezeti változás**

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**Authors/Szerzők:**
Prof. Dr. Poór József[a] (poor.jozsef@uni-mate.hu) DCs, CMC, professor emeritus; Dr. Ladislav Mura[b] (ladislav.mura@euba.sk) associate professor; Eric J. Sanders[c] (eric.sanders@elmhurst.edu) associate professor; Dr. Silvia Tóbiás Kosár[d] (kosars@ujs.sk) associate professor; Dr. Botond Géza Kálmán[e] (kalman.botond.geza@nje.hu) assistant professor; Dr. Zdeněk Caha[f] (caha@mail.vstecb.cz) associate professor; Dr. Erika Seres Huszárik[d] (huszarike@ujs.sk) associate professor; Dr. Tibor Zsigmond[d] (zsigmondt@ujs.sk) assistant professor; Dr. Erika Varga[a] (varga.erika@uni-mate.hu) associate professor; Dr. Ildikó Éva Kovács[a] (kovacs.ildiko@uni-mate.hu) senior researcher

[a]Hungarian University of Agriculture and Life Sciences (Magyar Agrár- és Élettudományi Egyetem) Hungary (Magyarország); [b]University of Economics in Bratislava (Pozsonyi Gazdasági Egyetem) Slovakia (Szlovákia); [c]Elmhurst University (Elmhurst Egyetem) USA (Amerikai Egyesült Államok); [d]J. Selye University (Selye János Egyetem) Slovakia (Szlovákia); [e]John von Neumann University (Neumann János Egyetem) Hungary (Magyarország); [f]Institute of Technology and Business (Technológiai és Üzleti Intézet) Czechia (Csehország)

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Currently, there are very few current studies on the impact of military operations on companies and the internal running of organizations at war. These publications focus more on the problems of Ukrainian companies (Koshlenko, 2024; Bondarchuk et al., 2025), and fewer such studies can be found in other countries. Based on analysis of the available literature focuses on the effects of energy, logistics, value chains and trade (Deloitte, 2022; KPMG, 2022; Markus, 2022; Ahlawat et al., 2022; Ostapenko et al., 2023; Fawn & Drobysh, 2023; Paryan & Hashfi, 2023; Ediz et al., 2025).

The publications written about the situation in Ukraine talk about the sustainability of business there, financial and financing opportunities (Bandura, Timtchenko & Hardman, 2024) and possible management solutions in war conditions (Uvarova & Saprykina, 2023). We find publications that are not only about the difficulties caused by the war, but also report on the opportunities created by new challenges (e.g. new ITC solutions, spread of business resilience, crisis plans, maintaining team spirit, etc.) (EU, 2024; Poyner, 2024).

Therefore, in June 2023, researchers from J. Selye University, in cooperation with researchers from several countries (the Czech Republic, Hungary, Romania, Slovakia, USA), launched their research "The impact of crises – COVID-19, recovery, war – on the management of companies and organizations." The purpose of this research to find what effects the responding organizations expect from the war on their business activities, management and HR in the countries participating in the research.

## Theoretical background

The economic development of various organizations (companies, institutions) was influenced by several significant changes in recent years. These changes also confirm the validity of Jared Diamond's statement (1999, p. 26) that "We can successfully prepare for the challenges of the future if we intelligently understand everything that is possible from the past" However, we are returning to past phenomena that today's generations of leaders have not previously experienced, such as "crises, trade wars, emerging capital flight markets, widespread social unrest, geopolitical confrontation and the specter of nuclear war" (WEF 2023, p. 6). Other historians drew attention to the fact that medieval plagues had another decisive social consequence: the large number of deaths increased the value of work, serfs and peasants were able to negotiate more favorable terms with their landlords (Romsics, 2021). These past phenomena live today in the guise of artificial intelligence, the global climate crisis, and the fifth industrial revolution (Harai, 2023; Vinkóczi et al., 2023). In the following, we analyze the significant effects of these changes from the perspective of the literature.

### COVID-19 pandemic

According to Pitterle et al. (2015), crises, especially external crises, can cause an economic slowdown, which can lead to rapidly developing continuous commodity and financial market imbalances. COVID-19 is considered an external shock and crisis (UNCTAD, 2020; Vittore et al., 2021). The pandemic showed a significant impact on financial markets in the case of 49 countries (Zaremba et al., 2021).

The closure significantly reduced economic activities, many companies scaled back their operations or closed (Brodeur et al., 2020, Gourinchas, 2020).

The pandemic has brought to the fore several areas of HR that need improvement: further development of internal communication, expansion of training, and reduction of administrative burdens (Pató et al., 2021). The wider acceptance of home office has also become essential, although recent research suggests that this form of work does not always result in higher productivity (Collings et al., 2021; Kokt &Chipunza, 2022).

Employers had to retain their employees with much more complex and innovative solutions than before (e.g., well work and wellbeing (Dajnoki et al., 2023). International trade also deteriorated significantly (Naseer et al., 2023; Gelencsér et al., 2023).

In response to the social and economic changes caused by the pandemic, the governments introduced a series of measures which included compensation, and concessions were also introduced in the area of tax payment and tax arrears (Mura et al., 2022a).

Despite the fact that unemployment in the world increased from 5.7% in 2019 to 8% in 2021 as a result of the COVID-19 crisis (ILO, 2021), the countries of the developed world–including the three countries examined in our article (the Czech Republic, Hungary and Slovakia)–were also affected by a strong labor shortage. In fact, it was also established that in February 2022, the level of unemployment in these countries returned to the pre-COVID crisis level (OECD, 2022). One of the key issues of HRM in these countries today is the dramatic increase in labor shortages, which has been influenced by a variety of factors, namely outbound labor migration after the regime change, unfavorable demographic factors, the economic downturn, as well as wage differences within the EU (Morley et al., 2020; Stachova et al., 2020).

While in 2020, the year the pandemic broke out, annual inflation was relatively low (0.7%), by 2021 it reached the so-called the level of stimulating inflation (2-3 percent price increase).

The main challenge of the pandemic for the global economy is the negative impact on the implementation of the sustainable development agenda until 2030 (Elavarasan et al., 2021; Fagbemi, 2021).

### The War between Russia and Ukraine

The war between Russia and Ukraine began in 2014 when Russia annexed Crimea and began supporting separatists, primarily in Eastern Ukraine. This escalated to a full-scale invasion of the country on 24 February 2022, and continues at the time of this writing in September 2025. The political and economic reasons for the war are beyond the scope of this paper. However, the war impacted firms buying and selling to both Ukraine and Russia, especially

firms located in Central and Eastern Europe. Their preparation for and response to this major regional crisis is the focus of this research.

### Crisis as an opportunity

During the coronavirus crisis, an opinion was often expressed that it could also be the basis for many renewals. These can be renewals and opportunities and can arise directly or indirectly (WEF, 2020; UN, 2021). An important assumption in our research was that every crisis is also an opportunity.

The novelty and complexity of COVID-19 threatened the achievement of organizational goals. According to Demirkaya and Aydın (2006), a crisis can create unexpected opportunities for organizations. Organizations must be able to prepare and allocate their resources; coordinate the necessary mechanism and use organizational resources and knowledge appropriately (Liu et al., 2020; Ton et al., 2022).

### Economic situation in analyzed countries

#### *Socio-economic situation*

The economic characteristics of these countries are listed in Table 1. By comparing the three countries by economic performance, conclusions can be drawn.

- In 2023, 25.85 million people lived in the three countries under study (Eurostat, 2024b), representing 5.77% of the population of the European Union (Eurostat, 2024b).
- In the year before the outbreak of the coronavirus crisis (2019), all countries had positive economic growth (2.51% to 4.86%). The same cannot be said for 2020, when the decline ranged from -3.34% to -5.40%. In 2021, growth (3.55-7.20%) was again observed in the countries studied. The 2022 figures were lower than the year before (1.67-4.87%).
- The unemployment rate before the outbreak of the pandemic in 2019 was low in all three countries (the Czech Republic: 1.3%, Hungary: 3.5% and Slovakia: 3.8%). The unemployment rate in 2019 ranged from 1.3% to 3.8% in the 3 countries. In 2021, unemployment also rose slightly (0.1% in Slovakia, 0.2% in the Czech Republic) or stagnated (Hungary). In 2022, unemployment fell again in all three countries (by 0.3-0.4%) (Eurostat, 2024b).
- In terms of GDP per capita, the crisis has led to a decline, to varying degrees, in all the countries surveyed, but by 2021 and then 2022, all three countries surveyed had experienced an increase (World Bank, 2024).

Foreign capital investments (FDI) are an important source of the economic development of the examined countries (Götz, Éltető & Sass, 2023). As a result of the indicated foreign FDI, 15-30% of the employed in these countries worked for subsidiaries of such ownership According to KSH (2020) investigations, in 2020, 25.2% of those employed in the corporate sector worked for foreign-owned companies in Hungary. According to studies by Palócz (2019), in the Czech Republic and Slovakia, the proportion of domestic employees in non-financial foreign-owned enterprises was 28 percent.

Table 1

**Economic characteristics of the examined countries**

| Characteristics | | CZ | HU | SK | Total/ average |
|---|---|---|---|---|---|
| Population (million people) | 2019 | 10.65 | 9.77 | 5.45 | 25.87 |
| | 2020 | 10.70 | 9.77 | 5.46 | 25.93 |
| | 2021 | 10.49 | 9.73 | 5.46 | 25.68 |
| | 2022 | 10.52 | 9.69 | 5.43 | 25.64 |
| | 2023 | 10.83 | 9.60 | 5.43 | 25.86 |
| GDP growth (%) | 2019 | 3.03% | 4.86 | 2.51% | 3.47% |
| | 2020 | - 5.50% | - 4.54% | - 3.34% | - 4.46% |
| | 2021 | 3.55% | 7.20% | 4.86% | 5.20% |
| | 2022 | 2.46% | 4.58% | 1.67% | 2.9% |
| Unemployment (%) | 2019 | 1.3% | 2.1% | 3.8% | 2.40% |
| | 2020 | 1.7% | 2.7% | 4.4% | 2.93% |
| | 2021 | 1.9% | 2.7% | 4.5% | 3.03% |
| | 2022 | 1.5% | 2.4% | 4.1% | 2.67% |
| GDP per capita (euro/person) | 2019 | 44 212.7 | 34 645.6 | 33 453.8 | 37 437. 37 |
| | 2020 | 42 827.1 | 34 169.9 | 32 922.9 | 36 639. 97 |
| | 2021 | 45 630.0 | 36 735.9 | 34 505.3 | 38 957.07 |
| | 2022 | 49 195.0 | 41 740.9 | 37 457.2 | 42 797.7 |

*Source: authors' own editing based on Eurostat (2024b), World Bank (2024)*

## Empirical Research

### Objective

The aim of the research "Factors endangering corporate-organizational stability, or the running, management and HR in the shadow of war" was to create a picture of the situation: after the recovery from the coronavirus crisis of the past two years.

### Hypotheses

When formulating our hypotheses, we paid special attention to the influencing factors of the given countries and the organizations involved, the crisis management options, and the crisis as a recovery solution (Creswell & Creswell, 2018). In connection with our research, we formulated the following five hypotheses:

Many studies (Pearson et al., 1998; Mitroff & Alpaslan, 2003; Bundy et al., 2017) have examined crisis management and the effective measures that organizations should implement in critical situations. A study by Gurkov & Dhams (2024) assessed the organizational communication strategies of foreign enterprises, working in Russia after the start of the war (24th of February, 2022). They assessed foreign companies from USA, UK, Canada, Australia, Japan, Germany and EU, etc., but did not examine, whether the origin (nationality) of these subsidies influence their attitude. Dai et al. (2017) studied 1.162 multinational enterprises subsidiaries across 20 war-affected countries and found that enterprises perceived the threat of war quite similarly. At the same time, differences

were found regarding the responses of the subsidiaries. Hofstede (2001) introduced five dimensions (power distance, uncertainty avoidance, individualism versus collectivism, masculinity versus femininity, and long term versus short-term orientation) in his seminal work in cross-cultural psychology and management, based on how national cultures differ from one another. A sixth dimension (indulgence versus restraint) was added in 2010 (Hofstede et al., 2010). Given these differences, Kostova & Roth (2002, p. 215) noted that "*organizational practices can be expected to vary across countries*".

Based on the above a research gap was found, as no previous study was found to focus on the differences between companies of different nationalities (especially between Czechia, Hungary, and Slovakia) in context of response to war situations.

*H1 This perception of the overall impact of the war impact as an opportunity or a constraint for positive organizational change is associated with national context.*

*H2: Organizations' preferences for specific crisis management measures differ significantly across countries.*

Several studies state that developing new business models becomes sustainable through taking and exploiting new risks.

A study by Wenzel et al. (2021) discusses how crises stimulate technological and organizational innovation.

A paper by Teece et al. (2016) provides a framework for understanding innovation in crisis contexts.

Fedynets (2023) highlights that changes within an organization are inevitable. Changes caused by crisis conditions in business operations must be implemented as soon as possible.

*H3: Organizations that perceive the war situation as an opportunity for positive organizational change are more likely to adopt innovative crisis management measures.*

According to Meyer & Peng (2016) organizational context influences perception of crises as threats or opportunities.

Child (1972) introduced the idea of strategic choice and how context shapes organizational responses.

Lengnick-Hall et al. (2011) discovered that organizational context is a determinant of crisis perception and response. Williams et al. (2017) also highlighted the importance of internal organizational contexts, as they shape whether crises are threats or opportunities for a given organization.

Manisaligil et al. (2023) discovered that organizations change similarly in the short term but differently in the long term.

*H4: Whether organizations perceive the war situation as an opportunity or as a compulsion to implement positive organizational changes is influenced by their organizational context.*

Based on the study by Doern (2016), the crisis management strategies of SMEs fundamentally differ from those of large corporations: they are characterized by a lack of prior planning, a reactive approach, personal intervention, and a strong reliance on external support. In contrast, larger firms tend to be more proactive, system-oriented, and capable of implementing more innovative solutions.

According to Archibugi et al. (2013) larger and resource-rich firms are more likely to respond with innovation, while smaller firms tend to scale back such activities during times of crisis. Smallbone et al. (2012) also found that firm size matters in shaping strategic responses to economic downturns.

*H5: Crisis responses differ by firm size and ownership, with larger and foreign-owned firms preferring innovative solutions.*

The main outcome variables are the perceived impacts of the war on organizations, opportunities for positive change, and adopted crisis measures. Independent variables include country, company size, and ownership structure, with these clearly distinguished to clarify the model

## Questionnaire

The questionnaire used in the survey addresses the following major groups of questions, for each of them collecting the respondent's experiences, opinions and expectations:

- the general characteristics of the respondent organization, its relationship with the Russian and Ukrainian markets, and its preparedness for war,
- the likely macro and micro economic and financial impact of the Russia-Ukraine war,
- the impact of the Russia-Ukraine war on your organization/business in 2022-2023,
- whether the war or post-war situation also represents an opportunity for the responding organization,
- analyzing the ways in which the organization is trying to adapt to the situation created by the war situation,
- the range of measures that are being planned or implemented to mitigate the negative effects of the Russia-Ukraine war,
- identification of materials, foodstuffs, spare parts and services which are scarce or difficult to obtain because of the war,
- characteristics of the respondent,
- other recommendations and comments.

To ensure the reliability and validity of the questionnaire, the authors designed the constructs and the items through a comprehensive literature search. We drew on numerous previous research studies. First, the Cranet nonprofit research network provided scientific facts about the

contextual nature of HRM (Brewster et al., 2018). Another important source for our questionnaire was the one developed by Central European international human resource management researchers to analyze HR changes in the CEE region (Zaharie et al., 2019). Third, we used the experiences of labor market research conducted in the V4 countries (Horbulák, 2022). A pilot study was conducted with a select group of organizations, which helped to gauge the clarity and coherence of the instrument.

### Sample

In the examined sample across all three nations, the largest proportion was represented by the domestic private sector with 51.9%, however, in the Slovak sample their proportion is much higher, more than 2/3 of the respondents (71.5%) came from the domestic private sector. At the same time, the proportion of companies with foreign or mixed ownership was lower (17%), compared to 34.2% of the Czech sample and 28.9% of the Hungarian sample (Table 2).

Table 2

**Distribution of the sample by country and by owner (%)**

| Ownership | CZ | HU | SK | Total |
|---|---|---|---|---|
| Government, local government | 11.2% | 19.2% | 9.1% | 16.3% |
| Domestic private | 53.6% | 47.8% | 71.5% | 51.9% |
| Foreign or mixed private | 34.2% | 28.9% | 17.0% | 28.6% |
| Nonprofit organizations | 1.0% | 3.4% | 1.2% | 2.6% |
| Other | 0.0% | 0.7% | 1.2% | .6% |
| Total (100%) n= | 295 | 910 | 165 | 1370 |

*Source: authors' own research*

In terms of organizational headcount/number of employees, 2/3 of the entire sample consisted of organizations employing less than 250 people, but their proportion in the Slovak sample is much higher, 89.7%. In the Czech and Hungarian samples, their proportion is similar, 60% and 62.3%, respectively.

