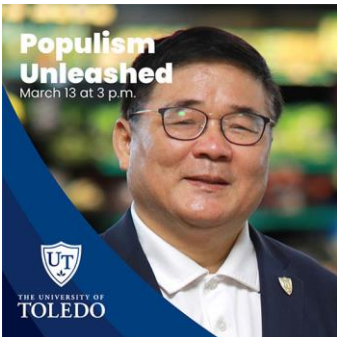


NEW POPULISM IN THE AGE OF ARTIFICIAL INTELLIGENCE:

Geopolitical Dynamics, Digital Influence and Expanding Frontiers



PAUL HONG, PH.D.

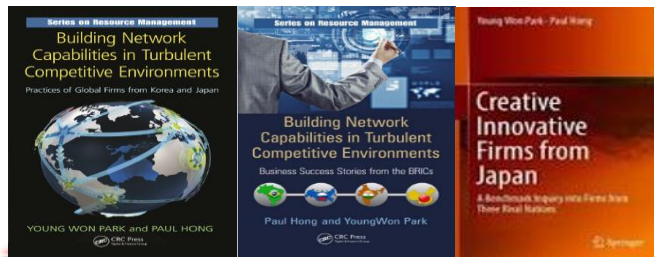
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Chair of ISSCM
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SPRINGER NATURE
Reference []

Joseph Chacko Chennattuserry
Madhumati Deshpande
Paul Hong
Editors

Encyclopedia of New Populism and Responses in the 21st Century

 Springer



Paul Hong is a Distinguished University Professor and serves as the Chair of Information Systems and Supply Chain Management at the John B. and Lillian E. Neff College of Business and Innovation, University of Toledo.

He is widely recognized for his research excellence, global collaborations, and academic leadership. He has received numerous prestigious honors, including the Fulbright-Nehru Teaching and Research Excellence Award, which underscores his international influence and scholarly impact.

Dr. Hong's expert views on innovation, global supply chains, and strategic transformation have been featured in leading platforms such as *The Wall Street Journal*, *The Hill*, *Fortune*, and *Forbes*, as well as numerous academic journals across business, technology, and policy disciplines. He continues to inspire students, scholars, and industry leaders with his research, thought leadership, and global outreach.

AGENDA

- 1. INTRODUCTION: DEFINING NEW POPULISM**
- 2. POPULISM & AI: NEW DYNAMICS**
- 3. 5PS OF AI DISRUPTION**
- 4. GEOPOLITICAL RISKS & GLOBAL CHALLENGES**
- 5. STRATEGIC PATHWAYS FORWARD**

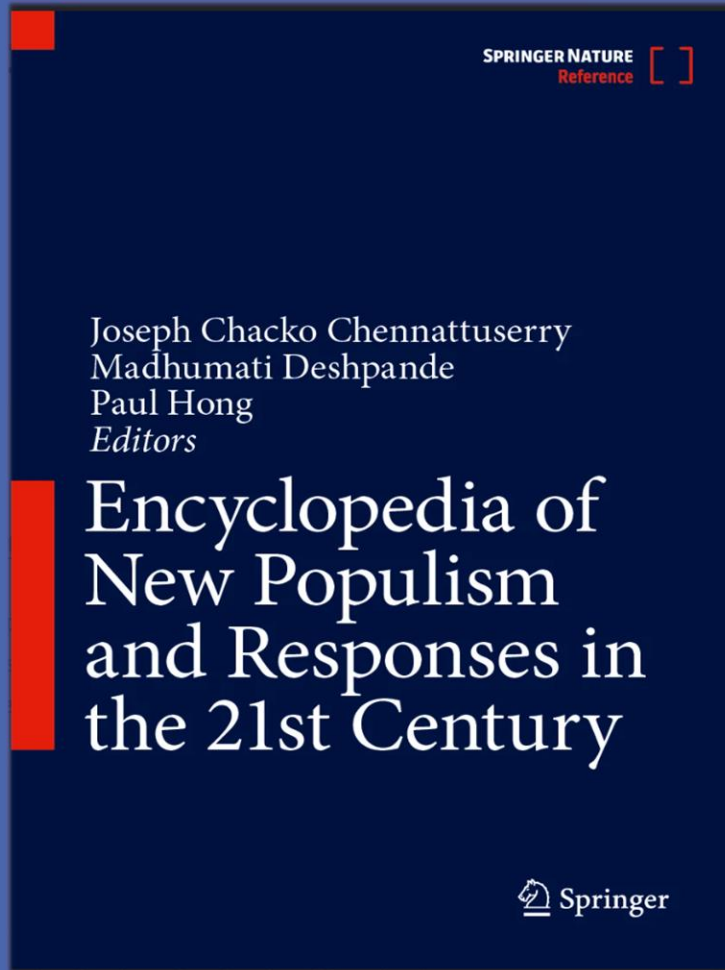
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Madhumati Deshpande
Paul Hong
Editors

