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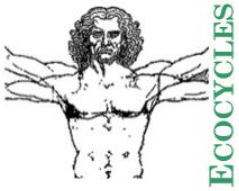

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CASE STUDY

Exploring talent geography in an underdeveloped Hungarian region

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Abstract – This study investigates the geographic and social dynamics of talent in Greater Cumania, an underdeveloped Hungarian region, offering new insights into the challenges of talent retention and attraction in peripheral areas.
The novelty of this research lies in its comprehensive analysis of the life trajectories of 22 individuals with outstanding achievements, integrating socio-geographical and mathematical-statistical methods to assess talent flow patterns. The study highlights the region's paradox: while producing exceptional talents such as Nobel laureates Katalin Karikó and Ferenc Herskó, it struggles to retain these individuals due to limited local opportunities and infrastructure.
The focus on Nobel laureates provides a broader justification for this analysis, emphasizing Hungary's unique position as a disproportionately high contributor to global intellectual achievement relative to its size. By identifying key barriers to talent retention, such as inadequate local support systems and urban pull factors, this research not only reveals the structural challenges faced by Greater Cumania but also connects these findings to global patterns of talent migration.
Actionable recommendations include strengthening local educational institutions, fostering innovation ecosystems, and implementing targeted policies to attract and retain talent. These measures could serve as a blueprint for similarly underdeveloped regions worldwide, bridging the gap between peripheries and metropolitan centres. By contextualizing the findings within international talent mobility trends, this study contributes to a more nuanced understanding of regional development in the global knowledge economy.

Keywords – talent geography; Greater Cumania; underdeveloped Hungarian region; inner periphery; Nobel Prize; Katalin Karikó

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1. INTRODUCTION

The paper examines the peripheral situation of the Greater Cumania Region (with some focus on the situation in Northern Finland), drawing on the relevant literature and incorporating the main findings of previous research. Northern Finland is often analyzed as a region that, despite its geographic remoteness and declining population, has successfully retained and attracted talent through strong educational and innovation systems (Hansen, 2007; Bound et al., 2006; Pakonen, 2022; Berniell et al., 2024). These insights offer a valuable comparative framework for understanding the specific challenges faced by Greater Cumania and for identifying potential development strategies.

Human capital is a critical driver of both sectoral and regional development and a significant factor in regional disparities (Florida, 2002; Hansen & Winther, 2012; Burzyński et al., 2018; Florida, 2022). It is widely accepted that human capital directly influences development by boosting productivity, enhancing labor market complementarities, and fostering innovation and technology diffusion (Burzyński et al., 2018). This has been true since the Industrial Revolution (Mokyr, 2005; Squicciarini & Voigtländer, 2015) and remains relevant today (Castelló-Climent & Mukhopadhyay, 2013; Jones, 2014; Kerr et al., 2016).

Human capital plays a pivotal role in regional and sectoral development, significantly influencing disparities in economic and social progress. Talent retention and migration are essential factors within this dynamic, deeply embedded in global theories of human mobility. For example, Florida's (2002) *Creative Class Theory* highlights the pull of diverse and opportunity-rich regions, while

Hansen & Winther (2012) emphasize the spatial dynamics of talent retention as critical to regional competitiveness. More recently, West's (2017) *Universal Scaling Laws* illustrate how larger urban centres naturally attract and amplify human talent, creating a feedback loop of innovation and development. The flow of talent is shaped by individual interests, regional economic factors, and national immigration policies. For instance, the U.S., despite being a major talent hub, has seen talent migration to Canada due to restrictive immigration policies (Bahar et al., 2022).

The concept of *talent* itself varies. According to the Hungarian Language Dictionary, talent is defined as a "natural, innate inclination or ability" (Bárczi & Országh, 1959-1962). Conversely, contemporary U.S. definitions describe talent in terms of high levels of human capital, often measured by the percentage of the population with a Bachelor or higher degree, and note that talent is attracted by diversity (Florida, 2002). This distinction highlights a difference: the Hungarian definition is broader and less value-specific, while the Western definition is more quantitative and qualitative. In English, the term *gift* refers to innate abilities that have not yet been developed, while the word *talent* denotes achieved significant results over a lifetime. Many individuals have inherent talent, but to truly excel, qualities such as diligence, perseverance, supportive circumstances, and luck are also necessary (Hancock et al., 2022).

This research is motivated by Hungary's notable achievement in producing Nobel laureates relative to its population. Despite facing political, social, and economic challenges, Hungary, with a population of approximately 9.6 million in 2024, ranks 93rd globally yet has produced 18 Nobel laureates, placing it between 15th and 20th worldwide. Remarkably, 1.86% of all Nobel laureates have Hungarian roots, despite Hungary representing only 0.117% of the global population. In Greater Cumania, two laureates were born or raised, representing 11.1% of Hungary's Nobel laureates, even though the region constitutes just 0.61% of the country's population.

Despite its intellectual and cultural achievements, Greater Cumania remains an internally peripheral region, struggling to leverage its potential due to less favorable local conditions when compared to both Europe and Hungary (Kovács et al., 2024). The contrast between the region's exceptional talents and its underdeveloped local society is significant, warranting further investigation.

In this study, we apply the notion that individuals from Greater Cumania exhibit extraordinary ability, combined with diligence and perseverance, leading to significant recognition on national and global levels. Our focus is on the individuals who have achieved notable success, classifying them as true talents rather than those with only potential.

This study, focusing on Greater Cumania, an underdeveloped Hungarian region, investigates the geographic and social dynamics of talent through a detailed examination of exceptional individuals. By linking local challenges to broader global patterns, this research provides actionable insights for regional policymakers and international stakeholders. The findings are particularly relevant in light of global talent strategies such as the OECD's (2021) focus on fostering talent-friendly ecosystems and the Global Talent Competitiveness Index (GTCI, 2023), which highlights the need for targeted interventions in peripheral regions to achieve balanced development.