## Statistical analysis

Internal validity integrity and result precision were assessed after applying non-parametric tests relevant to categorical data's attributes. In conformity with standard practices for result presentation, the frequency analysis began with a frequency investigation and descriptive statistics related to the major variables, followed by non-parametric tests for correlation and contrasting group differences as appropriate. Due to the wide variety of the variables, as well as the categorical and ordinal nature of the data, a structured approach to presentation was taken, which paralleled the research questions and hypotheses, consequently streamlining the ordering of frequency and comparative work.

Differences found between different groups were examined by applying chi-square tests, and changes that extended beyond several groups were tested by applying Kruskal-Wallis tests. To improve clarity, the results are now presented in two stages: first, country-specific findings are outlined in separate subsections; second, comparative insights across countries are summarized, focusing on the hypotheses tested. Mann-Whitney U tests were also used to appropriately examine distributions for comparison purposes. Results included measures of significance, effect size (Cramer's V), and association measures (ETA).

Although the Kruskal-Wallis, Chi-square, and Mann-Whitney U tests were used to investigate differences between/among groups, it is known that the use of a multivariate method like MANOVA could have provided additional information when investigating several dependent variables simultaneously across various nations. However, due to the ordinal nature of the Likert-scale data, the lack of multivariate normality, and the mixture of categorical and ordinal variables, the requirements for MANOVA were not fully met. Thus, the non-parametric tests were chosen as appropriate substitutes.

*H1: The perception of the overall impact of the war's impact as an opportunity or a constraint for positive organizational change is associated with national context.*

### Country-specific results

#### *Czech Republic*

In assessing the effects of the war, the greatest agreement among the surveyed organizations was that the consequences of the coronavirus situation are still a bigger problem than the Russian-Ukrainian war. In this regard, there is no significant difference between the countries based on the Chi-square test (Sig=0.127), for more than a quarter of the respondents this is still a problem.

The most problematic area was indicated by the respondents in all three countries as the increase in purchase prices (60% of the respondents), with the highest proportion in Slovakia (67.3%). Overall, this is followed by the change in the exchange rate of the domestic currency, which is a problem for Hungarian organizations in a much higher proportion than for the Czech and Slovak ones (59.5% vs. 34.9% and 39.6%, respectively), and also the relationship between the variables here is the strongest. In four cases, the test shows no correlation between the impact of the war and belonging to the country:

- threat to the stability of our work/service processes (Sig=0.858),
- lack of planned/started technological and IT development (Sig=0.479),
- general labor shortage due to the war (Sig=0.361),
- lack of qualified professionals due to the war (Sig=0.236) (Table 3).

Table 3

**The impact of the Russian-Ukrainian war on the organization by country – the total percentage of more typical and fully typical answers to the questions (%)**

| | The impact of the Russian-Ukrainian war on organization/enterprise | CZ | HU | SK | Total | Chi-square Sig | Cramer'sV |
|---|---|---|---|---|---|---|---|
| 1 | Increase in purchase prices due to the war | 62.7% | 58.9% | 67.3% | 60.7% | 0.000 | 0.130 |
| 2 | The negative effect of the change in the exchange rate of the domestic currency | 34.9% | 59.5% | 39.6% | 51.8% | 0.000 | 0.200 |
| 3 | Threat due to supply (lack) of energy sources | 38.3% | 32.0% | 43.6% | 34.8% | 0.000 | 0.133 |
| 4 | The stability and performance of our suppliers has changed due to the war | 31.0% | 31.9% | 35.8% | 32.2% | 0.000 | 0.118 |
| 5 | There is a shortage of raw materials and spare parts on our foreign market due to the war | 33.2% | 24.1% | 36.0% | 27.5% | 0.000 | 0.156 |
| 6 | The consequences of the coronavirus situation are still a bigger problem for us than the Russian-Ukrainian war | 30.6% | 26.7% | 24.2% | 27.2% | 0.127 | 0.075 |
| 7 | There is a shortage of raw materials and spare parts on our domestic market due to the war | 30.3% | 25.1% | 32.7% | 27.1% | 0.000 | 0.114 |
| 8 | Threat to the stability of our work/service processes | 15.3% | 23.9% | 29.1% | 22.7% | 0.000 | 0.115 |
| 9 | Lack of planned/started technological and IT development | 15.9% | 23.6% | 20.7% | 21.6% | 0.008 | 0.094 |
| 10 | Difficulties arising from the employment of refugee workers | 23.4% | 17.9% | 26.1% | 20.1% | 0.000 | 0.140 |
| 11 | General labor shortage due to the war | 15.0% | 17.2% | 15.2% | 16.5% | 0.008 | 0.094 |
| 12 | Lack of qualified specialists due to the war | 11.2% | 17.5% | 15.2% | 15.8% | 0.000 | 0.117 |
| 13 | Benefits of employing refugee workers | 21.6% | 11.8% | 15.2% | 14.3% | 0.000 | 0.152 |

*Source: authors' owns research*

*Note: all percentages displayed are of 'typical' or 'fully typical' respondents, and averages are based on a scale of Likert that varies from 1 (no agreement at all) to 7 (complete agreement). All percentages and mean calculations are strictly based on valid answers*

*Hungary*

While those who gave a neutral answer were around 30% in all three countries, the Slovaks are by far the most pessimistic in terms of whether the war situation creates an opportunity for or forces positive changes in the organization. Overall, only 14% see some possibility of this, while more than a quarter (27.4%) of the most optimistic Hungarian respondents. The Chi-square test (Sig=0.001) and the Kruskal-Wallis test (Sig=0.000) shows a correlation between belonging to the country and the perception of positive opportunities. After presenting these country-specific results, the following sections summarize the comparative insights across the Czech Republic, Hungary, and Slovakia, focusing directly on the hypotheses tested (Table 4).

*Slovakia*

*Overall, based on the above, Hypothesis 1 can be considered partially approved.*

> *H2. Organizations' preferences for specific crisis management measures differ significantly across countries.*

Almost half of the responding organizations in all three countries attach great importance to the following:

Table 4

**To what extent does the war situation represent an opportunity for organizations – % distribution of responses by country**

| The war or post-war situation also represents an opportunity for your organization / forces your organization to make positive changes | CZ | HU | SK | Total | Chi-square Sig | Cramer'sV |
|---|---|---|---|---|---|---|
| Do not agree at all | 19.0% | 18.1% | 28.7% | 19.6% | | |
| Mostly do not agree | 13.9% | 11.2% | 12.8% | 12.0% | | |
| Rather disagree | 19.7% | 14.8% | 15.2% | 15.9% | | |
| Neither agree nor disagree (neutral) | 30.2% | 28.5% | 29.3% | 29.0% | 0.001 | 0.111 |
| Rather agree | 12.5% | 16.2% | 9.1% | 14.6% | | |
| Mostly agree | 3.4% | 6.4% | 2.4% | 5.3% | | |
| Completely agree | 1.4% | 4.8% | 2.4% | 3.8% | | |
| Average of responses | 3.19 | 3.52 | 2.95 | 3.38 | | |

*Source: uthors' owns research*

- increasing organizational efficiency (53-56%),
- general cost reduction (48-53%),
- measures to help retain key people and talents (47-50%),
- more attention to innovation opportunities (45-48%),
- strengthening internal communication (43-47%).

Examining the applied crisis management measures by country, we find a significant difference between the countries in all cases based on the Chi-square test, and in 11 cases based on the Kruskal-Wallis test. The strongest differences are

- search for new procurement alternatives,
- rescheduling or postponing investments,
- revision of strategy,
- starting and strengthening training programs,
- stronger/renewed marketing activity.

Searching for new procurement alternatives is preferred by half of the Czech companies/organizations (50.0%), 41.5% of Slovaks, while only nearly a third of Hungarians (30.3%), but a much higher proportion of Slovaks think about revising the Strategy (44.4%) and Hungarian (38.4%) organizations, as well as the Czech (24.1). The Czechs and the Hungarians follow the rescheduling or postponement of investments in almost the same proportion (33% and 31.6%), while this is much more important for the Slovaks (43.6%). Stronger/renewed marketing activity is also more typical for the Slovaks (42.3%) than for the Hungarians (33.9%) and the Czechs (35.3%). Starting and strengthening training programs is the most important for Hungarian companies (36.1%), ahead of Czech (32.4%) and Slovak (25.8%) ones (Table 5).

*Based on the results, Hypothesis 2 is considered proven.*

*H3: Organizations that perceive the war situation as an opportunity for positive organizational change are more likely to adopt innovative crisis management measures.*

In the case of almost all crisis management measures, the average of the responses of this group is above the neutral value of 3, and in many cases approaches the value of 4, i.e., the measures are typically applied. There is a significant correlation between the variables for all crisis management measures, this is the strongest for the following measures in order:

Table 5

**Measures taken to mitigate the effects of war by country – aggregated percentage of more typical and fully typical responses to the questions (%)**

| | In what ways is your organization trying to adapt to the war situation? Proportion of typical responses | CZ | HU | SK | Total | Chi-square Sig | Kruskal-Wallis Sig | Cramer's V |
|---|---|---|---|---|---|---|---|---|
| 1 | Nothing needs to be done | 30.3% | 25.1% | 20.0% | 25.6% | 0.000 | 0.000 | 0.119 |
| 2 | Seeking new procurement alternatives | 50.0% | 30.3% | 41.5% | 35.9% | 0.000 | 0.000 | 0.155 |
| 3 | Strengthening supplier network | 48.1% | 40.6% | 44.4% | 42.7% | 0.000 | 0.002 | 0.111 |
| 4 | Domestic commodities, ensuring self-sufficiency | 32.5% | 34.9% | 35.4% | 34.4% | 0.000 | 0.079 | 0.119 |
| 5 | Maintaining export registration | 24.4% | 24.6% | 17.7% | 23.7% | 0.000 | 0.001 | 0.110 |
| 6 | Entering new markets | 35.7% | 34.3% | 26.8% | 33.7% | 0.000 | 0.038 | 0.121 |
| 7 | Increasing organizational efficiency | 54.1% | 52.9% | 56.4% | 53.6% | 0.003 | 0.101 | 0.099 |
| 8 | Restructuring the supply chain | 30.4% | 30.0% | 32.9% | 30.4% | 0.000 | 0.002 | 0.129 |
| 9 | Increasing automation, introducing new technologies | 35.6% | 34.4% | 28.8% | 34.0% | 0.003 | 0.101 | 0.099 |
| 10 | Using more flexible contracts | 35.3% | 35.1% | 35.4% | 35.1% | 0.004 | 0.452 | 0.097 |
| 11 | Improving cybersecurity | 42.6% | 38.4% | 37.2% | 39.1% | 0.008 | 0.020 | 0.094 |
| 12 | Increasing mental support for employees while facing uncertainty | 38.0% | 37.7% | 36.8% | 37.7% | 0.000 | 0.103 | 0.116 |
| 13 | Revising strategy | 24.1% | 38.4% | 44.4% | 36.1% | 0.000 | 0.000 | 0.137 |
| 14 | Stronger/renewed marketing activities | 35.3% | 33.9% | 42.3% | 35.2% | 0.000 | 0.019 | 0.133 |
| 15 | More focus on innovation opportunities | 45.2% | 47.8% | 46.9% | 47.1% | 0.001 | 0.643 | 0.103 |
| 16 | Rescheduling or postponing investments | 33.0% | 31.6% | 43.6% | 33.3% | 0.000 | 0.000 | 0.151 |
| 17 | Using business consultants to solve organizational/ operational problems that have arisen | 20.9% | 19.8% | 15.4% | 19.5% | 0.001 | 0.083 | 0.105 |
| 18 | Developing, strengthening and professionalizing HR functions | 29.6% | 33.6% | 25.8% | 31.8% | 0.000 | 0.139 | 0.113 |
| 19 | Retaining key people and talent | 47.1% | 49.4% | 50.3% | 49.0% | 0.000 | 0.782 | 0.123 |
| 20 | Launching complex knowledge management programmed | 26.4% | 28.7% | 19.3% | 27.0% | 0.000 | 0.181 | 0.114 |
| 21 | Rethinking employment conditions | 31.1% | 33.9% | 32.9% | 33.2% | 0.000 | 0.175 | 0.128 |
| 22 | Launching and strengthening training programmed | 32.4% | 36.1% | 25.8% | 34.1% | 0.000 | 0.015 | 0.134 |
| 23 | Reducing overall costs | 53.1% | 48.1% | 49.4% | 49.3% | 0.002 | 0.126 | 0.102 |
| 24 | Strengthening internal communication | 46.9% | 46.4% | 43.2% | 46.1% | 0.000 | 0.483 | 0.125 |

*Source: authors' owns research*

- revision of strategy,
- developing, strengthening and increasing the professionalism of HR functions,
- stronger automation, introduction of new technologies,
- increasing organizational efficiency,
- entry into new markets,
- improving cybersecurity,
- more attention to innovation opportunities.

This shows that organizations that see opportunities in the situation prefer innovative measures related to technology or the renewal of the organization more than the others.

Although there are significant differences between the three groups, in the case of the following measures, the average of all three groups is above 3, so their application typically occurs equally in all three groups:

- increasing organizational efficiency,
- general cost reduction,
- measures to help retain key people and talents,
- strengthening internal communication,
- more attention to innovation opportunities (Table 6).

*Overall, hypothesis 3 is considered proven.*

*H4: Whether organizations perceive the war situation as an opportunity or as a compulsion to implement positive organizational changes is influenced by their organizational context.*

More than a third of the large companies (35%) declared that they see an opportunity to implement positive organizational changes in the war and its aftermath, while only 1/5 of the SMEs (19.4%) did so. We see the same in the

Table 6

**Measures taken to mitigate the effects of war depending on the assessment of the possibilities – average of the answers to the questions**

| What measures are planned to mitigate the negative effects of the Russian-Ukrainian war | | The situation of war or its aftermath is also an opportunity for your organization/ forces your organization to implement positive changes | | | | Chi-square Sig | Kruskal-Wallis Sig | Cramer's V | Eta |
|---|---|---|---|---|---|---|---|---|---|
| | It does not represent an opportunity | Neutral | Values it as an opportunity | Total | | | | | |
| 1 | Nothing needs to be done | 2.82 | 2.80 | 2.51 | 2.74 | 0.000 | 0.002 | 0.112 | 0.101 |
| 2 | Seeking new procurement alternatives | 2.75 | 2.95 | 3.24 | 2.93 | 0.000 | 0.000 | 0.141 | 0.151 |
| 3 | Strengthening supplier network | 2.92 | 3.17 | 3.42 | 3.11 | 0.000 | 0.000 | 0.131 | 0.153 |
| 4 | Domestic commodities, ensuring self-sufficiency | 2.78 | 3.07 | 3.18 | 2.96 | 0.001 | 0.000 | 0.107 | 0.133 |
| 5 | Maintaining export registration | 2.40 | 2.76 | 2.90 | 2.63 | 0.000 | 0.000 | 0.131 | 0.168 |
| 6 | Entering new markets | 2.57 | 3.01 | 3.33 | 2.88 | 0.000 | 0.000 | 0.177 | 0.231 |
| 7 | Increasing organizational efficiency | 3.25 | 3.54 | 3.93 | 3.50 | 0.000 | 0.000 | 0.179 | 0.229 |
| 8 | Restructuring the supply chain | 2.59 | 2.86 | 3.19 | 2.81 | 0.000 | 0.000 | 0.160 | 0.188 |
| 9 | Increasing automation, introducing new technologies | 2.57 | 2.97 | 3.41 | 2.89 | 0.000 | 0.000 | 0.181 | 0.250 |
| 10 | Using more flexible contracts | 2.80 | 3.02 | 3.35 | 2.99 | 0.000 | 0.000 | 0.150 | 0.172 |
| 11 | Improving cybersecurity | 2.80 | 3.19 | 3.64 | 3.12 | 0.000 | 0.000 | 0.176 | 0.240 |
| 12 | Increasing mental support for employees while facing uncertainty | 2.83 | 3.15 | 3.49 | 3.08 | 0.000 | 0.000 | 0.161 | 0.201 |
| 13 | Revising strategy | 2.70 | 3.11 | 3.49 | 3.01 | 0.000 | 0.000 | 0.189 | 0.252 |
| 14 | Stronger/renewed marketing activities | 2.77 | 3.12 | 3.26 | 2.99 | 0.000 | 0.000 | 0.143 | 0.168 |
| 15 | More focus on innovation opportunities | 3.00 | 3.43 | 3.66 | 3.28 | 0.000 | 0.000 | 0.172 | 0.228 |
| 16 | Rescheduling or postponing investments | 2.83 | 3.02 | 3.05 | 2.93 | 0.001 | 0.030 | 0.107 | 0.081 |
| 17 | Using business consultants to solve organizational/operational problems that have arisen | 2.21 | 2.71 | 2.67 | 2.47 | 0.000 | 0.000 | 0.159 | 0.194 |
| 18 | Developing, strengthening and professionalizing HR functions | 2.52 | 2.98 | 3.30 | 2.84 | 0.000 | 0.000 | 0.187 | 0.250 |
| 19 | Retaining key people and talent | 3.11 | 3.36 | 3.67 | 3.32 | 0.000 | 0.000 | 0.132 | 0.172 |
| 20 | Launching complex knowledge management programmed | 2.45 | 2.87 | 3.09 | 2.72 | 0.000 | 0.000 | 0.168 | 0.208 |
| 21 | Rethinking employment conditions | 2.69 | 2.90 | 3.26 | 2.88 | 0.000 | 0.000 | 0.135 | 0.180 |
| 22 | Launching and strengthening training programmed | 2.63 | 2.92 | 3.31 | 2.88 | 0.000 | 0.000 | 0.160 | 0.209 |
| 23 | Reducing overall costs | 3.27 | 3.48 | 3.61 | 3.41 | 0.001 | 0.002 | 0.104 | 0.111 |
| 24 | Strengthening internal communication | 3.05 | 3.36 | 3.64 | 3.28 | 0.000 | 0.000 | 0.147 | 0.185 |

*Source: authors' owns research*

case of domestic private companies and foreign-owned companies: 20.5% of domestic private companies and 31.1% of foreign-owned companies take a similar position. Based on the averages, it can be seen that they are always below the neutral value of 4, so they point in the direction of disagreement. The responses of foreign-owned SMEs and domestic companies are somewhat more homogeneous than the large ones. In both cases, there is a significant weak relationship between the variables (Chi-square sig=0.000, Cramer's V=0.193 and 0.169), so the attitude to the situation also depends on the size of the company and the ownership conditions (Table 7).

