

THESIS SUMMARY

Bánkuty-Balogh Lilla Sarolta

**The intersection of geopolitics and
technological innovations:
implications for the Central-European region**

Ph.D. Dissertation

Supervisors:

Ádám Banai, Ph.D.

Professor

Imre Garaczi, Ph.D. Habil.

Professor

Budapest, 2023

Geopolitics and Sustainable Development
Doctoral Program

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The following document is the thesis summary of an article-based doctoral dissertation in accordance with § 31 of the Doctoral Regulation of Corvinus University Budapest, September 2022 (JISZ-SZ/2-1/2022), based on the following publications:

Article 1: Balogh, L. S. (2017). Could China Be the Winner of the Next Industrial Revolution? *Financial and Economic Review*, Vol. 16. (Special Issue), January 2017, pp. 73–100.

Article 2: Bánkuty-Balogh, L. S. (2021). Novel technologies and Geopolitical Strategies: Disinformation Narratives in the Countries of the Visegrád Group. *Politics in Central Europe*, 17(2): 165–195. DOI: <https://doi.org/10.2478/pce-2021-0008>

Article 3: Bánkuty-Balogh, L. S. (2022). A mesterséges intelligencia elterjedésének geoökonómiai hatásai és Magyarország. *Külgazdaság*, 66(7-8): 102–130. DOI: <https://doi.org/10.47630/KULG.2022.66.7-8.102>

I. Research background and justification of the topic

The role of innovation and emerging technologies are becoming increasingly important in shaping geopolitics and the balance of power in the world. In a knowledge-based economy, innovation and human capital are essential resources for interstate competition. This change in the economic system has led to a relative decline in the importance of traditional factors such as military power, gross national product, population, energy, land, and natural resources, and an increase in the importance of factors such as technological development, educational standards, and the flexibility of institutional arrangements. The networked world system has presented new geopolitical challenges, including nationalization and weaponization of technology, regional fragmentation, and erosion of interconnection, which can lead to higher tensions for a globalised world. In the light of changing circumstances, geopolitical narratives should follow a suitable approach in analysing the changing nature of international relations.

The main research question of the thesis evolves around what the effects of emerging technological innovations are on the economy and our societies, and how this shapes international relations and geopolitics. The dissertation also examines what are some subsequent trends that affect Hungary specifically, and the Central European region more broadly.

The dissertation is based on three previously published articles of the author, that analyse the significance of emerging technologies from a geopolitical viewpoint, each covering a distinct topic within the broader scheme of geopolitics and innovation, applying different methodological approaches.

The thesis contributes to the existing body of research as it (1) explores a contemporary topic that will gain increasing attention in the coming years, and as of today is still relatively under-researched; (2) provides a synthesising framework on relevant theories and concepts from classical to modern geopolitics, that can support further research in the area; (3) performs analysis related to Hungary and the wider Central European region on the topic of emerging technologies and geopolitics; (4) utilises a novel research method within the

social sciences, by applying a natural language processing (NLP) algorithm in one of the articles.

Research questions and hypotheses of the individual articles:

Article 1 examines China's growth prospects and competitiveness in the shift in production technologies, known as the Fourth Industrial Revolution or Industry 4.0. The main research question is whether China can emerge as the main global beneficiary of the transformation of production technologies in Industry 4.0. The analysis also weighs identified factors working in favour of or against the competitiveness of the Chinese high-tech sector.

(RQ1): Can China emerge as the main global beneficiary of the transformation of production technologies in the Industry 4.0?

(RQ2): How can we define the changing geopolitical context of the Fourth Industrial Revolution?

Article 2 examines the use of strategic narratives in disinformation campaigns targeting the Visegrád Group (V4). The hypotheses for the analysis were, that among disinformation news pieces targeted at the Visegrád countries, it would be possible to identify recurring topics. Also, that based on these key topics prevailing narratives and meta-narratives of disinformation campaigns targeted at the V4 region could be established.

H1: Among disinformation news pieces targeted at the Visegrád countries, it would be possible to identify recurring topics.

H2: If so, such recurring narratives could be structured into a coherent system that portrays an underlying logic or world view.

Article 3 discusses the potential impact of artificial intelligence (AI) solutions as a general-purpose technology (GPT) on the competitiveness of countries and their likely impact on the labour market. The article also examines the challenges and opportunities in terms of economic competitiveness for a small, open, middle-income economy

such as Hungary, and provides a comparative analysis on Hungary's and Estonia's digital transition.

(RQ1): Will the AI transformation lead to a more equitable distribution of wealth, or will it extrapolate economic inequalities between and within countries?