1.1 Literature review

The existing literature often extends beyond cause-and-effect analysis to include the practical economic and developmental implications of the geographical distribution and migration of talent. It is increasingly clear that in the 21st century there is a shift from labor-intensive economies to knowledge-based, technology-driven ones (Trauth et al., 2008). Highly skilled immigrants are crucial for local innovation (Bahar et al., 2022). This paper explores how migration policies influence global talent flows and, consequently, local and global innovation outcomes (Bahar et al., 2022).

The theoretical framework of talent migration and retention has evolved significantly over the past two decades. Key studies, such as Bahar et al. (2022), have emphasized the role of multinational corporations in shaping global talent flows, while O'Sullivan & Collings (2018) discuss how talent clusters can optimize regional potential. These insights align with international models like the *Brain Gain-Balance Theory*, which suggests that targeted incentives and supportive environments can offset the loss of talent from less-developed regions (Lanvin & Monteiro, 2023).

The practical implications of these theories are evident in global strategies. For instance, countries such as Canada have adopted talent-friendly immigration policies to counteract domestic shortages, while regional hubs in Asia, such as Singapore, have created innovation ecosystems to retain skilled professionals (Anderson, 2021). Similarly, European Union initiatives, such as Horizon Europe, prioritize funding for talent development in underdeveloped regions to reduce disparities and enhance overall competitiveness (OECD, 2021).

Hungary, despite its high per-capita Nobel laureate output, struggles to integrate these global strategies effectively into its regional policies. As demonstrated in Greater Cumania, the lack of systemic support exacerbates talent outflows, mirroring challenges faced by other peripheral areas worldwide, such as Northern Finland. Bridging these gaps requires a multifaceted approach that leverages global insights to address local conditions, as proposed in this study.

Recent studies have examined the relationship between talent and geography from various perspectives, highlighting its significance in economic and social contexts. O'Sullivan & Collings (2018) focused on talent management within clusters, exploring how effective management can enhance performance and the connection between mobility and talent management at regional and national levels. This aligns with broader economic geography research, which, as noted by Florida (2002), identifies that talent is attracted to diversity and abundant opportunities, linking talent concentration with high-tech locations.

In a similar vein, a French study analyzed talent distribution through urban development, revealing a correlation between limited access to education and spatial inequalities in talent distribution (Burzyński et al., 2018).

This perspective is complemented by research in Australia, which found spatial biases in innovation, with increasing distance creating centers and peripheries of innovation (Spiller, 2009). Geoffrey West's "Universal Scaling Law" (2017) further illustrates how larger settlements experience a 2x + 15% increase in various factors, including patented inventions, highlighting the scaling effects on infrastructure and social issues.

In China, a study on Shenzhen investigated how talent impacts community-building in high-rise environments, showing that individuals with high intellectual ability significantly enhance community networks despite the challenges of vertical living (MacLachlan & Gong, 2021). Additionally, the relationship between sport and geography, including sport as a means to escape poverty, has been extensively analyzed internationally. Foreign studies often provide practical insights into this relationship from sectoral, territorial, or combined perspectives (MacDonald et al., 2009; Rossing et al., 2016; Hancock et al., 2017; Faria et al., 2021; Hancock et al., 2022).

Talent geography, a subfield of social geography, examines the spatial distribution of exceptional abilities and associated geographic patterns (Mátyás, 2021). While research in developed countries often addresses broader areas with significant economic impacts, Hungary's smaller, shrinking population presents a different trajectory. While Hungary has made advances in understanding talent distribution, the practical application of these findings in national, regional, and local policies has yet to produce measurable socio-economic results.

In Hungary, talent geography research initially focused on symbolic aspects of intellectual excellence rather than practical economic development. Jenő Pintér was the first to map the birthplaces of Hungarian writers and poets (1928). Henriette Szirmayné Pulszky followed with research on various disciplines (1935). Influential work came from Gyula Hantos, who analyzed the "Soul of Hungarian Landscapes" using data from the Pallas Encyclopedia for a multidisciplinary approach (1936) (Győri, 2006).

For the almost fifty years following World War II, talent geography research ceased in communist Hungary. It was revived by Professor József Tóth of Pécs after the regime change, with his work from 1990, 1993, and 1998, and by his students, who developed influential theoretical frameworks (Győri, 2023). One of these, Ferenc Győri, wrote his doctoral thesis on "Theoretical and Practical Issues of Talent Geography" (2010), analyzing data from over sixteen thousand entries in the Hungarian Biographical Dictionary.

There is a lack of talent geography research on small Hungarian regions, which includes Greater Cumania. Győri (2015) noted that the Great Plain had a higher talent output from 1867-1962 compared to other regions, excluding the capital. However, while it did have a stronger talent retention capacity, its ability to attract talent from other regions was weaker. Similarly, Dövényi (2016) found that the Zemplén landscape generated significant talent but retained it only modestly.

In a study classifying Hungary's micro-regions into *creative classes*, it was found that a complex set of indicators is necessary for accurate classification. Of the 174 micro-regions at LAU level 1, not all had a critical mass of creative classes. The study identified *super-creative*, *spill-over*, *potentially creative*, and *moderately creative* sub-regions. Budapest, Debrecen, Pécs, Szeged, and Veszprém were categorized as top super-creative regions, while Balatonalmádi, Balatonföldvár, Balatonfüred, Keszthely, and Siófok were among the least creative (Rittgasszer, 2010). The area under study here falls outside these defined regions.

1.2 Measuring talent

The study employs a mixed-method approach that integrates socio-geographical and mathematical-statistical analyses. The narrowed dataset consists of 22 individuals with exceptional achievements, selected from a broader database of nearly three thousand Hungarian and Hungarian-born scientists, artists, athletes, and public figures (Mátyás, 2021). The selection process was based on predefined criteria emphasizing national and international recognition, ensuring that the sample represents the most influential talents from Greater Cumania. While the dataset size limits the generalizability of certain statistical correlations, the findings remain robust in identifying key trends in talent migration and retention.