Table 7

**To what extent is the war situation an opportunity for organizations – % distribution of responses by company size and owner**

| The situation of war or its aftermath is also an opportunity for your organization / forces your organization to implement positive changes | SME | Big firms | Domestic private | Foreign or mix | Total |
|---|---|---|---|---|---|
| Do not agree at all (1) | 21.5% | 11.8% | 21.8% | 12.3% | 18,4% |
| Mostly do not agree (2) | 14.0% | 9.8% | 12.7% | 12.6% | 12,7% |
| Rather disagree (3) | 16.6% | 16.2% | 16.0% | 17.2% | 16,4% |
| Neither agree nor disagree (neutral) (4) | 28.6% | 27.2% | 28.9% | 26.7% | 28,1% |
| Rather agree (5) | 12.6% | 21.7% | 13.9% | 18.3% | 15,4% |
| Mostly agree (6) | 4.5% | 7.5% | 4.8% | 6.7% | 5,5% |
| Completely agree (7) | 2.3% | 5.8% | 1.8% | 6.2% | 3,4% |
| Average of responses | 3.19 | 3.83 | 3.22 | 3.71 | 3,39 |
| Standard deviation | 1.589 | 1.624 | 1.590 | 1.647 | 1,626 |
| Chi-square test Sig. | 0.000 | | 0.000 | | |
| Cramer's V | 0.193 | | 0.169 | | |

*Source: authors' owns research*

Conclusion: The size of the organization (number of employees) and ownership structure are an important part of the organizational context (Robbins, 2023), so *hypothesis H4 was accepted.*

*H5: Crisis responses differ by firm size and ownership, with larger and foreign-owned firms preferring innovative solutions.*

Overall, the most preferred measures in both groups of companies (with typical responses of around 50%) are:

- increasing organizational efficiency,
- general cost reduction,
- measures to help retain key people and talents,
- strengthening internal communication,
- more attention to innovation opportunities.

The Chi-square test shows a significant correlation between the individual measures and the two company groups in all cases, with one exception. An exception is the measures promoting the retention of key people and talents – this is judged very similarly in both groups of companies (average of responses: 3.35 and 3.42). In addition, the Mann-Whitney test found no significant correlation in six other cases, which are almost equally typical in both groups of companies:

- search for new procurement alternatives (averages: 2.89 and 3.03),
- domestic commodity funds, ensuring self-sufficiency (averages: 2.99 and 2.95),
- stronger/renewed marketing activity (averages: 3.03 and 3.12),
- rescheduling or postponing investments (averages: 2.87 and 3.01),
- general cost reduction (averages: 3.41 and 3.45),
- strengthening internal communication (averages: 3.27 and 3.46).

The strongest correlation can be seen with the following measures:

- improving cybersecurity (Cramer's V=0.242),
- stronger automation, introduction of new technologies (Cramer's V=0.226),
- maintaining export registration (Cramer's V=0.224),
- developing, strengthening and increasing the professionalism of HR functions (Cramer's V=0.195),
- starting complex knowledge management programs (Cramer's V=0.192).

For each of the above measures, the averages of foreign-owned companies are above the neutral value of 3, while the averages of domestic private companies are below this, so their application is much more typical for foreigners.

The difference is that, apart from the measures promoting the retention of key people and talents (average of answers: 3.33 and 3.48), the Chi-square test does not show a significant relationship for two other measures. These are General cost reduction (average: 3.42 in both cases) and strengthening of internal communication (average: 3.28 and 3.45). The Mann-Whitney test does not indicate a significant correlation in three other cases:

- domestic commodity funds, ensuring self-sufficiency (averages: 2.97 and 3.00),
- stronger/renewed marketing activity (averages: 3.02 and 3.15),

- rescheduling or postponing investments (averages: 2.90 and 2.96).

The measures listed above are therefore almost equally typical for both SMEs and large companies, but in the case of the search for new procurement alternatives, both tests now show a significant relationship.

The strongest correlation can still be seen with the following measures:

- improving cybersecurity (Cramer's V=0.255),
- stronger automation, introduction of new technologies (Cramer's V=0.213),
- maintaining export registration (Cramer's V=0.186),
- developing, strengthening and increasing the professionalism of HR functions (Cramer's V=0.241),
- starting complex knowledge management programs (Cramer's V=0.224).

For each of the above measures, the averages of large companies are above the neutral value of 3, while the averages of SMEs are below this, so their application is much more typical for large companies. In the case of export registration, the difference between the two groups of companies examined is smaller (so the relationship is weaker), while the difference is more significant in the case of the development of HR functions and complex knowledge management (so the relationship is also stronger).

It is also worth highlighting that regardless of the differences between the categories, the most homogeneous answers in both breakdowns, i.e., the greatest agreement among the respondents within the examined company categories, were in the following cases (based on the standard deviation measures):

- increasing organizational efficiency,
- more attention to innovation opportunities,
- use of business consultants in order to solve organizational/operational problems,
- stronger/renewed marketing activity,
- general cost reduction (Table 8).

*Based on all this, the fifth hypothesis is accepted.*

## Discussion

This study confirms that organizations in the Czech Republic, Hungary, and Slovakia have faced a varied range of issues that are diverse and interlinked, both from the COVID-19 outbreak and the Russia–Ukraine

Table 8

**Averages of the measures taken to mitigate the effects of war, broken down by SMEs and large companies**

| | What measures are planned to mitigate the negative effects of the Russian-Ukrainian war | SMEs | Big firms | Total | Chi-square Sig | Mann-Whitney Sig | Cramer's V |
|---|---|---|---|---|---|---|---|
| 1 | Nothing needs to be done | 2.83 | 2.58 | 2.75 | 0.052 | 0.007 | 0.100 |
| 2 | Seeking new procurement alternatives | 2.88 | 3.08 | 2.94 | 0.002 | 0.037 | 0.132 |
| 3 | Strengthening supplier network | 3.08 | 3.34 | 3.16 | 0.009 | 0.005 | 0.119 |
| 4 | Domestic commodities, ensuring self-sufficiency | 2.97 | 3.00 | 2.98 | 0.009 | 0.851 | 0.119 |
| 5 | Maintaining export registration | 2.48 | 3.02 | 2.65 | 0.000 | 0.000 | 0.186 |
| 6 | Entering new markets | 2.86 | 3.13 | 2.94 | 0.004 | 0.005 | 0.127 |
| 7 | Increasing organizational efficiency | 3.46 | 3.70 | 3.53 | 0.036 | 0.004 | 0.105 |
| 8 | Restructuring the supply chain | 2.75 | 3.09 | 2.85 | 0.001 | 0.000 | 0.139 |
| 9 | Increasing automation, introducing new technologies | 2.71 | 3.33 | 2.90 | 0.000 | 0.000 | 0.213 |
| 10 | Using more flexible contracts | 2.93 | 3.20 | 3.01 | 0.005 | 0.003 | 0.125 |
| 11 | Improving cybersecurity | 2.84 | 3.59 | 3.07 | 0.000 | 0.000 | 0.255 |
| 12 | Increasing mental support for employees while facing uncertainty | 2.96 | 3.32 | 3.07 | 0.001 | 0.000 | 0.136 |
| 13 | Revising strategy | 2.93 | 3.21 | 3.01 | 0.001 | 0.002 | 0.138 |
| 14 | Stronger/renewed marketing activities | 3.02 | 3.15 | 3.06 | 0.014 | 0.207 | 0.115 |
| 15 | More focus on innovation opportunities | 3.21 | 3.52 | 3.31 | 0.001 | 0.000 | 0.137 |
| 16 | Rescheduling or postponing investments | 2.90 | 2.96 | 2.92 | 0.007 | 0.496 | 0.122 |
| 17 | Using business consultants to solve organizational/operational problems that have arisen | 2.37 | 2.71 | 2.47 | 0.000 | 0.000 | 0.191 |
| 18 | Developing, strengthening and professionalizing HR functions | 2.63 | 3.33 | 2.86 | 0.000 | 0.000 | 0.241 |
| 19 | Retaining key people and talent | 3.33 | 3.48 | 3.38 | 0.151 | 0.167 | 0.086 |
| 20 | Launching complex knowledge management programmed | 2.52 | 3.14 | 2.71 | 0.000 | 0.000 | 0.224 |
| 21 | Rethinking employment conditions | 2.83 | 3.05 | 2.90 | 0.005 | 0.013 | 0.125 |
| 22 | Launching and strengthening training programmed | 2.69 | 3.24 | 2.86 | 0.000 | 0.000 | 0.193 |
| 23 | Reducing overall costs | 3.42 | 3.42 | 3.42 | 0.276 | 0.703 | 0.076 |
| 24 | Strengthening internal communication | 3.28 | 3.45 | 3.33 | 0.058 | 0.069 | 0.099 |

*Source: authors' owns research*

conflict. Empirical evidence shows that perceptions of the effects of the crisis and the use of crisis management policies vary considerably between countries, firm size, and ownership. The findings lend limited support to contingency theory by highlighting the fact that the organizational environment and national context shape the way firms view crises as threats or opportunities for innovation. The study further shows that large-scale companies and foreign-owned firms are more likely to adopt innovative, technology-based solutions, while small and medium-sized firms and locally owned businesses often tend to adopt cost-cutting strategies and process adjustments. The trends are consistent with prior research while also presenting new insights into the web of relations between proximate geopolitical circumstances and post-pandemic recovery strategies in Central and Eastern Europe. The data further unveil that many organizations remain cautious; however, there is also growing evidence of the need for adaptability, knowledge management, and employees' well-being. As such, the prevailing climate calls for managers to deploy flexible strategies able to balance efficiency with resilience.

This research immensely contributes to the current literature in crisis and human resource management in three key dimensions. Firstly, it provides empirical evidence to how a compound crisis situation–namely, pandemic recovery and an imminent conflict–manifests in the organizational actions observed across Central and Eastern Europe, a geographical region that has heretofore not been studied in-depth in this regard. Secondly, it contributes to the development of contingency theory by illuminating the interplay between firm size, ownership structure, and country context in influencing crisis perceptions and response strategies. Finally, the paper offers practitioner- and policymaker-focused recommendations by highlighting the need for context-sensitive crisis planning, adaptive HR practices, and collective knowledge sharing to foster resilience in the face of persistent uncertainty.

## Conclusion

This research examined the impact of crises including the COVID pandemic and the Russo-Ukrainian war on organizational practices in the Czech Republic, Hungary, and Slovakia.

The central hypotheses of the study were largely supported by empirical data and were consistent with the reviewed literature. For example, Hypothesis 1 stated that the national context influences whether the crisis is perceived as an opportunity or a constraint (Hofstede,2001; Kostova & Roth,2002). Hungarian organizations were significantly more optimistic than Slovak ones – a clear indication of the contextual embeddedness of crisis interpretation (Osiyevskyy & Dewald, 2015; Wenzel et al., 2021). Organizations that viewed war as a potential catalyst for change were more likely to implement innovative measures, confirming Hypothesis 3 (Demirkaya & Aydın,2006; Liu et al., 2020).

Hypothesis 2 posits that crisis management preferences differ across countries. Our findings support this, consistent with Meyer and Peng's (2016) institutional theory and contingency theory (Child, 1972; Williams et al., 2017). Hypothesis 4 examined the role of organizational context. A significant proportion of larger and foreign-owned companies viewed war as a springboard for positive organizational change, confirming the findings of Archibugi et & al. (2013) and Estrin et al. (2008), as well as Doern's (2016) observations. Hypothesis 5 was also confirmed: foreign-owned and large companies tend to adopt more innovative and technology-driven solutions (Fedynets, 2023; Teece et al., 2016). Our findings support the crisis-focused literature from post-COVID and war contexts (e.g. Dajnoki et al., 2023; Ngoc Su et al., 2021), which notes that organizations need to rethink work structures, employee well-being, and digital strategies. This is particularly relevant in light of increasing volatility in energy markets (Ata et al., 2025), disrupted supply chains (Ngoc et al., 2022), and long-term threats to sustainable development (Elavarasan et al., 2021). The results point to a common challenge: the need to flexibly manage uncertainty and the importance of contingency planning (AM et al., 2020; Fagbemi, 2021). Large and foreign-owned companies saw the crisis as an investment (Hamouche, 2020) and an opportunity to introduce digital innovations. This reinforces the argument that some organizations not only survive the crisis but also actively transform themselves to thrive in its aftermath.

In practice, the study emphasizes that leaders and policymakers need to employ nuanced, context-specific crisis strategies. Post-COVID HRM and management research should increasingly focus on developing organizational agility, promoting resilience, and supporting employees during prolonged uncertainty.

In conclusion, this study contributes to the management and HR literature by presenting empirically sound knowledge from a region that is underrepresented in wartime organizational research. The study fills a gap in the management and human resource literature by closely examining organizational responses in an environment experiencing both post-pandemic recovery and geopolitical upheaval, and provides insightful observations that can enrich regional policymaking alongside global crisis management policies.

## Limitations and Future Directions

In our most recent research, we searched for answers and examples of actions taken by the responding organizations in the complex and difficult situation of the three indicated countries. We will continue to investigate and research these complex topics from the HR and management perspective as we have done so far) in the future as well. It is acknowledged that the use of convenience sampling within this study limits the ability to generalize findings. Future research should build upon this work by employing representative methods of sampling and possibly involving longitudinal approaches to examine temporal stability

of associations. Also, more multivariate techniques are needed to separate the effect of potential confounders.

Furthermore, it is important to recognize the need for a more specific determination of these limitations. A longitudinal design is proposed to examine the development of organizational responses as the conflict continues or de-escalates. Cross-national comparisons beyond Central Europe would be helpful in determining the generalizability of these noted patterns. Finally, the use of more advanced multivariate statistical techniques could allow for the control of confounding factors like industry type, ownership structure, and company size, while impact studies could examine the effects of specific crisis management strategies on organizational resilience and performance in a practical setting.

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ADAM OLEKSIUK

# ARTIFICIAL INTELLIGENCE IN GLOBAL MARKETING CAMPAIGNS – BETWEEN HUMAN CREATIVITY AND ALGORITHMIC PRECISION

# MESTERSÉGES INTELLIGENCIA A GLOBÁLIS MARKETINGKAMPÁNYOKBAN – AZ EMBERI KREATIVITÁS ÉS ALGORITMIKUS PONTOSSÁG KÖZÖTT

This article analyzes the impact of artificial intelligence (AI) on global marketing campaigns through a qualitative comparative analysis of nine case studies from various industries and markets. Using a four-level typology of human–AI collaboration, the study demonstrates that AI enhances personalization, automation, and operational efficiency but cannot replace human creativity, intuition, and cultural sensitivity. Combining a structured literature review with case-based evidence, the paper reveals the growing importance of hybrid models in which algorithmic technologies support creative processes. The findings show that the most successful campaigns emerge from the synergy between AI's analytical capabilities and human emotional competence. The article contributes to international marketing theory by integrating technological, creative, and cultural perspectives and offers practical recommendations for managers on the ethical and sustainable use of AI in complex, multicultural market contexts.