(RQ2): What is the disruptive potential of AI solutions on the labour market?

II. Methodology

Article 1: Case study approach based on secondary data analysis and literature review

Article 1 assesses China's current position and prospects for growth in the so called Fourth Industrial Revolution. The article presents an overview on the definitions and main driving megatrends of the Fourth Industrial Revolution, and models some of the possible socioeconomic implications that are already impacting or could potentially impact the country in the future.

China's current economic situation and growth prospects are analysed based on publicly available statistical data regarding relevant socio-economic indicators, such as per capita GDP and GDP growth, rate of poverty, industrial output and productivity, levels of debt, economic structure, expenditure on research and development.

The ratio of China's share in the global revenue pool comparing to its share of global GDP is used as an indicator to evaluate innovation performance in different sectors of the economy. The study compares this ratio in four industrial

sectors based on their relation to innovation: (1) customer-focused, (2) efficiency-driven, (3) engineering-based and (4) science-based industries, and measures China's success in each of these dimensions.

China's capability to create breakthrough innovation in different industrial sectors is then examined by gathering and analysing data and information on the science and technology ecosystem:

- i. the evolution of science and technology programmes implemented in the country,
- ii. the current state of scientific research and development infrastructure,
- iii. financial landscape (the role of venture capital and state financed programs) and commercialisation.

Finally, potential factors delaying the global breakthrough of the Chinese high-tech sector are identified.

Article 2: Quantitative discourse analysis and relationship mapping

Article 2 uses quantitative discourse analysis (DA) on disinformation messages to uncover strategic narratives that were spread by pro-Kremlin sources in the V4 region as a part of cyber-warfare activities. The research analysed close to 1000 individual news pieces containing disinformation, which originally appeared in one of the V4 languages in a 5-year time period. The collection included 458 Czech, 285 Polish, 160 Hungarian and 40 Slovak language articles that appeared between January of 2015 and November of 2020.

A natural language processing (NLP) algorithm has been used to analyse the textual data and extract information on recurring topics. The NLP algorithm was programmed to return the individual frequency of mentions of recurring topics and their relationship structure, based on co-mentions. This exercise was performed, both on an overall V4 and an individual country level, repeating the process on all four datasets.

The categories included people, countries, locations, concepts, organisations, events, and ideologies. The frequency of recurring themes within the articles has then been assessed, and their relative frequency compared among the four data sets to uncover consistent tendencies, as well as outliers in the data.

The the relationship structure of recurring themes based on co-mentions has been mapped to represent the findings visually.

Finally, the study employed the strategic narratives framework to make sense of the data and detect constructed identity claims and positions on specific issues that sought to shape the perceptions and actions of domestic and international audiences. Based on the strategic narratives framework and the quantitative analysis, the research exposed individual storylines and overarching meta-narratives that were present in the four datasets.

Article 3: Comparative analysis based on secondary data and literature review

Article 3 examines the geoeconomic impacts of existing and widely used second-wave artificial intelligence (AI) solutions, with particular emphasis to its aspects affecting economic development and income inequality. The research uses deductive reasoning based on macroeconomic concepts fundamental to digital technologies, such as innovators' rents (Korinek & Sitglitz, 2021; 2019), winner-takes-all markets (Brynjolfsson et al., 2018; Brynjolfsson & McAfee, 2014),

economics of superstars (Rosen, 1981), non-rivalry (Romer, 1986), network effects and path dependencies.

After defining theoretical models that serves as framework for the analysis, the study examines the distribution of the benefits from the use of AI technologies and investigates market dynamics, comparing the position of technological centres and peripheries.

Based on the perspective of moving from the global to the local, the macro-level analysis is followed by an analysis of the country-level effects of the use of AI, with special emphasis on national economic limits to the redistribution of returns, emergence of oligopolistic market structures, dynamics that reinforce and diverge from the effects of globalisation, and expected labour market trends.

The article presents a comparative analysis on Hungary and Estonia regarding the digital preparedness of social and economic systems. Data from the Digital Economy and Society Index (DESI, 2021) is used for analysis to compare digital development in the areas of (1) human capital, (2) internet access, (3) digital technology integration and (4) digital public services.

Labour market trends are analysed based on the SBTC-theory and the ALM-hypothesis, by applying them to the characteristics of the Hungarian labour market, reflecting on the European centre-periphery geographic relationship in the division of labour.

III. Findings of the dissertation

The dissertation examines what the effects of emerging technological innovations are on the economy and our societies, and how this shapes international relations and geopolitics, with a particular focus on Hungary and the Central European region. The study finds that there is a need to adapt geopolitical narratives to reflect a world system that is moving away from the traditional model of exclusive state actors exercising power, and is characterised by global interconnectedness and the advancement of technology.