Economic-development trajectories are tracked by global indexing databases that categorize countries and reflect the relevance of our topic, including aspects of talent. While our research focuses on Greater Cumania, a peripheral region within Hungary, it is essential to consider Hungary's global positioning, which is on the periphery of the EU socially, economically, and geographically.

In 2015, the Global Creativity Index (GCI), a one-off index later replaced by the Global Talent Index (GTI), ranked countries based on talent, technological development, and tolerance. Hungary was 28th out of 139 countries, with a score of 0.673, leading Central and Eastern Europe and the Visegrád Four (V4) countries (Hungary, the Czech Republic, Slovakia and Poland). Within Europe, only Luxembourg and Portugal had higher scores for the talent component (ChartsBin, 2024). The GTI reveals a decline in Hungary's ranking. This index, which evaluates countries on 11 indicators across three categories (demographics, university education, and talent environment), placed Hungary 30th out of 60 countries in 2023, with a score of 46.5 out of 100. This positions Hungary in the middle of the pack and last among the Visegrád Four (V4) countries (ChartsBin, 2024).

The Global Talent Competitiveness Index (GTCI) 2023 placed Hungary 38th out of 134 countries, with a score of 59.91 out of 100, and 26th in Europe. The GTCI evaluates skills based on inputs (Enable, Attract, Grow, Retain) and outputs (medium and high skills) (Lanvin & Monteiro, 2023). In 2019, Szepesi et al. found a very strong correlation (0.92) between the GTI and the GTCI. This high correlation suggests that the indices may not measure talent independently but could be influenced by the same variables, such as per capita income (as shown in Figure 1).

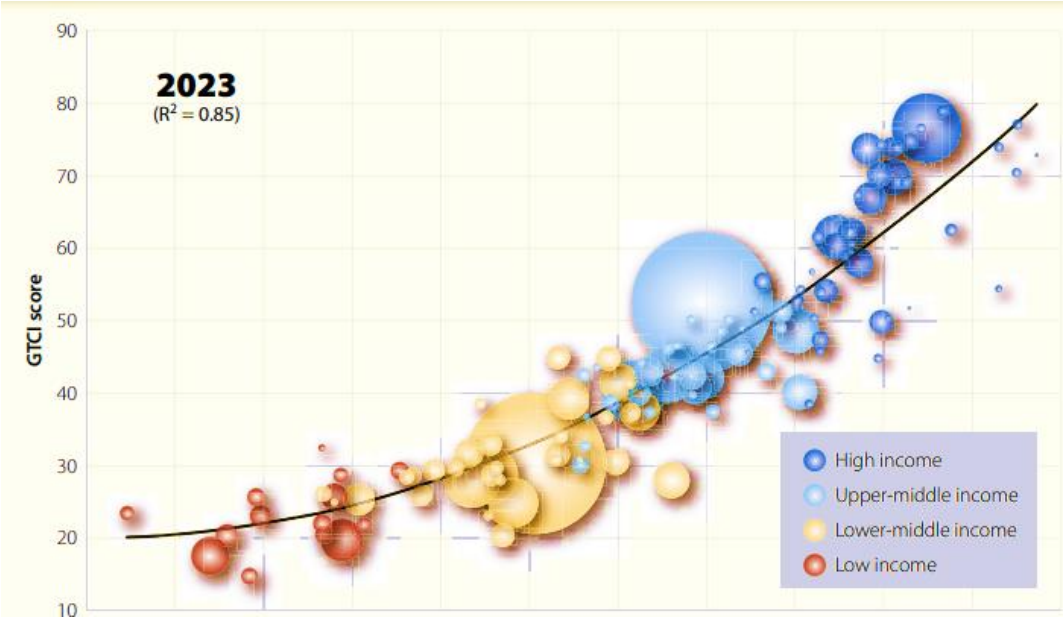

Figure 1. Correlation between per capita income and number of talents
Source: INSEAD, 2023

The IMD World Talent Ranking (WTR) evaluates the development, retention, and attraction of a skilled workforce using three main factors (Investment and Development, Appeal, and Readiness) across 31 weighted criteria. In 2023, Hungary was ranked 48th out of 64 countries on the WTR (IMD, 2023).

Fodor & Klein (2021) examined regional talent dynamics in Hungary using the Complex Study Competition Index (CSI) and the Human Development Index (HDI). Their findings reveal that Budapest dominates, with 86% of *stay-at-home* talent and 75% of those migrating from other areas. The Western Transdanubia region excels in talent absorption but has below-average talent output, suggesting an internal migration trend toward the west. In contrast, Northeastern Hungary performs poorly in both talent output and retention, attributed to its many small towns, low population density, and socio-economic challenges. Overall, the study underscores that a region's capacity to attract and retain talent often aligns with its broader performance metrics.

For Greater Cumania in Eastern Hungary, previous research has highlighted a negative trend in talent attraction. Jász-Nagykun-Szolnok County attracted only 7% of national talent, similar to other NUTS 3 regions such as Szabolcs-Szatmár-Bereg, Tolna, and Nógrád. In contrast, Budapest achieved a much higher rate of 157% (Győri, 2011a).

1.3. Greater Cumania

Greater Cumania, situated in Eastern Hungary's Tiszántúl region, is a flat landscape between the Tisza River and the Hortobágy. Historically shaped by water levels, the area includes Karcag, Kisújszállás, Kunhegyes, Kunmadaras, Túrkeve, and Kunszentmárton. These settlements, with similar natural and demographic characteristics, were defined by Örsi (1998) (Figure 2).