Keywords: **artificial intelligence, global marketing, campaigns, personalization, creativity, standardization**

Ez a cikk a mesterséges intelligencia (MI) hatását elemzi a globális marketingkampányokra kilenc különböző iparágból és piacról származó esettanulmány kvalitatív összehasonlító elemzésén keresztül. Egy négyszintű ember-MI együttműködési tipológiát használva a tanulmány bemutatja, hogy az MI javítja a személyre szabást, az automatizálást és az üzemeltetési hatékonyságot, de nem helyettesítheti az emberi kreativitást, intuíciót és kulturális érzékenységet. A strukturált irodalmi áttekintést esetalapú bizonyítékokkal kombinálva a cikk feltárja a hibrid modellek növekvő jelentőségét, amelyekben az algoritmikus technológiák támogatják a kreatív folyamatokat. Az eredmények azt mutatják, hogy a legsikeresebb kampányok az MI analitikai képességei és az emberi érzelmi kompetencia szinergiájából születnek. A cikk a technológiai, kreatív és kulturális perspektívák integrálásával járul hozzá a nemzetközi marketingelmélethez, és gyakorlati ajánlásokat kínál a menedzserek számára az MI etikus és fenntartható használatára vonatkozóan összetett, multikulturális piaci környezetben.

Kulcsszavak: **mesterséges intelligencia, globális marketing, kampányok, személyre szabás, kreativitás, szabványosítás**

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**Author/Szerző:**
Dr. Adam Oleksiuk[a] (aoleksi2@sgh.waw.pl) assistant professor

[a]SGH Warsaw School of Economics (SGH Varsói Gazdasági Egyetem) Poland (Lengyelország)

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Artificial intelligence is redefining the landscape of global marketing. Through sophisticated algorithms, AI provides new tools for data analysis, customer segmentation, and the personalization of marketing content. As a result, brands are increasingly turning to intelligent systems to optimize their communication strategies and reach consumers more effectively across diverse markets. However, the increasing use of AI also raises several concerns, including ethical issues, the risk of cultural insensitivity, the potential for over-standardization, and the loss of the human touch in brand communication. While artificial intelligence in marketing has been increasingly explored, prior research often separates technical implementation from branding strategy. This article addresses a research gap by examining the intersection of human–AI collaboration and its cultural implications in global campaigns–a perspective that has received limited empirical attention.

This article seeks to fill an important gap in the literature by examining how AI is used in global marketing campaigns and how it complements–or potentially replaces–human creativity. The analysis focuses on five key research questions: (RQ1) What limitations does artificial intelligence have in the design of global marketing campaigns? (RQ2) What advantages does artificial intelligence offer over human input in global marketing? (RQ3) In what areas do humans maintain an advantage over artificial intelligence? (RQ4) Is there a risk that the use of AI will result in the excessive standardization of marketing strategies? (RQ5) Which areas of global marketing are best suited to AI integration?

To address these questions, the paper presents a structured literature review followed by the qualitative analysis of selected international campaigns that exemplify different levels of AI involvement. The results are discussed in light of academic theory and practical marketing considerations.

The selection of the nine case studies was guided by the intention to capture diversity across industries, geographic markets, and types of AI applications in marketing. The cases represent a balanced sample of global campaigns–ranging from data-intensive platforms (e.g., Netflix, IBM Watson) to emotionally driven brand narratives (e.g., Apple, Dos Equis). This variety allows for identifying patterns of AI–human interaction that transcend individual sectors and illustrate broader trends in contemporary marketing communication.

Artificial intelligence (AI) is changing the way brands conduct marketing campaigns in the global arena. The digital age we live in is opening new opportunities for companies looking to reach their consumers in a more personalized and effective way. Thanks to advanced algorithms, AI makes it possible to analyze vast amounts of data, predict consumer behavior, automate tasks and create more engaging content (Adobe, 2024). This article discusses how artificial intelligence is changing the face of global marketing campaigns, offering businesses new branding tools.

When asked a question about the characteristics of AI (artificial intelligence), Chat GPT 4 generated the following responses at points (ChatGPT4) (Table 1).

Table 1

**Characteristics of artificial intelligence according to ChatGPT4**

| No | Feature | Description |
|---|---|---|
| 1. | Adaptability | AI has the ability to adapt to changing data and environments without manual programming |
| 2. | Automatic reasoning | Ability to solve problems based on available data, often used in decision support systems |
| 3. | Autonomy | AI systems can operate independently, making decisions without human oversight in specific contexts. |
| 4. | Interdisciplinarity | AI combines elements of computer science, mathematics, psychology, linguistics and other disciplines to create systems that can effectively simulate various aspects of human intelligence. |
| 5. | Optimization | AI can analyze vast amounts of data to find the most effective solutions to complex problems |
| 6. | Perception | AI can interpret the world using data from sensors, such as cameras (computer vision) or microphones (speech recognition), mimicking human senses. |
| 7. | Natural language processing (NLP) | Allows machines to understand and interpret human language, enabling communication between humans and computers. |
| 8. | Simulation of human reasoning | AI is designed to mimic thought processes characteristic of humans, such as learning, reasoning and independent decision-making. |
| 9. | Machine learning | A subfield of AI that deals with algorithms and statistical techniques that enable machines to improve their performance based on experience. |
| 10. | Reinforcement learning | A method of machine learning in which a system learns through rewards and punishments, gradually optimizing its actions to achieve a specific goal. |

*Note: Table 1 summarizes model-generated characteristics (ChatGPT-4) to illustrate common functional descriptors of AI; it is not treated as empirical evidence in this study.*

*Source: own compilation based on responses generated by Chat GTP4*

The paper analyses a selection of case studies of leading brands that are using AI to create global campaigns, highlighting how the technology is enabling them to transcend traditional communication and cultural barriers, paving the way for a more globalized and integrated approach to marketing. Against a backdrop of increasing competition and ever-changing consumer preferences, AI is becoming not only a tool to help reach a wide audience, but also a key enabler to build more meaningful relationships with customers around the world. Despite, these historical changes, however, it is important to emphasize that the marketer will remain an important part of designing global marketing campaigns.

## Methodology

This study applies Robert Yin's (2018) multiple-case study approach, with purposive sampling to select campaigns based on sectoral diversity, global visibility, and levels of AI integration. Data were obtained from publicly available sources, including company websites, industry reports, academic publications, and verified media coverage. Campaigns were coded using a four-dimensional framework: AI role, human role, technological implementation, and global impact. Triangulation and analytical comparison ensure robustness and consistency across case interpretations.

The selection and interpretation of case studies are informed by conceptual anchors from the Technology Acceptance Model (TAM), Service-Dominant Logic (SDL), and Dynamic Capabilities Theory, providing a multi-theoretical lens through which the interplay between AI and human creativity in global campaigns is examined.

### Research Design

The present study adopts a qualitative, exploratory research design. It combines a structured review of academic literature with a comparative analysis of selected global marketing campaigns. This methodological approach allows for both theoretical insight and practical illustration.

### Literature Selection Criteria

The literature analyzed was selected based on relevance to the use of AI in marketing, with a focus on sources published between 2018 and 2024. The inclusion criteria emphasized peer-reviewed journal articles and academic monographs that address conceptual frameworks or empirical applications of AI in marketing. Additional industry reports and practitioner-oriented studies were used to support the analysis of real-world cases.

The structured literature review followed a transparent and replicable protocol. Sources were identified through searches in *Researchgate*, and *Google Scholar* databases, using the keywords *"artificial intelligence and marketing," "AI and global campaigns," "AI and creativity," "human–AI collaboration in marketing"*, and *"AI personalization."* The time frame covered the years 2018–2024, ensuring contemporary relevance. Inclusion criteria encompassed peer-reviewed journal articles, monographs, and credible industry reports that addressed conceptual, methodological, or practical aspects of AI use in marketing. Studies that lacked direct reference to campaign design or cultural aspects were excluded.

For each selected campaign, data were coded across four analytical dimensions: (1) AI role (low, moderate, high), (2) human role (creative, supervisory, minimal), (3) technology implementation (data-driven, hybrid, or experiential), and (4) global impact (measured by geographic reach and cultural resonance). Coding decisions were based on triangulated data from academic, industry, and media sources to ensure internal validity and transparency.

### Case Study Selection and Rationale

The case studies were selected to represent a spectrum of global marketing campaigns characterized by varying degrees of AI involvement. Selection criteria included international visibility, clear use of AI tools (or the deliberate absence thereof), the campaign's cultural impact, and the availability of reliable documentation. The aim was to illustrate how AI contributes to campaign success, while also highlighting the continued relevance of human creativity. The chosen cases collectively represent a continuum of human–AI interaction and include both legacy campaigns known for human creativity and contemporary examples demonstrating AI-driven innovation. This diversity allows the typology to capture the entire spectrum–from symbolic, emotion-driven storytelling to algorithmically optimized personalization–thereby strengthening the analytical validity of the comparative approach.

### Analytical Framework

Each campaign was analyzed using a consistent framework that focused on four key dimensions: (1) the role of AI in campaign design or delivery; (2) the extent of human involvement in creative and strategic elements; (3) the main technologies and platforms used; and (4) the campaign's impact and effectiveness at the global level.

## Literature Review

Artificial intelligence (AI) has become a transformative force in marketing, prompting a surge of academic and practical interest. The literature on AI in marketing reflects both theoretical developments and empirical explorations, often intersecting with strategic management, consumer behavior, and technological innovation. This review critically synthesizes the existing body of knowledge, drawing upon selected academic publications, industry reports, and cross-disciplinary analyses. For clarity, the discussion is organized into five thematic areas: (1) AI capabilities and classification, (2) strategic applications and business value, (3) creativity and human–AI collaboration, (4) ethical and operational risks, and (5) managerial perspectives and industry insights.

### AI Capabilities and Classification

Alexa et al. (2024) provide a comprehensive framework that categorizes AI tools according to their function in decision-making, automation, and data processing. This categorization includes natural language processing, machine learning, and predictive analytics, all of which shape modern marketing strategies. Arvinth et al. (2024) emphasize that AI capabilities must be understood in the context of shifting consumer expectations and digital transition. Their analysis underlines the layered structure of AI tools: from basic automation to adaptive and cognitive AI that learns from behavioral patterns. Feng et al. (2021) present a bibliometric study showing the dominance of certain AI capabilities in marketing literature, while Grandinetti (2020) and Vishnoi & Bagga (2019) explore how these capabilities influence core marketing principles.

### Strategic Applications and Business Value

Strategic applications of AI have focused on personalization, customer engagement, and real-time decision-making. Chintalapati & Pandey (2022) and Chandra (2020) highlight how AI supports segmentation, lead qualification, and innovation within campaign design. Dimitrieska et al. (2018) stress AI's contribution to operational efficiency and customer profiling, while Eriksson et al. (2020) examine how AI transforms marketing strategy formulation. Act-On (2023a, 2023b) and Adobe (2024) provide insights from industry practice, forecasting that AI will become central to marketing automation, enhancing ROI and campaign precision. These sources affirm that AI-driven marketing strategies deliver value, but also demand new managerial capabilities and infrastructure.

### Creativity and Human–AI Collaboration

The synergy between human creativity and AI capabilities remains a central theme in recent scholarship. Chandra & Rahman (2024) develop a conceptual framework for value co-creation, arguing that AI can complement, but not replace, the emotional and intuitive aspects of marketing design. Labib (2024) similarly emphasizes the necessity of preserving human input in areas such as brand storytelling, suggesting that AI excels in data synthesis but lacks cultural and emotional resonance. Jarek & Mazurek (2019) reinforce this argument, presenting AI as a powerful support tool in marketing processes, while warning against overreliance in contexts where authenticity and emotion are vital. Hildebrand (2019) explores how AI affects consumer decision-making by shaping perception, but notes that successful campaigns still rely on human-led messaging and ethical framing.

### Ethical and Operational Risks

Despite its benefits, AI in marketing presents a range of ethical and operational risks. Wirth (2018) raises early concerns about data misuse and transparency, which are echoed in more recent studies such as Um et al. (2022), who advocate for standardized trust management in AI deployment. Ratten (2024) and Rerkpichai & Santhuenkaew (2024) highlight the dangers of algorithmic bias and the potential erosion of consumer trust, particularly in culturally sensitive campaigns. Chintalapati & Pandey (2022) identify a lack of human oversight as a critical failure point in automated marketing, while De Bruyn et al. (2020) warn of overfitting AI models to behavioral patterns that may not generalize. Together, these sources stress the importance of ethical frameworks and human governance in all stages of AI-supported marketing.

### Managerial Perspectives and Industry Insights

Several sources explore how marketing professionals perceive and adopt AI tools. According to Alexa et al. (2024), many organizations see AI as an enabler of strategic agility, but implementation challenges persist, especially regarding employee training and system integration. Shaik (2023) reports that while AI improves targeting accuracy and automation, it also introduces complexity in customer relationship management. Act-On (2023a, 2023b) and Adobe (2024) offer insights from industry practitioners, noting a growing demand for hybrid models where AI supports–rather than replaces–marketing teams. Jain et al. (2023) assess the use of AI tools such as ChatGPT in marketing research, concluding that such tools enhance productivity but must be applied with methodological caution. These findings underline the need for a balanced approach that integrates technological innovation with human judgment and organizational values.

### Theoretical Background and Conceptual Anchors

Recent scholarship offers several theoretical frameworks that enhance understanding of artificial intelligence (AI) adoption and application in marketing. Among the most prominent is the Technology Acceptance Model (TAM), which explains user intentions toward adopting new technologies based on perceived usefulness and ease of use (Davis, 1989). This model, though initially developed for individual IT users, has also been applied in organizational contexts to evaluate marketing professionals' acceptance of AI tools.

Equally relevant is the Service-Dominant Logic (SDL), which redefines marketing as a process of co-creating value rather than delivering static products (Vargo & Lusch, 2004). SDL emphasizes the role of AI not only as a tool but as a co-actor in the co-creation of personalized and interactive customer experiences.

Another useful lens is the Dynamic Capabilities Theory, which highlights a firm's ability to sense, seize, and transform in response to technological change (Teece, 2007). AI adoption in global marketing can be interpreted as a form of dynamic capability, especially when firms leverage it for real-time campaign adaptation across diverse markets.

Finally, the concept of AI-readiness models (e.g., Jarek & Mazurek, 2019) helps to assess organizational and cultural preparedness for AI integration. These models inform our understanding of the heterogeneity among firms in how they integrate AI into campaign design,

strategy, and execution. This paper draws selectively on these frameworks to interpret empirical findings and guide case analysis.

### Summary of Key Literature Contributions

To synthesize the diverse perspectives, the following table presents selected sources grouped by area of contribution (Table 2).

analysis; these are articulated through the following propositions. In order to strengthen the logical link between the theoretical framework and the empirical focus of this study, these propositions are formulated as theoretical assumptions (rather than statistical hypotheses) derived from the reviewed literature. They summarize key insights about the interplay between artificial intelligence and human creativity in global marketing communication.

Table 2

**Summary of Key Contributions from Selected Literature on AI in Marketing**

| Source | Focus Area | Key Insight | Limitations |
|---|---|---|---|
| Huang & Rust (2021) | AI typology in marketing | Introduces mechanical, thinking, and feeling AI | Conceptual, no empirical testing |
| Chintalapati & Pandey (2022) | Systematic review | Maps key AI applications: personalization, engagement | Review-based, not case-driven |
| Davenport et al. (2020) | Strategic impact | AI reshapes marketing decision-making processes | Requires empirical support |
| Eriksson et al. (2020) | Strategy formulation | Stresses need for human–AI balance in marketing | Conceptual only |
| Chandra & Rahman (2024) | Value co-creation | AI enables collaborative experiences with consumers | Theoretical, future-oriented |
| Feng et al. (2021) | Bibliometric trends | Documents rapid growth in AI-related marketing research | Descriptive, lacks interpretation |
| Adobe (2024) | Digital marketing trends | Human–AI fusion enhances personalization and ROI | Based on market surveys |
| Act-On (2023a, b) | Marketing automation | AI increases targeting precision and saves time | Industry-based, not academic |
| De Bruyn et al. (2020) | Opportunities and risks | Highlights trust, bias, and ethical pitfalls in AI use | Conceptual emphasis |
| Um et al. (2022) | Standardization and trust | Proposes technical frameworks for AI transparency | Less focus on user perspective |
| Jarek & Mazurek (2019) | Managerial perspective | AI enables data-driven marketing decisions | Outdated in tools and examples |
| Labib (2024) | Trends and future outlook | Summarizes innovations and strategic shifts in AI marketing | Broad scope, limited depth |
| Davis (1989) | Technology adoption | Introduces Technology Acceptance Model (TAM) – perceived ease & usefulness | Doesn't capture emotional/cultural dimensions |
| Vargo & Lusch (2004) | Service-Dominant Logic | Marketing value emerges from interaction, not goods delivery alone | Abstract, less applicable to AI specifics |
| Teece (2007) | Dynamic capabilities | Explains how firms adapt and reconfigure to changing environments like AI | High-level theory, needs contextual adaptation |

*Source: own elaboration based on the reviewed academic and industry literature*

Despite the abundance of literature, several inconsistencies remain across existing frameworks. For instance, while Huang and Rust (2021) emphasize technological capacity, Chandra and Rahman (2024) and Jarek and Mazurek (2019) underline the social and managerial dimensions of AI deployment. Yet, the empirical linkage between these strands is rarely articulated. The current study integrates these perspectives by aligning them with the five research questions introduced earlier, thereby transforming a descriptive review into a theoretically informed analytical framework. In doing so, the study proposes an initial set of analytical propositions regarding how AI complements, substitutes, or enhances human creativity in global marketing campaigns.