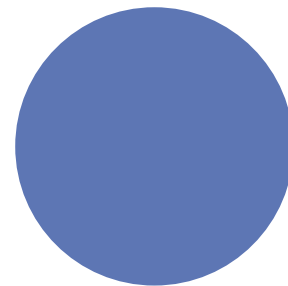
Encyclopedia of
New Populism
and Responses in
the 21st Century

 Springer

1. INTRO



The ***Encyclopedia of New Populism and Responses in the 21st Century*** brings together 400+ scholars across 243 articles to examine populism's historical, cultural, and political dimensions. It explores the shift from traditional to digital populism, analyzing its driving forces, consequences, and strategies for navigating modern power struggles.

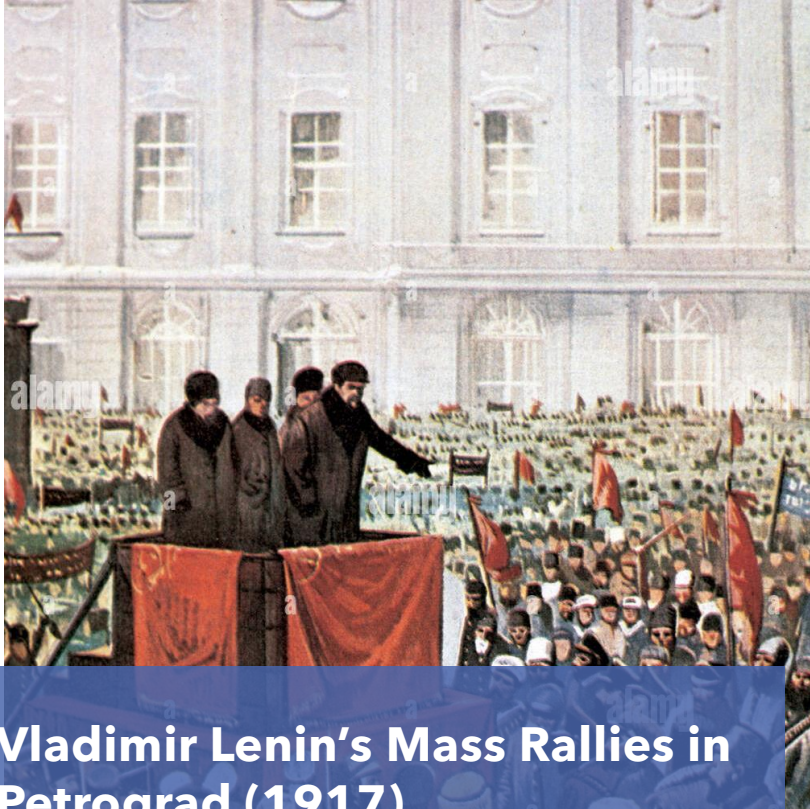


1.1.

**FIVE CENTRAL THEMES
OF THE BOOK**



1.2.POPULISM IN HISTORY



Vladimir Lenin's Mass Rallies in Petrograd (1917)

Vladimir Lenin's mass rallies in Petrograd (1917) were instrumental in mobilizing revolutionary fervor, leading to the Bolshevik seizure of power and the establishment of the Soviet Union.



MLK Jr.'s "I Have a Dream" Speech in Washington, DC (1963)

Martin Luther King Jr.'s "I Have a Dream" speech (1963) became a defining moment in the U.S. Civil Rights Movement, inspiring legislative change and advancing the fight for racial equality.

Finchelstein, F. (2019). *From fascism to populism in history*. University of California Press.

Kazin, M. (2014). *The populist persuasion: An American history*. Cornell University Press.