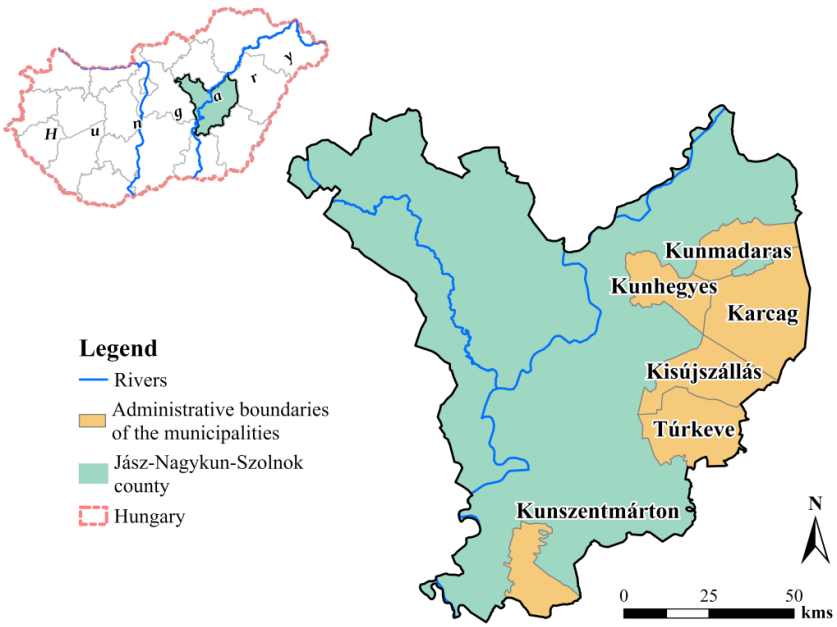

Figure 2: The traditional Greater Cumania
Source: Kovács et al. 2024

To understand the current state of Greater Cumania, it is essential to consider the impact of the Tisza River regulation in the mid-19th century. This intervention transformed the gently sloping banks into arable land, diminishing traditional floodplain farming (Tóth, 2013). The regulation disrupted the ecological balance, leading to severe droughts during dry years (Ducza, 2013). Additionally, the late 1800s saw the phylloxera epidemic devastate local vineyards (Tóth, 2013).

The most significant landscape transformation of the 20th century in Greater Cumania was the advent of socialist large-scale agriculture. Post-1945, small-scale farming briefly persisted but by the early 1950s, communist policies had led to its collapse; and experiments with non-native crops like cotton and rubber proved impractical (Tóth, 2013). From the 1960s, monoculture farming became dominant, with crops like rice being introduced, and new infrastructure such as grain silos, machine sheds, and irrigation systems reshaped the landscape (Tóth, 2013).

The ownership changes in the 1990s, and the subsequent transformation of the agrarian structure led to significant socio-economic and environmental issues in Greater Cumania. This transition, challenging for the region's low adaptive capacity, exacerbated its socio-economic decline and increased its lag behind both the Hungarian and European averages (Tóth, 2013).

While Greater Cumania's settlements share many similarities, notable differences exist. Kunszentmárton, resettled mainly by the Catholic Jász people, and geographically isolated from the other settlements, stands out. Differences also appear in the proportion of national minorities, educational attainment, unemployment rates, and depopulation across the municipalities. Additionally, Karcag, Kunhegyes, and Kunszentmárton serve as district seats, unlike Kisújszállás, Kunmadaras, and Túrkeve, which lack this status (Örsi, 1998; Bartha, 2018; Kovács et al., 2024).

In summary, Greater Cumania is a unique cultural region in Hungary, initially distinguished by its Cuman heritage and later by its rights and privileges established in 1745. Unlike other Hungarian areas, it features a duality: a less industrialized, agrarian economy alongside a well-developed institutional system and local social consciousness. Today, it remains an inner peripheral region of Eastern Hungary characterized by its agrarian economy, distinct settlement network, and spread out, spacious towns with fewer (or missing) villages.

1.4. Local societies as engines or brakes for development

For our research on talent geography, local societies play a crucial role. Greater Cumania, marked by long-standing issues exacerbated since World War I that intensified after 1990, faces severe socio-economic challenges. The region lags behind the Hungarian average economically and demographically, with a consistent trend of population decline. Recent findings by Horeczki et al. (2023) categorize its small towns as *dynamics losers*, reflecting ongoing struggles in population and development.

The economic weakness of small towns in Hungary, including those in Greater Cumania, impedes regional convergence (Horeczki et al., 2023). Gábor Pirisi warns of worsening decline and persistent out-migration due to ongoing economic struggles, with the stability of these towns increasingly uncertain. Damage to local institutions

further exacerbates these issues (Pirisi, 2009). Data from the Hungarian Central Statistical Office (KSH) shows a declining population across all settlements in Greater Cumania (KSH 2024). Kunszentmárton experienced the largest drop at 26.3% by 2022, while Kunhegyes had the smallest decrease at 7.1% over the same period (Figure 3).

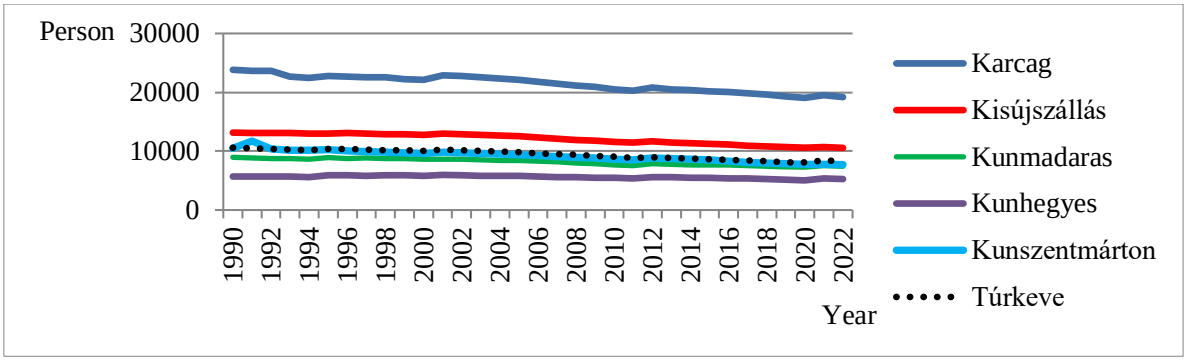

Figure 3: Population change of settlements 1990-2022
Source: KSH 2023, Kovács et al., 2024

New research highlights serious qualitative issues in Greater Cumania: out-migration predominantly affects younger, more educated individuals, and ethnic shifts are destabilizing local communities. The average education level and cultural engagement in the region are lower than the national average (Kovács et al., 2024). Additionally, Túrkeve, Kisújszállás, and Kunmadaras have a poor talent balance, with significant gaps between the number of talented individuals born and those who have died (Győri, 2010).