The theoretical reflections outlined above suggest several conceptual directions that frame the subsequent

Propositions:

P1: Artificial intelligence enhances analytical and operational dimensions of marketing but does not substitute human creativity or intuition.

P2: The emotional and symbolic impact of global marketing campaigns continues to rely primarily on human-led conceptualization and storytelling.

P3: The most effective marketing strategies emerge from a hybrid human–AI collaboration that balances algorithmic precision with cultural and creative depth.

Building upon these propositions, the study addresses the five research questions introduced in the *Introduction* (RQ1–RQ5), linking the theoretical premises to the comparative case analysis that follows.

This synthesis confirms that AI offers immense potential for global marketing but must be contextualized through human insight and local adaptation. The present study addresses the gap between theory and practice through a comparative case analysis

## Findings

### Theoretical Contribution

This study contributes to the academic debate by proposing a four-level typology of AI–human collaboration in global marketing campaigns. This framework builds on and extends existing literature on AI typologies (e.g., Huang & Rust, 2021) and helps bridge conceptual gaps by providing a structured, practice-oriented lens through which firms can assess their use of AI in creative processes. It offers a foundation for future empirical testing and comparative analysis across industries and cultural contexts.

The proposed four-level typology of human–AI collaboration extends prior conceptualizations, particularly those of Huang and Rust (2021) and Chandra and Rahman (2024). While Huang and Rust introduced a threefold distinction between mechanical, thinking, and feeling AI, their model focused primarily on the cognitive sophistication of AI systems rather than on the interaction between technology and human creativity. In contrast, our typology introduces a relational perspective: it maps not only the level of algorithmic autonomy but also the degree of human interpretive and cultural input. Compared with Chandra and Rahman's (2024) framework of value co-creation, our model operationalizes collaboration through four observable dimensions, thus offering a bridge between theoretical abstraction and empirical application. This positioning demonstrates that the typology advances current debates by contextualizing AI–human interaction specifically within global marketing campaign design.

### Case Selection and Structure of Analysis

In order to explore the research questions, eight global marketing campaigns were selected based on their international reach, level of AI integration, and relevance to contrasting human and machine-driven creativity. These campaigns vary in industry, geography, and technological maturity. Each case is presented using a four-dimensional framework: (1) the role of AI in campaign design or delivery, (2) the role of human creativity, (3) the technologies or platforms involved, and (4) global reach and outcomes.

### Case Study Narratives

To illustrate the proposed typology, the study presents nine representative campaigns that exemplify different configurations of human and AI involvement. These narratives are not reproduced merely for descriptive richness but serve to demonstrate how creative control, data-driven precision, and cultural interpretation interact in global marketing practice. The analytical focus is therefore on patterns and contrasts that illuminate the broader conceptual model. Every global marketing campaign that is remembered and that moves audiences was born in the heads and hearts of marketers. Even those that rely entirely on technology show how irreplaceable marketers' ideas and concepts are. It should be emphasized that in all these campaigns the role of technology is essential, but without the ideas of a human/marketer it is just a tool. It should be remembered that a marketing campaign is an organized series of activities related to the promotion of a product, or brand, which are carried out in a specific time and space. The purpose of a marketing campaign is to increase brand awareness, increase sales, build customer loyalty or achieve another specific goal. Marketing campaigns can be implemented using various channels, such as traditional advertising, online advertising, public relations, email marketing, influencer marketing, etc. The main goal of any marketing campaign is to influence specific consumer behavior. Primarily, the idea is to attract the attention of potential customers. A professionally designed and executed marketing campaign can bring tangible benefits to a company, such as increased sales, improved brand image, increased customer loyalty, etc. Therefore, it is important that marketing campaigns are carefully planned and executed with goals and budget in mind, as well as tracked and evaluated for effectiveness.

The following is a choice of global marketing campaigns, the creation of which was made possible by human creation on the one hand, and on the other hand, those that took advantage of the potential that artificial intelligence brings.

The "Think Different" campaign, launched by Apple in 1997 and lasting until 2002, remains one of the most significant achievements in the history of marketing. Conceived under the direction of Steve Jobs and executed by the agency TBWA/Chiat/Day, the campaign symbolically redefined Apple's identity, emphasizing creativity, innovation, and nonconformity. Initially, Apple collaborated with BBDO on a "We're back" campaign, but Jobs, dissatisfied with the concept, redirected efforts toward a message that would celebrate creative individuals who change the world.

Craig Tanimoto from TBWA/Chiat/Day proposed the slogan *"Think Different"*, which captured the campaign's essence. Instead of focusing on product specifications, Apple promoted a lifestyle and mindset that valued imagination and courage. The campaign featured outstanding historical and contemporary figures such as Albert Einstein, Thomas Edison, Gandhi, Amelia Earhart, Pablo Picasso, and Alfred Hitchcock. Jobs also made the unconventional decision to avoid computer magazines in favor of high-profile outlets such as *Time*, *Newsweek*, and *Forbes*, as well as large-format billboards–an approach that broke existing industry conventions.

Despite initial difficulties in obtaining image rights and selecting the right soundtrack, the campaign became a global success, enhancing Apple's image as an innovative and visionary company. Its impact extended beyond marketing results: *"Think Different"* positioned Apple as a cultural brand appealing to creative and open-minded audiences. The campaign also contributed to the

commercial success of the colorful iMac line, strengthening Apple's association with innovation and design excellence. The case demonstrates how human creativity and intuition–particularly Jobs's capacity to link cultural symbols with brand identity–remain irreplaceable elements in global marketing. Artificial intelligence could support execution and optimization, but not the kind of emotional and symbolic synthesis that defined the campaign's success (Macminik, 2016).

The *Fearless Girl* campaign (2017), created by State Street Global Advisors, combined artistic symbolism with a powerful social message promoting gender equality and women's representation on corporate boards. The bronze statue, designed by artist Kristen Visbal and placed opposite Wall Street's *Charging Bull*, became an instant cultural phenomenon. Installed on the eve of International Women's Day, it captured global attention and inspired public debate on women's leadership in business. Although initially planned as a temporary installation, the statue's popularity led to its permanent relocation near the New York Stock Exchange in 2018. The campaign successfully merged artistic expression with a corporate initiative, showing that a brand can address social values while strengthening its image and public visibility. The integration of emotional symbolism, artistic expression, and strategic communication exemplifies the irreplaceable role of human creativity and empathy in marketing – dimensions that AI, despite its analytical power, cannot authentically reproduce (The Wall Street Experience, 2022).

Coca-Cola's *Share a Coke* campaign, launched in 2011, revolutionized traditional marketing communication through large-scale personalization. The brand replaced its iconic logo with popular first names and phrases, inviting consumers to "share a Coke" with friends or loved ones. The campaign combined a simple idea with powerful emotional appeal, encouraging user-generated content and social media engagement. By leveraging data and digital promotion, Coca-Cola created a global wave of participation, turning personal bottles into viral content shared under the hashtag #shareacoke. The campaign boosted sales and strengthened emotional attachment to the brand. Its success inspired similar personalization strategies in other companies and proved that individualized engagement could generate measurable commercial results. While AI supported data management and personalization logistics, the creative concept and emotional narrative clearly originated from human insight (Arbo Blog, 2023).

Old Spice transformed its image through the 2010 campaign *The Man Your Man Could Smell Like*, developed by Wieden+Kennedy. Aimed at revitalizing the men's grooming category, the campaign cleverly targeted both male and female audiences by blending humor, irony, and dynamic storytelling. Following its initial success, Old Spice launched an interactive "Response" campaign, producing 186 personalized video replies to online comments within 2.5 days. This innovative use of real-time engagement dramatically increased visibility and sales – by 60% in the first months – and established the brand as a social media pioneer. The campaign's combination of humor, cultural awareness, and responsiveness showcased the creative agility that remains characteristic of human-driven marketing. AI could optimize performance metrics, but not replicate the improvisational tone or cultural wit that defined Old Spice's success (Wieden+Kennedy, 2010).

The *Most Interesting Man in the World* campaign by Dos Equis, developed with Havas Worldwide, became one of the most iconic advertising efforts in modern history. It revitalized the brand by creating a memorable, charismatic archetype embodying sophistication and adventure. The campaign's humorous storytelling and cultural references captured the imagination of global audiences, turning the character into an enduring internet meme. Despite market challenges, Dos Equis achieved a 22% increase in U.S. sales and tripled performance in Canada. The campaign's longevity reflected its strong narrative construction and emotional resonance, qualities rooted in human creativity and cultural intuition. By blending humor, myth, and identity, the campaign achieved a symbolic authenticity that no algorithmic optimization could reproduce (Daily Brand, 2023).

In 2018, Alibaba launched its global campaign *To the Greatness of Small* in partnership with the Winter Olympics in Pyeongchang. Created by BBDO China, the campaign celebrated small and medium-sized enterprises (SMEs) as key drivers of the global economy. Through emotional storytelling and cinematic imagery, Alibaba portrayed athletes and entrepreneurs as symbols of perseverance and ambition, aligning the company's mission with empowerment and inclusion. Distributed globally across platforms such as YouTube, Facebook, and LinkedIn, the campaign strengthened Alibaba's international brand visibility and showcased its social values. It also demonstrated how AI-driven data analytics supported the global targeting and optimization of digital content, while the narrative design and emotional coherence remained human-led. The case underlines that human storytelling gives meaning to AI-enabled reach and personalization (Campaigns of the World, 2021).

The above campaigns show that human creativity and the ability to set up authentic, emotional relationships with audiences is invaluable in marketing and advertising. Artificial intelligence can offer tools to support these processes, but deep understanding. The creation of comprehensive global marketing campaigns by artificial intelligence (AI) alone is still a novelty and experiment rather than standard practice. Although AI is increasingly being used to support various aspects of marketing campaigns, such as data analysis, content personalization, automation and campaign optimization, the full design and execution of a global marketing campaign by AI without any human intervention is rare.

However, there are some examples where AI had a significant role in the creative process or campaign execution. Burger King's *Whopper Detour* campaign (2018) exemplified the innovative fusion of technology and creative strategy. Using geolocation technology, the brand offered customers a Whopper for one cent–available only through

the Burger King app when users were near a McDonald's restaurant. This clever provocation, enhanced by social media challenges such as *Unlock the 1-Cent Whopper*, generated viral engagement and a surge in app downloads. AI tools supported the campaign's personalization, real-time optimization, and behavioral targeting. Yet the conceptual brilliance – turning competition into playful engagement – was purely human. The campaign demonstrated how AI can amplify creativity through data-driven precision, but cannot originate the humor or strategic irony that connect emotionally with audiences (Marketing Trendsetters, 2023).

IBM's *The Voice of Art* campaign, launched in Brazil in 2017 in partnership with the Pinacoteca Museum, illustrated how artificial intelligence can facilitate interactive and educational marketing. Using IBM Watson's cognitive system, visitors could "converse" with artworks and receive real-time responses about their history and meaning. Watson was trained on the museum's collection, creating a unique blend of art, technology, and accessibility. The project provided personalized experiences and inclusive features for hearing-impaired visitors. It demonstrated the potential of AI in enhancing cultural engagement while preserving human curation and ethical oversight. The campaign became a landmark example of how AI can enrich human experience rather than replace it (Anacecilia.digital, 2022).

Netflix employs AI as a core component of its global marketing strategy, using machine learning to personalize recommendations, thumbnails, and promotional content. The platform continuously analyses viewer data to predict preferences, segment audiences, and optimize promotional timing. While algorithms enhance efficiency and engagement, human teams remain responsible for the creative side of campaign messaging, visual aesthetics, and global adaptation. Netflix's case illustrates the peak of AI-led marketing, where automation scales communication but still depends on human cultural oversight to avoid homogenization (Netflix Research, 2024).

Across all nine cases, a clear pattern emerges: artificial intelligence enhances personalization, targeting, and operational scale, yet the *essence of creativity, empathy, and symbolic meaning remains inherently human*. Campaigns such as Apple's *Think Different* and Dos Equis's *Most Interesting Man* demonstrate narrative and emotional depth that no algorithm can reproduce, while hybrid models like *Share a Coke* or *Whopper Detour* illustrate the advantages of AI–human collaboration. Collectively, these examples show that successful global marketing depends on balance–using AI for precision and reach, and human imagination for authenticity and resonance.

Table 3 provides an analytical overview of how companies across sectors apply AI to varying degrees. It reflects a continuum ranging from fully human-driven creativity (e.g., Apple, Dos Equis) to hybrid approaches where AI supports but does not replace decision-making (e.g., Coca-Cola, IBM Watson, Burger King), and to data-centric personalization strategies exemplified by Netflix. A closer comparison reveals that AI-driven campaigns tend to prioritize performance optimization–such as click-through rates or behavioral targeting–whereas human-led initiatives emphasize symbolic communication, emotional connection, and long-term brand equity. For instance, while Netflix leverages AI to customize interfaces and suggestions at the micro level, Apple constructs a global emotional narrative that transcends immediate personalization. The former relies on behavioral data and algorithmic inference; the latter builds on cultural associations and universal values such as simplicity, elegance, or rebellion.

Table 3

**Summary of Global Marketing Campaigns Involving AI**

| Brand / Campaign | Type | AI Involvement | Objective | Human–AI Relationship |
|---|---|---|---|---|
| Apple – Think Different | Brand repositioning, emotional branding | Low | Change brand image, promote creativity | Human-driven, symbolic storytelling |
| Fearless Girl – State Street | Public installation, gender equality | None | Promote board diversity | Entirely human, symbolic art |
| Coca-Cola – Share a Coke | Personalization via packaging | Moderate | Boost emotional connection & sales | Human concept + AI for personalization |
| Old Spice – Smell Like a Man | Humor-based viral marketing | Low | Rebrand to appeal to women buyers | Creative + real-time human engagement |
| Dos Equis – Most Interesting Man | Character-based storytelling | None | Rebuild brand identity | Fully human-crafted concept |
| Alibaba – To the Greatness of Small | Olympic-themed global campaign | Moderate | Support SMEs globally | AI-assisted targeting, human narrative |
| Burger King – Whopper Detour | Location-based mobile promotion | High | Drive downloads & customer shift | Hybrid – geolocation + creative strategy |
| IBM Watson – The Voice of Art | Museum experience via AI | High | Interactive art education | AI-driven interaction, human curation |
| Netflix – Content personalization | Adaptive digital promotion | High | Boost viewer engagement | AI-driven delivery, human content |

*Source: own elaboration based on campaign documentation and secondary sources, including official websites, marketing case repositories, and media analyses of Apple, Coca-Cola, IBM Watson, Alibaba, Netflix, Old Spice, Dos Equis, Burger King, and Fearless Girl campaigns*

Campaigns like Coca-Cola's *Share a Coke* represent a transitional model in which human creative vision guides the use of algorithmic tools. Here, AI amplifies rather than replaces creativity–generating thousands of visual variations or combinations that human designers might not have envisioned. This marks a conceptual shift from a binary "AI versus human" approach toward a continuum of hybrid collaboration. The IBM Watson *Voice of Art* project further illustrates how AI can enhance not only technical performance but also educational and emotional engagement by enabling interactive dialogue between audiences and artworks. This extends beyond operational efficiency into the realm of cultural enrichment, where data-driven systems facilitate immersive experiences.

At the same time, campaigns like Dos Equis and Apple reaffirm the enduring value of human-led creativity, particularly when cultural positioning and brand archetypes are central. In such cases, omitting AI from the creative process may constitute a deliberate strategic choice rather than a technological limitation–a preference for narrative authenticity and emotional depth over algorithmic optimization.

### Cross-Case Comparison and Insights

These campaigns demonstrate a spectrum of AI utilization in global marketing. At one end are campaigns like Apple's "Think Different" and Dos Equis' legendary character strategy, where AI plays no role and human storytelling dominates. At the other end, Netflix's recommendation system highlights the strength of algorithms in personalization and content delivery. Burger King's "Whopper Detour" and Coca-Cola's "Share a Coke" combine AI and geolocation/data personalization with strong human-conceived ideas, illustrating a hybrid approach. IBM Watson's art project reveals how AI can engage consumers experientially, yet still rely on human UX design, concept framing, or cultural anchoring.

### Relevance to Research Questions

The cases collectively offer insights into all five research questions:

Q1 (Limitations of AI): Apple and Dos Equis reveal that emotionally resonant storytelling remains a human domain; IBM Watson showed challenges in creating emotionally meaningful interaction through AI alone.

Q2 (Advantages of AI): Netflix and IBM Watson demonstrate how AI enhances targeting, personalization, and content-experience alignment.