The thesis analysed specific findings on subtopics related to the broader scheme of geopolitics and innovation, described in three individual articles:

Article 1 discusses the fourth industrial revolution and its impact on China:

- The technological shift of the Industry 4.0 is accompanied by a set of broader socioeconomic, geopolitical and demographic developments, which are crucial in determining whether China can position itself successfully

to come out as one of the global winners (if not the winner) of the technological transformation.

- On most measures examined, the research finds that China is already in the frontline of the global technological innovation scene, in terms of human, infrastructural and financial resources invested into creating breakthrough innovation.
- The study concludes that while Chinese companies are already world leaders in consumer-focused sectors, there is a lag in science and engineering-based industries.
- The evidence indicates that if China does not experience systemic disruptions and can continue to support innovation at current pace, tackle challenges in regulatory processes, intellectual property protection, and most importantly human resource development, Chinese firms could become world leaders in high-tech sectors the near future.
- The most significant factors delaying the global success of the Chinese high-tech sector include: (1) the time component of high-tech scientific developments; (2) issues of the regulatory environment; (3) the local advantage of domestic companies; (4) network characteristics of the

knowledge-based economy; and (5) the acquisition of social technologies of innovation.

Article 2 argues that the projection of strategic narratives through disinformation campaigns is an important geopolitical tool in the global competition for power:

- In the current media environment of growing information disorder and social media being primary sources of news, the spread of disinformation is becoming increasingly easy and cost-effective.
- Disinformation and deception can influence people to accept and share content that is based on emotions rather than facts.
- 5 key meta-narratives were detected in all four Visegrád countries, feeding into a coherent system of beliefs, such as the envisioned collapse of the European Union and the establishment of a system of Neo-Atlantism that would divide the continent.

- Due to its strategic importance, the Visegrád Group should expect to become a target of disinformation campaigns aimed at manipulating public opinion.

Article 3 examines the impact of artificial intelligence (AI) on wealth distribution and economic developmental patterns between and within countries:

- While technological progress can lead to Pareto improvements at the global level, the use and diffusion of AI can have different impacts on different economic actors and countries.
- AI's operating logic allows for the emergence and persistence of winner-take-all market dynamics that benefit larger players, which can contribute to growing inequalities.
- Hungary faces a difficult competitive environment due to its size, economic weight, semi-peripheral location, and medium level of development.
- Hungary has untapped potential in integrating digital competences more strongly into education curricula and lifelong learning to increase economic productivity.

- Hungary should exploit the high-quality digital data assets generated in certain public administrations, which could serve as input for domestically developed AI solutions.

Overall, the individual studies have revealed that there is a need to adapt geopolitical narratives to reflect a world system that is moving away from the traditional model of exclusive state actors exercising power, and is characterised by global interconnectedness and the advancement of technology. The emergence of subnational and supranational, non-state and non-political actors has changed the composition and functioning of international society, leading to a shift from identity-based and predominantly political approaches to an increasing emphasis on economic considerations.

While a contemporary understanding of geopolitics builds on the increased role of non-state actors and the emergence of networks and virtual spaces, it also recognises that traditional geopolitical factors such as resource distribution, national interests, and geographic location remain important considerations in understanding the world's balance of power.

IV. Main references

Brynjolfsson, E., & McAfee, A. (2014). *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. WW Norton & Company, United States.

Brynjolfsson, E., Mitchell, T., & Rock, D. (2018). What Can Machines Learn, and What Does It Mean for Occupations and the Economy? *AEA Papers and Proceedings*, 108, 43–47. DOI: 10.1257/pandp.20181019

Castells, M. (1996). *The Rise of the Network Society*. Oxford, Blackwell.

Dalby, S. (1998). *Geopolitics, Knowledge and Power at the End of the Century*, in „The Geopolitics Reader”, London, Routledge, 1998., p. 305-312.

Dövényi et al. (2021). *Legitim geopolitika*, Pallas Athéné Könyvkiadó, Budapest.

Florida, R. (1995). Toward the Learning Region. *Futures*, 27 (5): 527–536. [https:// doi.org/10.1016/0016-3287\(95\)00021-n](https://doi.org/10.1016/0016-3287(95)00021-n).

Khanna, Parag (2017). *Connectography. Mapping the Future of Global Civilization*. Random House, New York.

Korinek, A., & Stiglitz, J. E. (2019). Artificial Intelligence and Its Implications for Income Distribution and Unemployment. In A. Agrawal, J. Gans, & A. Goldfarb (Eds.), *The Economics of*

Artificial Intelligence (1st ed., pp. 349–391). The University of Chicago Press.