One major issue in the region is the entrenched belief that "there are no opportunities here", leading young people to leave for bigger cities or abroad. This persistent sense of *peripheralization* directly contributes to the region's ongoing socio-economic decline.

Based on these observations, we have formulated the following research questions:

RQ1: To what extent do high achievers from Greater Cumania follow the trend of pursuing careers in larger municipalities or abroad after local secondary school, and do any return to their hometowns?
RQ2: Considering the previous findings, how sustainable is the social development of Greater Cumania as an internal periphery? Is there potential for attracting and retaining talent, or is the region at risk of ongoing socio-economic decline?
RQ3: Can the socio-geographical and mathematical-statistical methods used in this research effectively reveal correlations between the geographic characteristics of talent in the region, or might other methodologies in the future offer better insights into the relationship between space and talent?

2. METHODS

In talent geography, a key question is that of defining what qualifies as *talent* and what characterizes someone's work as *exceptional*. For figures like Katalin Karikó and Ferenc Herskó, the Nobel Prize provides clear validation of their outstanding contributions. However, for others, establishing objective measures of value remains challenging (Young, 2013).

The authors utilized the database from The Talent Geography of the Carpathian Basin (Mátyás, 2021), which examined nearly three thousand Hungarian and Hungarian-born scientists, artists, athletes, and public figures. The book's author solicited the names of notable past and present staff members from around thirty Hungarian-language higher education institutions and four additional Hungarian-language institutions, totaling approximately 200 inquiries. Additionally, the Hungarian sample was compiled using data from scientific websites, textbooks, journals, as well as recommendations from the book's editors and advisors.

A key question in the spatial analysis of talent is defining who qualifies as Hungarian. In this study, this issue was not significant, as most individuals analyzed were born in Greater Cumania and have lived and worked in Hungary throughout their lives. Furthermore, the authors utilized data from a nationwide database (Mátyás, 2021) to avoid inflating the number of identified talents unrealistically. Only individuals listed in the 2021 book were included, with the exception of Katalin Karikó, whose data was added to the Greater Cumania dataset.
The following statistical methods were used in our work:

- Descriptive statistical analyses (frequencies, ratios, mean, and median) were performed to determine the talent frequency of each municipality per 10,000 inhabitants and to characterize the distribution of talent frequencies.

- Cross-sectional analyses were conducted using the Cramer association coefficient and the PRE-Index. The Cramer association coefficient assessed the relationship between place of birth and talent, where a value of 1 indicates a perfect relationship, and 0 indicates no relationship. The PRE-Index evaluated the relationship

between a municipality's population and its talent rate, with values close to 0 indicating independence and values close to 1 indicating a strong relationship. A correlation coefficient was calculated to test the relationship between the municipality's population and the number of talents.

- Time series analyses were conducted through the analysis of the years of birth of the talents (1724–1938), with a particular focus on the period 1884–1938.

- Comparative analyses (standard deviation and variance) were performed to detect differences in talent frequency between municipalities. Normalized data, including comparisons with national data, were also analyzed. Demographic correlations were explored by comparing birth rates with regional and national trends for the period 1880–1940.

3. RESULTS

3.1. Place and date of birth

Some settlements produce a disproportionate number of exceptionally talented individuals compared to their surroundings. The question arises whether these individuals were inherently more talented or if social factors such as family or education played a key role in their development. Research generally agrees that social factors are crucial in nurturing talent (Mátyás, 2021). Analysis shows that settlements that generate talent often struggle with its retention, and as urbanization accelerates, the number of such talent-producing settlements continues to decline (Győri, 2011a; 2011b).

In Greater Cumania, Túrkeve leads in its talent birth rate, with three talents per 10,000 people. Kisújszállás and Karcag follow, each with three and five talents, respectively. In Túrkeve, the high talent rate is due to one family, the Kellner (later Korda), whose three sons account for the settlement's notable figures; no other local talents were born there, though the town has produced other notable individuals.

Kisújszállás officially has three noted talents, but if we include Katalin Karikó—who was born in Szolnok due to health reasons but is originally from Kisújszállás—the settlement has the highest talent frequency in Greater Cumania.

Compared to Mátyás's 2021 study, Greater Cumania's settlements also show exceptional talent frequency at the national level. Mátyás's research focused on towns with at least three notable residents and used a per 100,000 population scale. For clarity, frequency indicators here are adjusted to a per 10,000 population scale. Nationally, the top rankings are Tét (7.32), Szikszó (5.68), Budapest (4.98), Makó (4.89), Csorna (4.86), Balassagyarmat (4.03), Ercsi (3.72), Szentes (3.69), Keszthely (3.46), and Kiskunfélegyháza (3.41). This indicates that small towns and smaller medium-sized towns in Hungary generally have above-average talent frequency (Mátyás, 2021: 514).

Calculated per 10,000 people, Túrkeve (3.68), Kisújszállás (2.87), and Karcag (2.58) rank among the national leaders, with Túrkeve at 9th, Kisújszállás at 16th, and Karcag at 20th. When including Katalin Karikó's expanded value, Kisújszállás rises to the 7th highest birth rate in the country. Considering birth rates with cross-border municipalities, Túrkeve is 20th, Kisújszállás 31st, and Karcag 40th (Table 1).

Table 1: Number of talents per 10,000 inhabitants in the municipalities of Greater Cumania (by place of birth, person)

Settlement	Inhabitants (2021) (person)	Frequency indicator per 10,000 inhabitants	In the ranking of the Carpathian Basin settlements (or in the ranking calculated on the current national territory)	Number of talents born in the municipality (persons)
Túrkeve	8146	3.68	20 (9)	3
Kisújszállás	10 464	2.87 (3.82) [1]	31 (16; 7)	3
Karcag	19 353	2.58	40 (20)	5
Kunmadaras	5018	1.99	-	1
Kunhegyes	7217	1.39	-	1
Kunszentmárton	7756	1.29	-	1

Source: After Mátyás 2021, authors' calculation

The Nobel Prize winners from Greater Cumania, Katalin Karikó and Ferenc Herskó, were born in close proximity, which is rare. If Karikó had been born in Kisújszállás instead of Szolnok, the two laureates would have been just 16.5 km apart—an exceptional distance within Hungary's settlement network.