Q3 (Human superiority areas): Brand identity, emotional design, narrative construction, and cultural sensitivity clearly rely on human creativity, as seen in Apple, Dos Equis, and Coca-Cola.

Q4 (Standardization risks): Netflix uses AI to adapt globally, but risks cultural flattening; this is mitigated by human input in campaign oversight.

Q5 (Best suited areas for AI): Trend analysis, targeting, segmentation, and campaign automation emerge as the most AI-compatible domains.

### Key Observations

The analysis confirms that AI excels in the areas of automation, optimization, and mass personalization. However, campaigns that resonate deeply with audiences continue to rely on emotional appeal, cultural relevance, and storytelling–domains where human marketers demonstrate clear superiority. The most successful global marketing efforts are those that integrate the efficiency of AI with the authenticity of human expression.

## Discussion

This article contributes to the literature by proposing a refined model of human–AI collaboration, expanding on the Huang & Rust (2021) typology. By incorporating emotional and cultural dimensions into AI strategy, the model offers a holistic framework that bridges the gap between technology-driven optimization and narrative-driven branding.

The analyzed campaigns confirm that artificial intelligence is playing an increasingly central role in global marketing, particularly in areas requiring precision, data analysis, and real-time personalization. However, they also reveal clear boundaries for algorithmic decision-making, especially when emotions, cultural sensitivity, or brand storytelling are involved. A cross-case comparison suggests that optimal marketing outcomes are most often achieved through hybrid strategies that integrate the strengths of both AI and human input. This supports the emerging academic consensus on the concept of *AI augmentation* rather than full automation.

### A Typology of Human–AI Collaboration in Global Campaigns

Based on the case studies, the following four-level typology of collaboration is proposed:

Level 1: Human-Led Campaigns (No AI Involvement) – Brand stories are entirely conceived, executed, and emotionally framed by human teams. These campaigns rely on cultural sensitivity, symbolic messaging, and storytelling grounded in human experience.

Examples: Apple's "Think Different," Dos Equis' "The Most Interesting Man in the World".

Level 2: Human-Centered Campaigns Enhanced by Data and Technology – The creative vision is human-led, but selected AI or digital tools support execution, such as targeting, delivery, or personalization.

Examples: Coca-Cola's "Share a Coke" (name-based personalization), Burger King's "Whopper Detour" (geolocation-based offers).

Level 3: AI-Facilitated Interaction with Human Framing – AI systems generate real-time content or interaction, while humans guide conceptual design, ethics, and user experience.

Example: IBM Watson's "The Voice of Art" (AI-driven engagement in museum spaces).

Level 4: Algorithm-Led Personalization at Scale – AI plays a dominant role in content selection, customization, and timing, with human involvement mostly limited to strategic oversight.

Example: Netflix's campaign optimization through viewing data and algorithmic recommendations.

This model illustrates how marketing organizations can decide the appropriate degree of AI integration depending on campaign objectives, industry characteristics, and target audience expectations. Rather than a binary choice between human and artificial intelligence, the framework shows a continuum of hybrid strategies, where both forces can complement each other across different levels of creative and operational intensity.

### Addressing the Research Questions through Comparative Analysis

The empirical material supports the following conclusions regarding the five guiding research questions:

RQ1: AI's limitations are most evident in areas demanding emotional resonance and deep cultural sensitivity. These are best handled by human creatives.

RQ2: AI's strengths lie in operational scale, real-time analysis, and cost-effective targeting. This is especially effective in digital environments with large data pools.

RQ3: Human superiority is evident in narrative development, humor, ethics, and long-term brand building.

RQ4: Risks of standardization are real but manageable through human editorial control and localized adaptations.

RQ5: AI's optimal application areas include segmentation, A/B testing, content timing, dynamic pricing, and consumer profiling.

### Theoretical Reflections – Balancing Automation and Imagination

From a theoretical standpoint, the relationship between AI and creativity can be situated within the broader tension between standardization and differentiation. While AI excels at optimizing for efficiency and measurable performance (Huang & Rust, 2021), it does not inherently create meaning. Drawing from Stern (2006), Holt (2004), and Escalas and Bettman (2005), marketing can be understood as a meaning-making and narrative process–thus, human interpretation and semiotic sensibility remain irreplaceable.

Furthermore, academic models such as the AI Maturity Curve (Chui et al., 2018) or the Cognitive-Affective Model of Creativity (Martindale, 1999) emphasize the need for co-existence. High-performing organizations gradually shift from AI-assisted to AI-augmented models, while retaining human agency over narrative coherence, ethics, and cultural resonance.

### Managerial Recommendations

Based on the findings, the following recommendations are proposed for marketing executives considering AI in global campaigns:

Combine AI with local cultural expertise – Use algorithms to identify opportunities but involve human teams in final content design.

Avoid full automation in brand storytelling – Authentic emotional engagement still depends on human creativity.

Implement AI ethics protocols – Ensure transparency, consent, and fairness in automated decisions.

Invest in hybrid teams – Foster collaboration between data scientists and creatives for balanced campaign execution.

Pilot AI tools in diverse markets before global rollout – Prevent unintended cultural missteps.

Integrate brand values into AI strategy – Ensure that algorithmic optimization aligns with core brand identity.

While the above recommendations provide general guidance, their application should consider sector-specific and cultural contexts. For instance, technology-intensive sectors such as streaming or e-commerce may prioritize algorithmic personalization, whereas luxury and heritage brands should emphasize narrative authenticity and symbolic communication. In emerging markets, where digital infrastructure and consumer trust vary, hybrid AI-human models can mitigate risks of cultural misalignment or over-standardization. These nuanced implications highlight the need for adaptive managerial strategies rather than universal prescriptions.

### Theoretical and Practical Contributions

Based on the analysis, this article proposes a model of human–AI collaboration in global marketing campaigns. The model outlines four core phases–insight, strategy, execution, and optimization–each with complementary contributions from AI and human actors (Table 4).

Table 4

**Roles of Artificial Intelligence and Human Input Across Campaign Phases**

| Phase | AI Role | Human Role |
|---|---|---|
| Insight | Data analysis, segmentation | Interpretation, priority setting |
| Strategy | Scenario simulation | Vision, brand voice, creative brief |
| Execution | Automation, targeting | Creative assets, storytelling |
| Optimization | Performance tracking, A/B testing | Adjustment, emotional resonance |

*Source: own elaboration based on comparative insights from global marketing campaigns and AI-assisted strategy literature*

This framework emphasizes synergy rather than substitution and suggests that future marketing success will depend on an intelligent integration of both forces.

## Limitations and Future Research

As with any qualitative study based on case analysis, this research has limitations. First, the selection of eight campaigns, while diverse, is not exhaustive. There may be additional industry-specific or regional dynamics not captured here. Second, the article does not rely on primary data, such as interviews or consumer surveys, which could offer deeper insight into user perception of AI-driven campaigns.

Future research could pursue several avenues. Longitudinal studies of AI integration in marketing

departments could shed light on organizational learning. Cross-cultural analyses of consumer responses to AI personalization would also be valuable. Finally, more critical inquiry is needed into the societal impacts of automated persuasion, especially as AI becomes increasingly autonomous in decision-making processes.

Moreover, since this study relies exclusively on secondary data, issues of validity and bias must be acknowledged. Information derived from corporate and media sources may reflect promotional narratives rather than objective evaluations. Although triangulation helped mitigate this risk, future research should incorporate primary data–such as interviews with marketing professionals or consumers–to enhance the credibility and depth of interpretation.

## Conclusions

Artificial intelligence is transforming the landscape of global marketing by enabling brands to better understand, segment, and engage consumers. However, the technology is not a replacement for human creativity. Instead, AI should be viewed as a powerful assistant–capable of enhancing efficiency, personalization, and reach, but still dependent on human insight to ensure emotional connection and cultural alignment. Unlike prior work that isolates AI capabilities from creative strategy, this article integrates both, offering a comprehensive framework for hybrid campaign design. The typology and comparative analysis enable both scholars and practitioners to better understand the nuances of human–AI synergy in global marketing contexts.

This article has demonstrated that a nuanced, hybrid approach combining AI capabilities with human expertise delivers the most effective global marketing campaigns. As the technology evolves, further research will be needed to explore new forms of collaboration, ethical implications, and long-term brand impacts.

The findings also emphasize the need for a more integrated research agenda that links theoretical exploration with empirical evidence from diverse markets. By aligning conceptual propositions with real-world marketing dynamics, future scholarship can contribute not only to advancing marketing theory but also to shaping responsible and human-centered AI practices in the global business environment.

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ZSUZSANNA HENTZ

# STUDY OF SPORTS CONSUMPTION HABITS IN A CENTRAL EASTERN EUROPEAN CAPITAL CITY

# SPORTFOGYASZTÁSI SZOKÁSOK EGY KÖZÉP-KELET-EURÓPAI FŐVÁROSBAN

This study investigates attitudes toward sports experiences, public sports, and sports facilities in Budapest, focusing on sports-related needs and habits. Based on a quantitative survey of 1.000 respondents who regularly engage in sports, it assesses their opinions and expectations regarding municipal roles in promoting local sports. Nearly 80% of participants believe that local governments should play an active role in supporting community sports. The findings reveal that around 70% of Budapest residents exercise independently, primarily engaging in outdoor cardio activities, indicating notable price sensitivity. Consequently, investments in public sports equipment parks should be prioritized. Respondents spending less on sports express a demand for cost reductions from local authorities. The results also confirm that a city's sports infrastructure has a strong influence on local participation rates. Furthermore, gender, education level, and place of residence significantly affect sports-related expenditures, while economic awareness shapes residents' sports choices and spending behaviour.

Keywords: **sport consumption, sport expenditure, sport infrastructure, sport economy, public service provision, physical activity, recreational sport**

Jelen kutatás a sportolási élmények, a fővárosi sportlétesítményekhez fűződő attitűdök, a sportolási igények és szokások megismerésére fókuszál, budapesti viszonylatban. A cikk célja, a rendszeresen sportoló populáció megismerése kvantitatív kutatási módszerrel, 1000 fős mintán. A közösségi tapasztalat ismerete kulcsfontosságú a városvezetés szakpolitikai döntéseinél, hiszen a rendszeresen sportolók közel 80%-a az önkormányzati beavatkozást várja. Budapesten a lakosság közel 70%-a önállóan végez fizikai aktivitást, és ők leginkább a kültéri kardió sporttevékenység űzését helyezik előtérbe, ami egyfajta árérzékenységre is utal, ami a sportinfrastrukturális fejlesztések esetén a közterületi sporteszközparkok priorizálását szorgalmazza. Ez a réteg kimutathatóan kevesebbet költ sportcélú kiadásokra, valamint lakossági költségcsökkentési igényként is megfogalmazódott a helyi önkormányzatok felé. A sportágak népszerűségének aránya is kapcsolatot mutat a tudatos gazdasági alapú sportágválasztással, mely esetben a lakossági árérzékenység hangsúlyosan megjelenik. A szerző továbbá azonosította, hogy a városi sportinfrastruktúra alapvetően meghatározza a sportágak helyi népszerűségét, míg a nem, az iskolai végzettség és a lakóhely szignifikánsan befolyásolja a sportkiadások mértékét.

Kulcsszavak: **sportfogyasztás, sportkiadások, sportinfrastruktúra, sportgazdaság, közszolgáltatás nyújtása, fizikai aktivitás, rekreációs sport**

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**Author/Szerző:**
Hentz Zsuzsanna[a] (hentz.zsuzsanna@edu.pte.hu) PhD student

[a]University of Pécs (Pécsi Tudományegyetem) Hungary (Magyarország)

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Through its continuous development, modern sport has become a sector with significant social and economic impact (Sárközy, 2017). The economic situation of sport has improved significantly, with considerable growth observed in several areas, including industrial organizations, economics, and labor economics. These areas demonstrate the complexity and diversity of sports economics, both as an academic discipline and as a practical field (Leeds et al., 2022). The growing interconnection between sport and broader economic systems reflects its dual role as a cultural phenomenon and an economic driver.

The global sports economy was worth USD 512 billion in 2024 and is expected to reach USD 800 billion by 2030 (Deloitte, 2025). Based on this, the main sources of revenue are media rights, sponsorship, merchandising, and sports tourism, but the economic role of recreational sports is also growing, as recreational sports participants can generate more than EUR 200 billion in economic value annually in the EU (ISCA, 2025). In addition, the EU budget has steadily increased its spending on leisure and sports activities, given their significant economic and social impact, from €44.070 million in 2013 to €60.500 million in 2022. The government's priority in this area has clearly increased, with support growing particularly during the pandemic. This sector is a significant social and economic driver, especially in local communities.

Sport increasingly became a commodity during the 20th century and developed into an extremely profitable industry, bringing about a broader transformation of leisure and the emergence of a market-driven consumer culture. It has been proven that increasing physical activity in society brings great benefits to the national economy (Ács et al., 2011; Ács et al., 2016).

If a municipality has low levels of sport participation or if appropriate sporting opportunities are not available for certain groups, local leaders can take targeted measures to address the problems. In addition, sport consumption is closely linked to the functioning of the local economy. Playing sport, attending sporting events and buying sport-related products can have economic impacts, create jobs, increase the turnover of local businesses and contribute to tourism. The development of sport consumption can therefore be interpreted as an economic indicator, and sport therefore plays a key role in the performance of local and municipal authorities.

The study by Szabó, Máté and Havran (2021) is one of the first comprehensive Hungarian studies on the economic role of recreational sports in Central and Eastern Europe, with a particular focus on Hungary. Between 2010 and 2019, households significantly increased their spending on leisure sports services and sports equipment. In Hungary, this increase was around 14%, while in Bulgaria it was 34% and in Slovakia 29%. This suggests that, although there is still some catching up to do in terms of market size in the euro area, consumer demand is showing an upward trend.

Based on data from the Central Statistical Office (2023), it can be concluded that, according to the per capita consumption volume indices for the household sector in Hungary, the demand for goods in the culture, entertainment and leisure sports showed an average annual growth of 4.25% between 2000 and 2023. The impact of the COVID-19 pandemic deserves special attention, as it caused demand to fall by 1.2% in 2020. However, in 2021, with the easing of pandemic measures, the consumption volume index rose by 20.8%, followed by a further 17.2% increase in 2022. Although the pace of expansion slowed in 2023, growth was still 6.2% higher than in the previous year. This trend is supported by the fact that in the post-pandemic period, the population's affinity for sports increased significantly, related market segments expanded dynamically, and sports consumption behavior underwent a major transformation. In comparison, actual household consumption increased by only 2.5% on average between 2020 and 2023. In the post-COVID-19 period, the willingness to engage in physical activity slowly and gradually returned to pre-pandemic levels (Fenyves, 2023), but changes in the way physical activity was performed persisted.

Over the past years, a number of transformations (e.g. COVID-19, inflation) have had an impact on the quantitative and qualitative realization of physical activity (Skinner & Smith, 2021; Evans et al., 2020; Horky, 2020; Parnell et al., 2020; Ratten, 2020), and it is therefore of paramount importance to examine the current situation, both by identifying the current influencing factors and by learning from existing opinions and experiences. In this research, the focus of the study of sports consumption is on active sports consumption, including both formal, i.e. with market transactions, and informal, i.e. without market transactions (Kokolakakis et al., 2017). Formal sport intuitively refers to club-based sports in which governing bodies can make important decisions, exercise control, and establish operating models (Jeanes et al., 2019). Informal sport can intuitively be considered as sport practiced "outside" these structures, such as soccer played in the park, group cycling tours (O'Connor & Brown, 2007), and "parkrun" (Hindley, 2018).

The study focuses on sporting experiences, attitudes towards public sports and sports facilities in the capital, sporting needs and sporting habits. The aim is to find out the attitudes and opinions of the population that regularly participates in sports in Budapest. The main categories of the exploratory research were the population playing sports independently without a coach, the population playing sports under the guidance of a coach, the certified amateur athletes (inter-organised sporting activities) and the professional athletes (inter-organised sporting activities).

In the following, the paper summarises the theoretical framework of sports consumption and puts into context the characteristics of different forms of sports. It then describes the environmental influences that are most likely to affect the propensity to participate in sports and thus influence different sports attitudes. Finally, the study presents its quantitative findings and draws various conclusions and recommendations that can serve as

incentives for urban sports orientation, with a particular focus on Budapest, the capital of Hungary.

Budapest as an urban area is a particularly relevant location for studying sports consumption for several reasons. On the one hand, the capital is Hungary's most populous and economically developed settlement, where a significant part of sports services, infrastructure, and market opportunities are concentrated. On the other hand, Budapest's unique socio-economic and cultural background, as well as its historical development, influence the patterns and prevalence of sports consumption. Budapest is home to a significant proportion of the country's population, which represents an extensive demand base for sports consumption services (Hajdú, 2016). The city has a well-developed network of sports facilities and high-quality sportclubs and sporting events, which promote formal sports consumption (Szabó, Máté & Havran, 2021). This is particularly important in sports consumption involving market transactions, such as gym memberships, competitions, and the purchase of sports equipment.