Korinek, A., & Stiglitz, J. E. (2021). Artificial Intelligence, Globalization, and Strategies for Economic Development. Working Paper 28453. National Bureau of Economic Research.

Luttwak, E. (1990). From geopolitics to geo-economics: logic of conflict, grammar of commerce, *The National Interest*, 20:17-23.

Mackinder, H. J. (1904). The geographical pivot of history. Reprint. *The Geographical Journal*, 170 (4), December 2004, pp. 298–321.

Moisio, Sami (2018). *Geopolitics of the Knowledge-Based Economy*. Routledge, New York, <https://doi.org/10.4324/9781315742984>.

Nye, J. (2002). *The Paradox of American Power*, Oxford University Press.

Ó Tuathail, G. (1998). *Thinking critically about geopolitics*, in „The Geopolitics Reader”, London, Routledge, 1998, p. 1-15.

Ó Tuathail, G. (2005). *Critical Geopolitics, The Politics of Writing Global Space*. Routledge, London.

Palotai, D., & Virág B. (2016). Versenyképesség és növekedés. Magyar Nemzeti Bank, Budapest.

Porter, M. E. (1998). Clusters and the New Economics of Competition. *Harvard Business Review*, 76 (6): 77–90.

Rifkin, J. (2015). *The Zero marginal cost society: The internet of things, the collaborative commons, and the eclipse of capitalism*. Palgrave Macmillan, New York.

Romer, P. M. (1986). Increasing Returns and Long-Run Growth. *The Journal of Political Economy*, 94(5), 1002–1037. <https://doi.org/10.1086/261420>

Rosen, S. (1981). The Economics of Superstars. *The American Economic Review*, 71(5) 845–858.

Schumpeter, J. (1980). *A gazdasági fejlődés elmélete*. Közgazdasági és jogi könyvkiadó, Budapest, p. 320.

Schwab, K. (2016): *The Fourth Industrial Revolution*. World Economic Forum, Geneva.

Simai, M. (2014). A térszerkezet és a geoökonómia. Spatial structure and geo-economics. *Tér és Társadalom / Space and Society*, 28(1), 25–39.

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, 70(1): 65-94.

Szilágyi, I. (2013). *Geopolitika*. Publikon Kiadó, Pécs.

V. List of own publications related to the topic

Baranyai, E. & Bánkuty-Balogh L. S. (forthcoming). A GDP-n kívüli tényezők hatása a jólétre. In Baksay, G. Ed., *Fenntartható GDP*, Magyar Nemzeti Bank, Budapest. Book chapter to be published.

Bánkuty-Balogh, L. S, Lehmann, K. & Szalai, Z. (forthcoming). A dollár dominancia fenntarthatósága endogén pénzelméleti és geopolitikai megközelítésben. In Halmai, P. Ed., *Fenntarthatóság a közgazdaságban*. Budapesti Metropolitan Egyetem & Akadémiai könyvkiadó, Budapest.

Bánkuty-Balogh, L. S. (2022). A mesterséges intelligencia elterjedésének geoökonómiai hatásai és Magyarország. *Külgazdaság*, 66(7-8): 102–130. DOI: <https://doi.org/10.47630/KULG.2022.66.7-8.102>

Bánkuty-Balogh, L. S. (2021). The role of techno-optimism in environmental sustainability narratives. In Szerényi, Zs. et al. Eds., *Environmental, social and economic sustainability in the light of geopolitical challenges of our age*. Corvinus University of Budapest (2021), pp.72-89.

Bánkuty-Balogh, L. S. (2021). Novel technologies and Geopolitical Strategies: Disinformation Narratives in the Countries of the Visegrád Group. *Politics in Central Europe*, 17(2): 165-195. DOI: <https://doi.org/10.2478/pce-2021-0008>

Balogh, L. S. (2019). Az igazsággépezet. Michael J. Casey–Paul Vigna: *The Truth Machine – The Blockchain and the Future of Everything*. *Közgazdasági Szemle*, 66 (9). pp. 1005-1009. ISSN 0023-4346

Balogh, L. S. (2019). Hipszturbanizáció – Az új dzsentrifikáció. *Hungarian Geopolitics*, 2019 (4): 146-157.

Balogh, L. S. (2018). A tudás geopolitikája: A tudásalapú gazdaság értelmezése geopolitika kontextusban. *Polgári Szemle*, 14 (4-6). pp. 404-415.

Balogh, L. S. (2017). Could China Be the Winner of the Next Industrial Revolution? *Financial and Economic Review*, Vol. 16. (Special Issue), January 2017, pp. 73–100.