Using the Cramer association coefficient, we found a value of C=0.00493 (49%), indicating a weak, almost independent relationship between the number of talented people and the number of municipalities as birthplaces.

[1] If we consider Katalin Karikó to have been born in Kisújszállás, the frequency index for Kisújszállás is 3.82.

The closeness of the relationship between the population of a municipality and the talent ratio was tested using the PRE-Index. The result of the PRE-Index was very low (0.0000000000005057211). That is, the talent rate is independent of the population of the municipality.

The relationship between the population of the municipality and the number of talents was tested using a correlation coefficient. Based on our results, we can say that there is no relationship between our variables, there is no significant correlation between them, as can be seen in Figure 4. Although no significant correlation was identified between settlement size and the number of talents, the limited dataset warrants caution in drawing definitive conclusions. Future research with a larger dataset could provide a more precise understanding of this relationship.

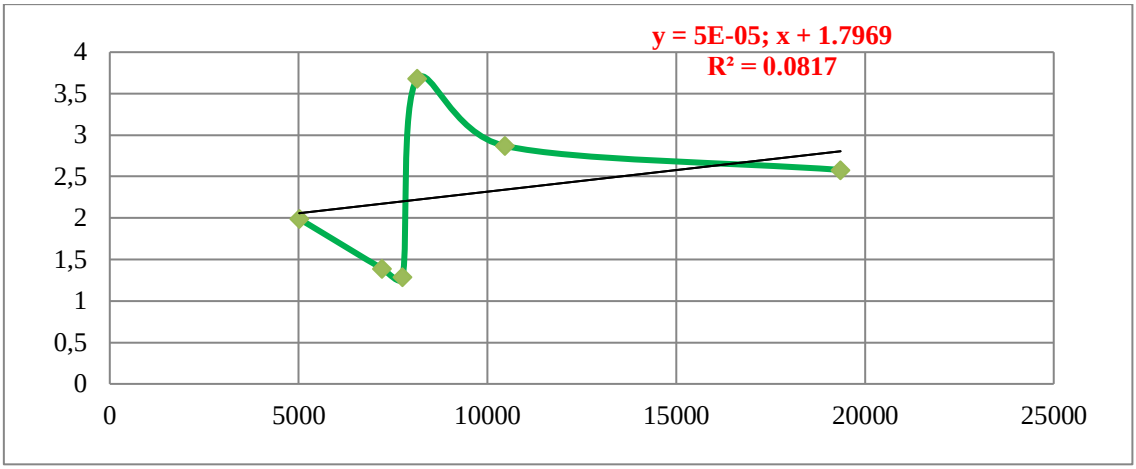

Figure 4. Correlation between the population of a municipality and the number of talented people
Source: author's own contribution, 2024

The analysis focuses on individuals born between 1724 and 1938. The starting date aligns with the repopulation of the area after the Turkish period in the 1710s, marking the availability of more reliable demographic records. The end date is chosen because the individuals studied have either reached the height of their achievements or have passed away.

Thirteen of the outstanding individuals were born between 1884 and 1938, meaning over 90% of the talents from Greater Cumania were born within just over fifty years. This high concentration aligns with national birth trends, but Greater Cumania's figures are even more dynamic. Nationally, 53.9% of births occurred between 1880 and 1940, highlighting the region's exceptional birth rate during this period.

3.2. The impact of primary and secondary education on talent development

Kindergarten, primary, and secondary schools fall under primary and secondary education. Greater Cumania has never had a higher education institution. While all levels of education influence a child's development, secondary and higher education have the greatest impact on future careers. This research focused on secondary schools, as primary school data was often missing from biographies.
Secondary schools in small towns, unlike those in larger cities, have a smaller pool of applicants and focus on nurturing local intellectuals. Students in these towns often come from poorer families, limiting their ability to invest in talent development through extra lessons or academic competitions. In smaller towns like those in Greater Cumania, the local secondary school is often the only opportunity for gifted students to receive education that matches their potential, meaning they often begin their academic careers at a disadvantage.

Teachers who recognize and nurture talent play a crucial role in overcoming these disadvantages. By providing ongoing support, such as specialist courses, free lessons, academic competition preparation, and access to specialized books, they create opportunities for talented rural students to pursue academic careers. As Katalin Karikó reflected, her teachers in Kisújszállás made it possible for "the stubborn daughter of a butcher" to continue her education, highlighting the impact of dedicated educators (Nagy, 2023).

Peers with similar interests can sometimes encourage talent, but this was not evident among the individuals studied. Secondary school plays a crucial role in launching academic careers, especially in natural sciences like mathematics, physics, or chemistry.
Key findings include that all the analyzed individuals, excepting the 18th-century officer Mihály Kováts, had secondary education. Of the fourteen people born in Greater Cumania, five attended secondary school in Kisújszállás (including Katalin Karikó), three in Karcag, and one in Kunszentmárton. Notably, László Kádár, Zsigmond Móricz, and Pál Déri, although not born in Greater Cumania, attended secondary school there. The region lost eight individuals who left for their high school studies elsewhere.

Greater Cumania struggles to retain talent due to the lack of higher education institutions and suitable job opportunities,

leading to a negative talent balance. Local secondary schools could have served as intellectual hubs, offering employment opportunities and attracting talent, but this was not the case in the examined settlements.

Urbanization has further increased the pull of big cities, making it even harder for small towns to retain talent. In summary, Greater Cumania's *genius loci* are attributed to the quality of its elementary and secondary schools and dedicated teachers, particularly evident in Kisújszállás, where five notable individuals studied at the local secondary school.