## Recreational sports and sports consumption

Nowadays, doing sports is a value, a priority in many aspects of life, including health promotion and development, but it also plays an important role in public education, tourism, media and the economy (Csernák, 2023). The sport economy has a significant impact on the labour market, health and local economies, and is therefore closely linked to society as a whole (Ács et al., 2020). With its significant social and economic impact, it is necessary to seize all opportunities to increase physical activity (Ács et al., 2011; Stocker & Ács, 2012; Ács et al., 2016).

During the 20th century, there was a strong separation between recreational and professional sports (Sárközy, 2013). The increased amount of leisure time and the spread of a health-oriented worldview gave rise to new leisure habits, thus the emergence of recreational sports (Kovács, 2010), and, in contrast, the importance of the need for hard competition and performance, thus the other pole, professional sports, was also intensified (Fóris & Bérces, 2005).

Recreational sport is a voluntary, informal, active, physically demanding leisure activity involving physical exertion and physical exercise, according to specific rules (Nagy, 1995). There are both formal, i.e. with market transactions, and informal, i.e. without market transactions (Dénes & Misovicz, 1994), as sport can be played in commercially based service providers, public institutions, public parks, squares, NGOs (associations) and at home (Szabó, 2011). Professional sports are clearly for-profit industries, but there are also business elements in recreational sports. For this reason, sport consumption can be understood in both professional and recreational sports. According to Dénes and Misovicz (1994), sports consumption is nothing other than the production, distribution and exchange of sports goods and services, as well as the set of decision alternatives that arise in consumption and their realisation.

Sports consumption was previously divided into three domains by Stewart et al. (2003). The first of these is active sport consumption, where individuals engage in sport on their own, through active participation, while investing their time, energy and money. The second area is passive sport consumption, i.e. passive participation, where the individual becomes involved in the sporting activity merely as a spectator. The third element takes the form of various sports products and equipment, sports services (Csóka & Törőcsik, 2018).

In the case of passive sport consumption, participation in sport is only indirect, as individuals participate passively and thus only consume the experience of sport (Csóka et al., 2020). In recreational sports, the direct source of revenue can be the consumer, sponsorship and merchandise market, while the indirect source is the sports market (Szabó, 2012). For providers of recreational sports, they are manufacturers and suppliers of sports equipment, equipment and sportswear. With regard to this market, we can speak of derived demand, since, if consumer demand and demand for recreational sports services increases, then demand for sports equipment, sports equipment, sports clothing will also increase.

According to Kovács et al. (2015), the main inhibiting factor for the consumption of leisure sports is the lack of leisure time, while the cost of the sport is only second. The Eurobarometer (2022) also identified lack of time as the main reason for not taking part in sports (Kosztin & Balatoni, 2019), but for socially disadvantaged populations, financial constraints are at least as strong a barrier. It is therefore clear that, in addition to inadequate attitudes and lack of time, the dimension of money is also a strong determinant of sport. According to Paár (2010a), money, the dimension of income, is the most important influencing factor, since in Hungary sports consumption expenditure is considered a luxury good, so we can only spend our leisure time on leisure sports consumption in an appropriate economic and social environment (Paár, 2010b), whereas for instance in Germany the characteristics of sports consumption is significantly different (Paár et al., 2021),

However, in addition to these, a secondary filter is also present in the area of sport consumption, namely the quality of the various sports services. Quality has become a fundamental factor in determining consumer satisfaction (Szabó, 2012). The intangible values that are generated in the consumer have become the main focus of value creation (Stocker, 2013), and sports does not only create value in tangible form for the consumer of the sports service.

The emergence and spread of the COVID-19 virus have directly affected all areas of the world. In a very short time, the virus outbreak has changed many lifestyle habits and behavioural patterns (Mutz & Gerke, 2021). Sport is one of the areas that has been strongly affected by the outbreak. In 2020, a significant downturn was identified in the sports industry, affecting both competitive and recreational sports systems and players, as well as impacting related sports markets, sports tourism or even sports media sectors (Skinner & Smith, 2021; Evans et al., 2020; Horky, 2020; Parnell et al., 2020). Restrictions have also

had a significant influence on the physical activity of the population and on the development of their sporting habits (Ráthonyi et al., 2021; Stockwell et al., 2021) and even their psychological well-being (Laczkó et al., 2023).

Stockwell and colleagues concluded in their study of 64 representative studies conducted in countries around the world that during the first wave of the COVID-19 epidemic, the time spent in physical activity decreased and the time spent in sedentary activities increased in almost all countries worldwide. Only 3 of the 45 studies in the adult population found no significant reduction in time spent exercising (Romero-Blanco et al., 2020; Muriel et al., 2020). 17.7% of studies in the adult population found a reduction in time spent exercising of more than 50% (Stockwell et al., 2021).

During the COVID-19 pandemic, physical activity levels in Hungarian sports also changed significantly ($p<0.001$), decreasing by 166±1128 minutes (mean±SD) per week on average. Physical activity levels decreased the most in women (-286±980 minutes per week) and children (-304±951 minutes per week), and the least in middle-aged people (-83±1024 minutes per week) and graduates (-99±982 minutes per week). Better quality of life was experienced by those who were more physically active during the pandemic ($p<0.001$) or even increased their physical activity ($p=0.030$). The more physically active people are, the greater their well-being (Szabó et al., 2020).

Based on data from the Central Statistical Office (2023), it can be concluded that, according to the per capita consumption volume indices for the household sector in Hungary, demand for goods in the culture, entertainment and recreational sports in Hungary showed an average annual growth of 4.25% between 2000 and 2023. The impact of the COVID-19 pandemic deserves special attention, as it caused a 1.2% decline in demand in 2020. However, in 2021, with the easing of pandemic measures, the consumption volume index rose by 20.8%, followed by a further 17.2% increase in 2022. Although the pace of expansion slowed in 2023, growth was still 6.2% higher than in the previous year. This trend is supported by the fact that in the post-pandemic period, the population's affinity for sports increased significantly, related market segments expanded dynamically, and sports consumption behavior underwent a significant transformation. In the post-COVID-19 period, the propensity to exercise slowly and gradually returned to pre-epidemic levels (Fenyves, 2023), but changes in the way in which physical activity was performed persisted.

In addition to the lifestyle changes caused by the epidemic, various economic factors such as economic growth, income levels, inflation and unemployment also have a significant impact on sport consumption and sporting habits. The relationship between the economic situation and sport is complex and multidimensional. Economic growth and high income, levels tend to increase attendance at sporting events, and the amount spent on sport (Muszbek, 2018). In contrast, economic downturns and declining incomes can reduce sport consumption, as households reduce non-essential expenditures, including sport-related expenditures, which are considered luxuries, as disposable income becomes less valuable (Paár, 2010b).

The number of academic articles examining the direct relationship between inflation and sport consumption is very limited, but empirical research suggests that inflation has a significant and direct impact on the quantity and quality of sport consumption (The Financial Times, 2024).

According to the most recent data from the Hungarian Central Statistical Office (KSH), inflation in Hungary averaged 3.7% in 2024, rising to 4.6% in December. In 2024, prices rose by an average of 3.7% year-on-year (KSH, 2024), with food prices increasing by 2.8% and services by 8.9%.

Economic factors, such as inflation, can indirectly affect sport consumption through social interactions and changes in consumer habits, and are therefore an important background factor for this research.

## Research design

An examination of the associated social influences is essential to the current understanding of sporting habits and attitudes, and the background of this study was influenced and framed by this theoretical inquiry. Based on the literature review, the following research questions (RQ), and hypothesis (H) were proposed:

Research Question1: *What differences can be identified between formal and informal leisure sports habits, by type of sports activity?*

Hypotesis1: *There is a significant difference between the sporting habits of informal and formal recreational athletes.*

Research Question2: *What relationship can be identified between the demand for active sports consumption (amateur and professional certified athletes playing sports in organised settings) and supply (number of sports clubs and sports enterprises operating in the districts of Budapest)?*

Hypotesis2*: Active sports consumption demand (amateur and professional certified athletes performing in an organised setting) and supply (number of sports clubs and sports enterprises operating in districts of Budapest) have a linear relationship.*

Research Question3: *What kind of relationship can be observed between demographic factors and the level of spending on sports activity?*

Hypotesis3: *Gender, educational attainment, and place of residence significantly affect the level of spending on sports.*

### Data and methodology

In order to collect data, I conducted a primary online questionnaire survey. The questionnaire was compiled based on previous domestic and international research on sports consumption and leisure habits (Downward & Riordan, 2007; Eurobarometer, 2022) and used a previously validated 25-item questionnaire structure that represents a five-dimensional (consumer attitude) sports consumption

attitude model. This tool allows for a quantitative analysis of sports consumer attitudes. The questionnaire was based on responses received between March and September 2024.

The sample consisted exclusively of Budapest residents aged between 14 and 65 who regularly participate in sports (based on place of residence). The sample therefore did not represent the entire population of Budapest, but a specific subgroup.

Budapest has a population of approximately 1.65 million, of which approximately 65-70% are between the ages of 14 and 65. According to Eurobarometer (2022) data, the proportion of people who regularly participate in sports in Hungary is 35-45%, which means that the estimated size of the Budapest population is 480,000, and the sample size is 0.2%.

I selected the elements of the population using a stratified random sampling method (N=1000), as the research focused on the population that regularly participates in sports. I rounded the sample numbers presented for easier interpretation.

The theoretical background of the research was further supported by a personal survey of sports sector employees in the 23 districts of Budapest, which will be used to compile a list of all sports facilities in Budapest. The results were corrected by document analysis and online data collection (Table 1).

practised sport, and different subjective factors, whereby experiences, needs and subjective values were expressed.

The aim of the questionnaire survey was to examine the results of social listening on a larger sample, focusing on sporting experiences, attitudes towards public sport and sport facilities in the capital, sporting needs and sporting habits. The research focused exclusively on the attitudes and opinions of the regular sports population, relying on the direct experience of sports participants.

This combined research method allowed to nuance the results obtained in more detail and contributed to the validation of the research, given the cross-validation of different data sources. It also made better performance estimation more achievable and reduced bias.

The results of the exploratory research have been demonstrated through frequency calculations. A linear regression (β) test was used to examine the extent of gender, education and residence as independent variables and sport expenditure as dependent variable. The fit test of the regression model was complemented by a coefficient of determination ($R^2$) calculation. The relationship between the type and number of sports facilities available in Budapest and the most popular sports was also measured using multiple linear regression. In addition, I examined whether the number of sports clubs and sports enterprises is correlated with the proportion of physical

Table 1.

**Characteristics of the participants (sample) of the questionnaire survey**

| Characteristic | Category | Percentage | Absolute number (individuals) |
|---|---|---|---|
| **Age** | mean | 34.5 yr | – |
| | median | 29.7 yr | – |
| | mode | 35.6 yr | |
| | min | 14 yr | – |
| | max | 65 yr | – |
| | standard deviation | 14.8 yr | – |
| | | | |
| **Place of residence** | living in the Buda district (I., II., II., XI., XII.) | 39% | 390 |
| | living in the Pest district (IV., V., VI, VII., VIII., IX., X., XIII., XIV., XV., XVI., XVII., XVIII., XIX., XX., XXI., XXII., XXIII.,) | 61% | 610 |
| **Education level** | bachelor's degree | 28% | 280 |
| | secondary education | 51% | 510 |
| | tertiary education | 21% | 210 |
| **Gender/sex** | men | 48% | 480 |
| | woman | 52% | 520 |

*Source: own compilation*

The qualitative questionnaire research used closed questions and open-ended questions as well to find out respondents' personal opinions, attitudes, experiences and motivations about playing sport. The questions covered demographic factors such as gender, age, place of residence (including district), different attitudinal, sociocultural factors such as: type of sporting activity, level of spending on sport, areas of sport consumption, activity performed in organised settings and the proportion of amateur and professional certified athletes performing in organised settings. When applying statistical analyses, categorisation was carried out, on the basis of which the extracted data and information were organised, grouped and classified into categories. The purpose of the categorisation was to make the raw data processable and to organise it according to aspects related to the

research questions. On this basis, the categories made it possible to identify relationships and patterns between the different elements. I used a paired t-test to compare the quantitative and qualitative assessment of sporting opportunities.

## Results

According to the representative survey 71% (N=710) of the respondents are recreational athletes who carry out physical activity independently, 28% (N=280) are recreational athletes who carry out physical activity in an organised setting. A respondent group, accounting for 1% (N=10), was unable to categorize the way they engage in physical activity.

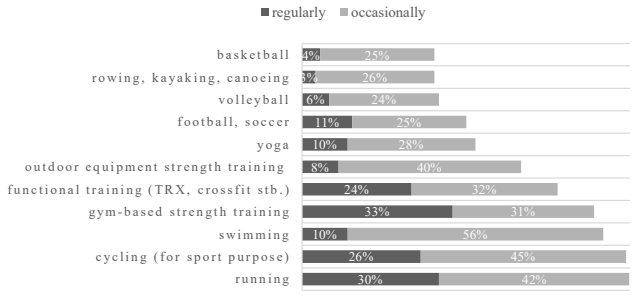
13% of respondents (N=130) are certified amateur athletes and 5% (N=50) are certified professional athletes who play sport for pay. They also practise sport in their free time, both independently and under the guidance of a coach. They are therefore assessed in the research as recreational sports athletes.

The majority of respondents (88%, N=880) exercise at least 1-2 times a week and two thirds (62%, N=610) more often. Among those who exercise independently without the guidance of a coach, men are in the majority (53%, N=376), whereas almost three quarters of those who exercise under the guidance of a coach are women (70%, N=196) and the vast majority have at least a secondary education (93%, N=260). For amateur or professional certified athletes, two thirds are male (67%, N= 120), the majority are under 30 (56%, N= 100), more often than average have a primary education (21%, N= 37) and more than one third are Buda residents (35%= 63).

Figure 1 shows the distribution of sporting habits by sport and frequency. Among the sports regularly practised, the most common is strength training on gym equipment (33%, N=330), followed by running (30%, N=300) and cycling (26%, N=260). Swimming (56%, N=560) is the most popular of the occasional sports. The majority also play two sports (61%, N=610).

Figure 1.

**Sporting habits by sport and frequency**




*Source: own compilation*

The research question 1. sought to identify differences between formal and informal recreational sports activities, and the hypothesis 1. was that there is a significant difference between the sports habits of informal and formal recreational athletes.

In this regard, the research data show a significant relationship between the population playing sport independently without a coach (informal sport) and outdoor cardio exercise ($\chi^2$= 9.788; d=4, p=0.038), i.e. people without a coach often choose outdoor cardio exercise (running, cycling for sport). The population exercising under the guidance of a coach ($\chi^2$=9.59; df=4, p=0.049) prefers indoor type of exercise, more strengthening or relaxing (gym strengthening, yoga).

The number of sports clubs and sports enterprises operating in Budapest is not correlated with the proportion of physical activity performed in an organised setting and the proportion of amateur and professional certified athletes performing in an organised setting (p=0.068), and the null hypothesis cannot be rejected. The sports infrastructure serving the sports is an important independent factor, as its categorised quantitative representation is comparable to the dependent factors examined in this research. The areas suitable for sports in Budapest are summarised in Table 2.

Table 2.

**Areas suitable for sports in Budapest**

| Areas suitable for sports in Budapest | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | XIII | XIV | XV | XVI | XVII | XVIII | XIX | XX | XXI | XXII | XXIII | summa |
| other | 1 | 0 | 31 | 1 | 0 | 0 | 0 | 2 | 2 | 23 | 7 | 1 | 5 | 0 | 2 | 12 | 3 | 4 | 0 | 0 | 0 | 2 | 1 | 97 |
| puplic park | 4 | 18 | 1 | 3 | 1 | 2 | 1 | 0 | 21 | 6 | 10 | 6 | 16 | 2 | 5 | 6 | 1 | 14 | 2 | 2 | 8 | 10 | 1 | 140 |
| swimming pool | 1 | 2 | 3 | 2 | 0 | 1 | 2 | 2 | 4 | 3 | 7 | 5 | 8 | 4 | 1 | 2 | 2 | 4 | 2 | 1 | 3 | 1 | 0 | 60 |
| sports complex | 1 | 6 | 6 | 8 | 1 | 0 | 2 | 2 | 6 | 11 | 7 | 3 | 7 | 5 | 5 | 0 | 1 | 3 | 3 | 1 | 17 | 3 | 2 | 100 |
| sports field | 1 | 3 | 4 | 2 | 0 | 1 | 0 | 6 | 3 | 7 | 3 | 3 | 0 | 8 | 32 | 7 | 5 | 1 | 0 | 0 | 29 | 1 | 0 | 116 |
| stadium | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 15 |
| sports hall | 0 | 1 | 4 | 10 | 0 | 1 | 2 | 0 | 9 | 3 | 9 | 2 | 5 | 3 | 3 | 2 | 0 | 3 | 0 | 3 | 2 | 2 | 1 | 65 |
| summa: | 8 | 30 | 50 | 28 | 2 | 5 | 7 | 15 | 47 | 53 | 43 | 20 | 42 | 23 | 49 | 29 | 12 | 29 | 8 | 8 | 61 | 19 | 5 | |
| The division based on the 23 districts of Budapest. | | | | | | | | | | | | | | | | | | | | | | | | |

*Source: own compilation*

The sports facilities were grouped according to the type of sports facility/sports area in which they are located (11 categories were created according to the sports processed in Figure 2). The proportions of these categories were compared with the popularity of the sports.