3.3. Stages of life

In every person's life, there are places where they will spend a significant part of their time, and that is no different for those with above-average talent. Over time, people have become more mobile, frequently changing their place of residence. This has long been true for scientists, artists, and athletes, who have historically been much more mobile than the general population.

Examining life stages reveals how mobile a person is, or how often representatives of a scientific field change their research locations. With the internationalization of science, researchers are now characterized by even greater mobility, often having eight or ten career stages. In this research, we tracked locations where a person spent at least three months after obtaining their highest educational qualification, as this allows for better detection of spatial movements, and a three-month stay can significantly impact a life path.

For people born in Greater Cumania, the following observations can be made: Not a single individual spent even a short period of their career in any of the region's settlements after obtaining their higher education qualification. Ideally, a region should be able to retain talent, especially among those born there. Unfortunately, this has not been the case for Greater Cumania. The cultural region only served as a temporary residence and workplace (springboard) for talents born elsewhere.

We examined which settlements and countries attracted the talents of Greater Cumania. Most people spent some time in Budapest (11 individuals), where the majority spent the greater part of their careers. Decades ago, as today, the capital was practically unavoidable for scientists, artists, and athletes. As Ferenc Győri wrote: "Budapest was, and still is, a stop that cannot be avoided when establishing yourself in intellectual and artistic life and building a career" (Győri, 2011a: 110).

Foreign countries have also had a strong pull on residents of Greater Cumania, with many settling permanently abroad, far from their birthplace. The people born in Greater Cumania lived for extended periods in twelve countries: Australia, Austria, Egypt, France, India, Israel, Great Britain, Germany, Italy, Oman, the Republic of Türkiye, and the USA. Some individuals showed above-average mobility. For instance, the artistic Korda brothers and the football coach József Gelei exhibited the greatest mobility; the Korda brothers lived in five countries, and Gelei worked in four. On the other hand, seven people never spent much time abroad and their career stages were limited to Hungarian locations.

Greater Cumania's below-average ability to retain talent is evident in the fact that seven of the fifteen people born there (including Katalin Karikó) have lived or are currently living abroad, and will likely end their lives there. This represents over 40% of the region's talented individuals. Pál Déri, László Kádár, and Zsigmond Móricz were not born in Greater Cumania but attended secondary school there. However, they never returned to settle permanently. Among those not born in Greater Cumania, one person each spent at least three months in Kisújszállás, Kunmadaras, Kunszentmárton, and Karcag.

In conclusion, none of the Greater Cumanian settlements were able to exert a significant and lasting attraction. The proportion of *retainers*—those who remain in a settlement—is crucial to its vitality. While some talents were attracted temporarily, none were retained long-term.

At the end of this analysis, it's worth classifying the talents of Greater Cumania (22 individuals in total) by their field—whether they were social or natural scientists, artists, athletes, or other public figures. The data shows that Greater Cumania's strengths are equally distributed between natural sciences and the arts, with significantly fewer talents in social sciences, sports, and other fields. When comparing these sector values with the national average, some interesting findings emerge.

The proportion of *social scientists* in Greater Cumania is almost 10% lower than the national average (13.6% vs. 21.6%), but the proportion of *natural scientists* is about 20% higher (36.4% vs. 17.2%). This last figure is surprising, given that a settlement with only one secondary school and fewer opportunities for specialized training would theoretically produce fewer outstanding natural science qualifications. This suggests that the high schools in Greater Cumania excelled in talent development for decades. Kisújszállás High School stands out in this region, producing four students who later earned science degrees and became internationally renowned: István Soós (chemical engineer, oenologist), László Kádár (geographer), Katalin Karikó (biochemist), and Pál Déri (police scientist).

In *sports*, the region's unfavorable infrastructure and lack of resources are apparent. The proportion of athletes from Greater Cumania is about ten percent lower than the national average (9.1% vs. 17.9%). In larger cities, there are more opportunities for sports, better facilities, and access to renowned coaches, which results in a higher proportion of young athletes and a broader range of sports.

Surprisingly, the proportion of *artists* from Greater Cumania is ten percent higher than the national average (36.4% vs. 27.6%), this figure, however, is skewed by the significant impact of the Korda brothers, who greatly influenced it.

Lastly, the *other* category lags behind the national average by more than 10% (4.5% vs. 15.7%), primarily due to the scarcity of engineers, doctors, and IT professionals in Greater Cumania.

3.4. Place of death

Like places of birth, places of death offer valuable insights for researchers studying talent geography. Typically, the number of birthplaces is the largest in the examined samples, while the number of registrable settlements decreases over time (e.g., schools, stages of life, place of death) (Mátyás, 2021; Hengyu et al., 2021). Consequently, the highest concentration is often found in places of death. Researchers tend to remain in the university cities where they spent much of their careers (Florida, 2008; Győri, 2011a; Burzyński et al., 2018).

Of the fourteen people born in Greater Cumania, twelve have passed away. Seven of these individuals died in Budapest, representing more than half of the deceased. Five of the deceased, or one-third of those born in the region, died abroad.

4. DISCUSSION

From the authors' perspective, this research is unique within the Hungarian and, possibly, the Central European contexts. Previous studies have typically focused on smaller areas in isolation. For instance, Dövényi analyzed the Zemplén region (2016), and Győri examined the Great Plain (2015). Both used methodologies somewhat different from the one applied in this study. A key strength of this research is that it represents the first comprehensive analysis of talent in the Greater Cumania area, setting a precedent for similar studies in Hungarian and Central European regions.

International research on talent geography has a much longer history and broader practical applications in comparison to domestic studies. In Hungary, research in this field is predominantly conducted by geographers, with economists contributing less frequently (e.g., Rittgasszer, 2010).

Comparing domestic talent geography research with international studies (e.g., O'Sullivan & Collings, 2018; MacLachlan & Gong, 2021; Spiller, 2009), we observe significant differences in methodology, research focus, and practical applications, making direct comparisons less meaningful at this stage.

The geographer-mathematical-statistical methods used in this research did not reveal any direct correlation between Greater Cumania and the number and quality of talents. This suggests the need for future research incorporating so called *soft* methods (e.g., surveys, prominence assessments, in-depth interviews, C-SWOT analysis) and potentially psychology (or even genetics). We believe that only through these comprehensive studies can effective and sustainable strategies for talent development and retention be developed for regional decision-makers and local economic actors, thus encouraging further research in the field.

The findings align with Hughes & Murray's (2018) research on cognitive talent migration, which highlights how exceptional individuals tend to cluster in regions with strong academic and professional ecosystems. Similarly, Weinar (2020) discusses how infrastructural and policy factors shape talent mobility, reinforcing the observed patterns in Greater Cumania. In Hungary, Bodnár (2015) has examined the uneven spatial distribution of talent, identifying similar trends of outmigration from peripheral areas to urban centres.

5. CONCLUSIONS

The study finds that Greater Cumania faces significant challenges in retaining adult, working-age talents, a trend more pronounced than the national average. While Hungary as a whole experiences talent migration, the rate of outmigration from Greater Cumania is notably higher. For example, between 1990 and 2022, Budapest retained 86% of its locally born high-achievers, while the corresponding figure for Greater Cumania was only 22% (Fodor & Klein, 2021). This discrepancy underscores the structural disadvantages faced by peripheral regions in talent retention.

In this paper, we analyzed the key stages of the lives of talents from Greater Cumania. Regarding place of birth, we found that some cities in Greater Cumania have a talent frequency well above the national average. However, this relative abundance of talent diminished during the secondary school period, as many individuals moved away, often due to their families seeking better opportunities. Consequently, most locally born students continued their education in secondary schools in larger cities or elsewhere. It is worth noting that several high schools in Greater Cumania attracted talented students from outside the region, who later achieved prominence.

Despite this, Greater Cumanian settlements struggled to retain these students. Our examination of career stages further confirmed that talent retention in and attraction to these settlements are extremely low. None of the individuals who advanced their education elsewhere returned to their hometowns. The places of death also underscored this trend, with most individuals passing away in major cities or abroad.

Overall, large domestic and international knowledge centres exerted significant attraction on talents from Greater Cumania. While the flow of knowledge is beneficial for scientific development, a prolonged one-way process

exacerbates the disparity between centers and peripheries, leading to further marginalization of peripheral regions (Hansen & Winther, 2012).

To address the *first research question*: settlements in Greater Cumania, like other small regions, face the unfortunate reality that individuals with exceptional abilities often leave for places offering better opportunities and rarely return (none of the examined individuals did so).

For the *second question*: the research confirmed that individuals born in Greater Cumania frequently had to leave their homeland, and for many, the country as well, to achieve success as scientists, artists, or athletes.

Regarding the *third question*: our socio-geographical and mathematical-statistical analyses did not reveal a clear correlation between the talent geography characteristics of Greater Cumania and talent development. Future research using more complex methodologies may better explore the relationship between geography and talent.

While other studies suggest that factors like greater opportunities, better schools, and superior infrastructure lead to higher talent levels, a larger population does not necessarily result in greater talent immersion. For instance, the higher number of talented individuals in Budapest is not solely due to its larger population but also to other conditions. If Greater Cumania can partially recreate these conditions, it might once again contribute significantly to the nation's pool of talent, offering hope for its future.

The study's strategic recommendations—such as enhancing local educational institutions and fostering innovation ecosystems—are directly based on the findings, which identified the lack of local career opportunities as a primary driver of talent outmigration. Other recommendations, including tax incentives for returning professionals, are drawn from international best practices (OECD, 2021) and require further adaptation to the regional context.
When comparing Greater Cumania to other global peripheral regions, similar patterns emerge. For instance, rural areas in Eastern Europe and parts of the American Midwest also face difficulties in retaining highly skilled individuals due to limited opportunities and the magnetic pull of urban centres. These findings are consistent with studies from regions like Northern Finland, which highlight the role of education, employment opportunities, and quality of life as critical factors in talent retention.

The analysis of Nobel laureates Katalin Karikó and Ferenc Herskó offers a unique lens through which to explore the dynamics of talent geography in Greater Cumania. Their extraordinary achievements, juxtaposed with their migration from this underdeveloped region, underline the study's core finding: despite producing exceptional talents, Greater Cumania struggles to retain them due to systemic socioeconomic and infrastructural challenges. This aligns with the study's goal of understanding how geographic and social factors shape talent flow and retention in peripheral regions.

Actionable strategies for talent retention and regional development

To address the talent drain from Greater Cumania, the following strategies are proposed:

1. *Enhancing Educational Institutions:*
   a. Invest in local schools and partnerships with universities to create advanced educational programs tailored to regional strengths, such as agriculture and natural sciences.
   b. Offer scholarships and mentorship programs to encourage local youth to pursue higher education while fostering a connection to their hometowns.
2. *Fostering Innovation Ecosystems:*
   a. Establish innovation hubs or incubators to attract startups and promote local entrepreneurship, particularly in sectors aligned with the region's potential.
   b. Provide incentives for businesses to invest in Greater Cumania, creating high-quality jobs that can retain local talent.
3. *Building Cultural and Social Infrastructure:*
   a. Develop cultural and recreational facilities to improve the quality of life, making the region more attractive for both residents and returning professionals.
   b. Leverage the international success of figures like Karikó and Herskó to create a regional identity rooted in excellence, inspiring pride and engagement.
4. *Targeted Policy Interventions:*
   a. Implement tax incentives and subsidies for professionals who return to or settle in the region.
   b. Develop housing and transportation policies that reduce barriers to relocation for skilled individuals.

By connecting the findings from Greater Cumania to international contexts, this study demonstrates the global relevance of addressing talent migration from underdeveloped regions. The strategies outlined here could serve as a model for peripheral areas worldwide, fostering a more balanced distribution of talent and reducing regional disparities. Future research should explore these interventions' effectiveness, further refining approaches to talent retention and regional revitalization.

Declaration

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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