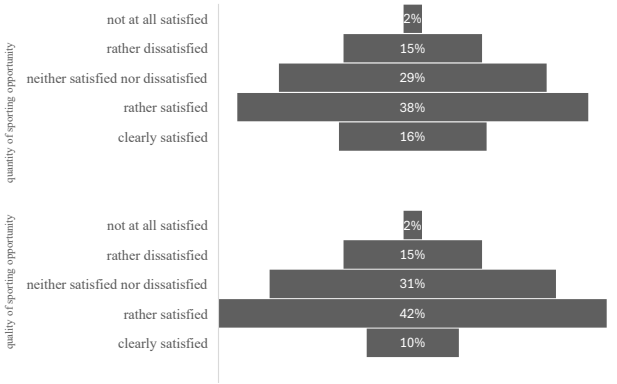
Examining Research Question 2, a positive–albeit moderate–relationship between the popularity of playing a sport and the number of categorised sports facilities and outdoor sports areas (β=0.396; p=0.047, $R^2$=0.314) can be identified, suggesting that if the number of sports facilities serving a given sport increases, the popularity of playing that sport is expected to increase (e.g. The reason for the moderate relationship is that there are a number of other factors that influence the popularity factor, such as quality of service, international success of the sport, distance of facilities from the residence, financial situation, etc.)

Looking at the development of sporting opportunities, it can be said that athletes in Budapest are rather satisfied, with only less than a fifth of them having a particularly negative opinion. There are no social groups that are significantly less satisfied than the average, but it can be said that men (9%; N=90), young people (11%; N=110), people from Buda (8%; N=80) and recreational sportspeople who play without a coach are less satisfied with the sports facilities in the capital. The quantitative and qualitative maturation of sporting opportunities is summarised in Figure 2.

Overall, more than half of Budapest citizens (54%, N=540) are satisfied with the amount of sports activities available, in this case, the rather satisfied and clearly satisfied ratings were combined. On the scale of quality of sports facilities, 52% of respondents (N=520) were either satisfied or clearly satisfied. A comparison of the two factors, i.e. quantitative and qualitative ratings, reveals no significant difference between the two scores, thus confirming the respective outcomes (t=0, p=0,988).

Figure 2.

**Quantitative and qualitative assessment of sporting opportunities**




*Source: own compilation*

In the quantitative assessment, revealed a need for more outdoor sports areas and identified the lack of equal opportunities per district as a problem. When quality was assessed, the most common problems identified were: crowding, crowds; neglected conditions; lack of shaded, covered spaces (to protect against rainfall or heat); difficulty in using outdoor spaces in winter.

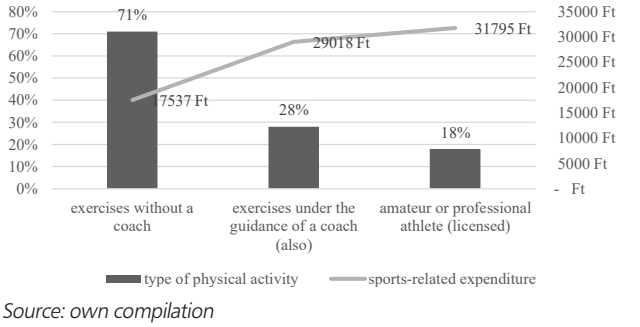
Besides the quality factor, the willingness to spend was also examined. The analysis of the respondents' sports spending shows that more than 90% (N=900) spend on tickets, season tickets or sportswear. On average, members of the population spend slightly more than HUF 20.000 per month on sports.

The questionnaire survey revealed that the average amount spent on sports by those Budapest residents who exercise without the guidance of a coach (N=710) is estimated at HUF 17.537/month, while those who exercise under the guidance of a coach spend an average of HUF 29.018/month on sports.

Research question 3 focuses on differences between demographic factors and the level of expenditure on sports activities, and, based on hypothesis 3, whether gender, educational attainment, and place of residence significantly influence the level of expenditure on sports. When examining gender, education and residence as independent variables and the level of sport expenditure, gender, education and residence are found to significantly affect the level of sport expenditure (p=0.003). However, when examining between variables, there is a low fit (p=0.003; $R^2$=0.387), i.e. biological and environmental conditions explain little variance in the level of sport expenditure. This may be due to the fact that other untested factors, such as specific wages, health status, amount of leisure time, etc., may influence the outcome, i.e. the evolution of sport expenditure. When comparing sport expenditure, it can be concluded that women spend on average more on sport than men and that gender has a significant effect on the level of expenditure (p=0.03; β=0.387). The type of sport activity and the monthly amount of expenditure on sport are illustrated in Figure 3.

Figure 3.

**Type of sporting activity and amount of sport expenditure per month**



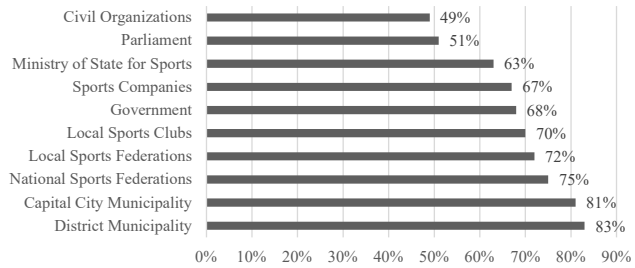

*Source: own compilation*

The survey explored the basic perceptions of sport development, identifying who people expect to provide solutions and inputs. Respondents strongly disagree that sport and physical activity should be a private matter for everyone and therefore less should be spent on it by local authorities or the state. The vast majority of respondents believe that the promotion of recreational sport is an important task

for local authorities, and half of them would also expect events to be organised. According to 83% (N=1.000) of respondents (N=830) to the online questionnaire, the support of recreational sport and the provision of local sporting opportunities is primarily the responsibility of district municipalities. 81% (N=810) of respondents (N=810) consider the Municipality of Budapest to be the second most important player, while national sports federations (75%, N=750), local sports associations (72%, N=720) and local sports clubs (70%, N=700) were also identified as important players. Respondents attributed less importance to state actors and the private sector in the provision of local recreational sport, with fewer respondents identifying these areas as the responsibility of the government in power (68%, (N=680), the national decision-making body, i.e. parliament, scored 51%, the role of sports enterprises 67% (N=670) and the role of NGOs 49% (N=490) (Figure 4).

Figure 4.

**Analysis of the competence of sport development**




*Source: own compilation*

The first-ranked district governments can be points of intervention for sport at the local level, the Metropolitan Municipality can play a strong role in conceptual policy-making at the Budapest level, while national and local sports federations can have an impact along specific sports lines. The ordering of competences is clearly interpreted in relation to recreational sport, while an almost opposite ordering is likely for elite sport.

The summary of the research results is summarised in Table 3.

## Discussion

In the following, the research results will be evaluated and the trends and sub-results of Budapest will be compared with those of some Central and Eastern European countries (Romania, Bulgaria, Poland, Slovakia).

Based on the research results, Hypothesis1, that there is a significant difference between the sporting habits of informal and formal recreational athletes, is supported. In the Central and Eastern European region, the popularity of home-based physical activity is outstanding, with 62% in Slovakia, 60% in Romania and 55% in Bulgaria exercising independently without the guidance of a coach (Perényi, 2015). This is even higher in Hungary, the capital city, where 71% of respondents (N=710) engage in this form of physical activity.

Citizens who exercise independently without a trainer, i.e. those who engage in informal recreational sports activities, are most likely to choose outdoor cardio training ($\chi^2$= 9.788; d=4, p=0.038), (running, cycling for sport), while citizens who exercise under the guidance of a coach prefer indoor type of exercise, more of a strengthening or relaxing nature (gym strengthening, yoga) ($\chi^2$=9.59; df=4, p=0.049). The results are similar in the Central and Eastern European region, with outdoor sports such as running, cycling and hiking being particularly popular in the Czech capital Prague, and fitness training in gyms being the second most popular (Czech Statistical Office, 2021).

Price sensitivity may be one of the reasons behind the choice of sporting activities (Paár, 2011). Those who

Table 3.

**Regression models**

| Variable / Measure | β | $\chi^2$ | d | $R^2$ | p-value | t-value | VIF |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| **sporting habits**<br>informal sport – cardio exercise | | 9.788* | 4 | | 0.038* | | 3.78 |
| formal sport - indoor type of exercise | | 9.592* | 4 | | 0.049* | | 3.99 |
| **organised frameworks**<br>clubs, enterprises - amateur and professional | | | | | 0.068. | | 1.54 |
| **infrastructure**<br>type of sport and the number of categorised sports facilities | 0.396* | | | 0.314* | 0.047* | | 3.91 |
| sportinfrastructure. - quantitative and qualitative ratings | | | | | 0,988. | 0 | 1.02 |
| **expenditure**<br>gender, education and residence - sport expenditure | | | | 0.387*** | 0.003*** | | 3.66 |
| woman – sport expenditure | 0.387* | | | | 0.031* | | 2.62 |

*Significance codes: 0 '***' 0.01 '**' 0.05 '*' 0.1 '.'*

*Source: authors' edition based on SPSS calculations*

engage in sporting activities independently, without a coach, are likely to want to minimise their expenditure on sport, so they choose outdoor sports activities that require a one-off financial outlay or do not require spending money at all. In addition, ease of learning the sport may be an important consideration, and the risk of improper performance of the movement is likely to be minimised, given that there is no coach supervision during the sporting activity. In the case of coach-led sports, it can be assumed that price is not a determining factor and that those who choose a professionally led form of exercise are those for whom it represents quality and for whom they are willing to pay.

The presence of price sensitivity is further supported by the fact that the proportion of people following sports broadcasts (viewing without financial investment) is more than twice as high as the proportion of those attending sports events in person (viewing with financial investment).

Some research has found that lack of adequate income is a barrier to participation in recreational sport (Humphreys & Ruseski, 2006; Lera-López & Rapún-Gárate, 2007; Eakins, 2018), but some authors argue that although higher income increases the likelihood of sport participation, it reduces or has no effect on the amount of time spent in physical activity (Downward & Riordan, 2007; Lera-López & Rapún-Gárate, 2011; Humphreys & Ruseski, 2011). Several studies confirm that sport is a luxury good (Paár, 2011; Pawlowski & Breuer, 2012).

My assumptions were that citizens who exercise under the guidance of a coach basically spend more on sports than those who exercise independently. The questionnaire survey revealed that citizens of Budapest who exercise without the guidance of a coach (N=710) spend an estimated average of HUF 17.537/month on sports, while those who also exercise under the guidance of a coach spend an average of HUF 29.018/month on sport. Compared to the Czech Republic and Slovenia, Hungarians spend half as much on sports goods, sports equipment and sportswear (Gősi, 2019).

Laczkó and Stocker (2018) studied spending on sporting events and their findings show that Hungarians spend on average HUF 8.000 per day, i.e. they spend on sporting events lasting 3-4 days what they usually spend on sport per month (HUF 24.000-32.000). In contrast, foreign spectators spend an average of HUF 26.250 per day on such sporting events.

The monthly sports expenditure generated by regular participants in sport, is basically higher than for a population that does not participate in sport or only occasionally. Regular athletes spend more on sport than those who do not regularly play sport, but some who do not play sport still spend on it, this is mostly reflected in passive sport consumption, but there could be several reasons. For example, it could be that someone does not play sport, but they pay a membership fee or season ticket for a family member who plays sport regularly, or they may spend money on season tickets or sports clothing but end up not being physically active.

A positive–albeit moderate–relationship between the popularity rate of a sport and the number of categorised sports facilities and outdoor sports areas ($\beta$=0.396; p=0.047, $R^2$=0.314) can be identified, suggesting that if the number of sports facilities serving a given sport increases, the popularity of that sport is expected to increase. The reason for the moderate relationship is that there are a number of other factors that influence the popularity factor, such as quality of service, international success of the sport, distance of facilities from the place of residence, financial situation, etc. This result is confirmed by a study from Poland, which showed that sport infrastructure alone does not lead to development in sport, other resources are needed (Müller-Frączek, 2020, 2021).

It was investigated (Hypothesis2) whether the demand for active sports consumption (amateur and professional certified athletes playing sports in organised settings) and the supply (number of sports clubs and sports enterprises operating in the districts of Budapest) are linearly related, but the results suggest that this hypothesis have to be rejected. The number of sports clubs and sports enterprises in Budapest are not correlated with the proportion of organised physical activity and the proportion of organised amateur and professional certified athletes (p=0.068). A limitation of the study, however, is that the maximum capacity of sports associations and clubs is not known, so the relationship cannot be determined with complete accuracy.

According to Hypothesis3: Gender, educational attainment, and place of residence significantly affect the level of spending on sports. When examining gender, educational attainment, and place of residence as independent variables and the level of spending on sports, it is found that gender, educational attainment, and place of residence significantly affect the level of spending on sports (p=0.003). This suggests that the hypothesis is supported, but that there is not a very high fit between the variables (p=0.003; $R^2$=0.387), i.e. demographic conditions explain little of the variance in the level of sport expenditure. This may be due to the fact that other factors, such as income, health status, amount of leisure time, etc., which are not examined, may influence the results, i.e. the evolution of sport expenditure. Paár (2011) calculates that sport consumption increases by 2.06% for a 1% increase in net income. However, when comparing sport expenditure, women on average spend more on sport than men and gender has a significant effect on the level of expenditure (p=0.03; $\beta$=0.387). Previous research has shown that men are more likely to participate in sport and also spend more time in sporting activities than women (Lera-López & Rapún-Gárate, 2007; Humphreys & Ruseski, 2006; Downward & Riordan, 2007; Hovemann & Wicker, 2009; Kokolakakis et al., 2011; Widdop et al., 2018; Eakins, 2018), however, Lera-López and Rapún-Gárate (2011) found in their study that women participate in sport more frequently than men. The frequency factor may also have an impact on expenditure on sport, as a more frequent number of exercise sessions (exercising under the guidance of a coach)

leads to higher expenditure, either due to the purchase of gym passes, group class passes, etc.

Macro data from European Union countries show a correlation between education and sports participation (Humphreys & Ruseski, 2006; Downward & Riordan, 2007; Breuer & Wicker, 2008; Hovemann & Wicker, 2009; Kokolakakis et al., 2017).

Hypothesis4: People in Budapest are generally satisfied with the sports facilities in Budapest:

More than half of Budapest residents (54%, N=540) are satisfied with the quantity and quality of sports facilities available (52%, N=520). No significant difference between the two factors was found (t=0, p=0.988). The results suggest that it is important for the population to have access to sports facilities and sports facilities, but it is also important to know their condition and quality. The results show that the needs of the population are largely met and that the facilities are able to provide sports services at the expected level, but that there is room for improvement in terms of both the number and quality of sports facilities available. By increasing both the quantity and quality elements, higher sporting activity rates can be generated, making this an important area for improvement for city leaders.

A look at Central and Eastern Europe shows that Prague has a similar appreciation of sports facilities and sports infrastructure in the city, with a high proportion of the population satisfied with these (Czech Statistical Office, 2021). In the case of Romania, young people in Timisoara are satisfied with the quality of sports facilities and developments, yet 47.8% of them do not participate in sports (below the national level). Research (Nadolu, 2020) shows that motivation for sports activity is at a rather low level, and therefore sports investment per se is not associated with an increase in sports activity.

## Conclusions

The findings of this research extend beyond the Budapest context, revealing correlations and trends that may inform broader interpretations and applications. The exploratory study classified respondents into four groups: individuals exercising independently, those training under professional guidance, qualified amateur athletes, and professional athletes–all categories applicable to any municipality or national context.

Key determinants of sports participation include local-level (societal) factors and individual traits or motivations. Results indicate that sports infrastructure strongly influences physical activity levels, with quality emerging as a critical determinant of participation. Regardless of exercise type, all activities depend on available infrastructure.

Respondents attributed primary responsibility for developing recreational sports and maintaining local facilities to district governments (83%) and the Municipality of Budapest (81%). This perception is justified, as local authorities play a central role in promoting recreational sports core elements of public service delivery that directly affect sport consumption and community activity levels.

## Limitations and further research directions

The analysis revealed that gender, education, and place of residence significantly correlate with sports spending, a relationship that could be clarified by incorporating additional variables. The high p-value suggests extending the model to enhance explanatory power and capture further influencing factors.

Findings indicate that local authorities are key stakeholders in addressing consumer expectations and ensuring access to sport. Accordingly, future research should continue along two lines: exploring public perceptions and examining mayors' goal-setting practices.

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