Urbinati, N. (2019). Political theory of populism. *Annual review of political science*, 22(1), 111-127.

1.3.POPULISM TODAY



Donald Trump's Digital & Physical Hybrid Rallies (2024)

Donald Trump's digital & physical hybrid rallies (2024) exemplify AI-driven populism by leveraging social media algorithms, live-streaming, and digital engagement tools to amplify mass mobilization and bypass traditional media.



Kamala Harris's Smaller-scale Targeted Digital Events (2024)

Kamala Harris's smaller-scale targeted digital events (2024) showcase AI-powered microtargeting, using data analytics and personalized outreach to connect with specific voter demographics, enhancing engagement through precision-tailored messaging.

Gusterson, H. (2017). From Brexit to Trump: Anthropology and the rise of nationalist populism. *American ethnologist*, 44(2), 209-214.

Inglehart, R. F., & Norris, P. (2016). Trump, Brexit, and the rise of populism: Economic have-nots and cultural backlash.

Norris, P., & Inglehart, R. (2019). Cultural backlash: Trump, Brexit, and authoritarian populism. Cambridge University Press.

Rodrik, D. (2021). Why does globalization fuel populism? Economics, culture, and the rise of right-wing populism. *Annual review of economics*, 13(1), 133-170.

1.4. Populism vs. New Populism

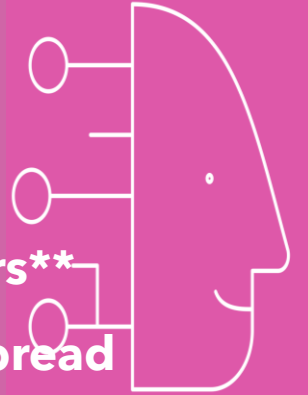
Traditional Populism

- Charismatic Leaders
- Physical Gatherings
- Geographic Limits
- Emotional Appeals
- Slow Global Impacts

VS

New Populism

- Algorithmic Amplification*
- Virtual/Digital Mobilization
- Global, Borderless Reach
- Microtargeted Emotional Triggers**
- Instant Global Misinformation Spread



* Computer programs automatically boost certain posts or videos based on clicks, likes, or attention they get.

** Showing preselected people highly specific messages designed to stir emotions—like fear, anger, or hope—based on their unique profiling criteria.

Bartlett, J., Birdwell, J., & Littler, M. (2011). *The new face of digital populism*. Demos.

Guriev, S., & Papaioannou, E. (2022). The political economy of populism. *Journal of Economic literature*, 60(3), 753-832.

Rovira Kaltwasser, C., Taggart, P., Ochoa Espejo, P., & Ostiguy, P. (Eds.). (2017). *The Oxford handbook of populism*. Oxford University Press.

Chennattuserry, J. C., Deshpande, M., & Hong, P. (2024). *Encyclopedia of New Populism and Responses in the 21st Century*. Springer.

1.5. Elon Musk's Tweets Move Markets

Did you know that today, a single tweet from Elon Musk can shift billions of dollars in global markets, instantly influencing international economic dynamics?

- ✓ Large follower base
- ✓ Sensitivity of stock/crypto markets
- ✓ Algorithmic trading triggers
- ✓ Herd behavior of retail investors



Note: Elon Musk's tweets can shift billions in global markets because of his massive influence, the market's sensitivity to his statements, algorithmic trading that reacts instantly, and the tendency of retail investors to follow his signals, creating rapid and self-reinforcing price movements.

1.6. SOFT-POWER DIPLOMACY

VOGUE

NEWS

Watch BTS Address the United Nations With an Emotional Speech About Self-Acceptance

BY CHRISTIAN ALLAIRE
September 24, 2018



Photo: AP Images

BTS and BLACKPINK leverage **AI-driven digital platforms, Auto Content Boost, and microtargeting** to engage global audiences, promote cultural diplomacy, and positively shape South Korea's soft-power influence worldwide.

Hong, P., Kim, S. C., Lee, A., & Kang, H. (2024). The entrepreneurial transformation process of BTS: initiation, development, growth and expansion. *Journal of Enterprising Communities: People and Places in the Global Economy*, 18(5), 1078-1097.

Kim, Y., & Nye, J. (2021). The soft power of the Korean Wave. *Parasite, BTS and drama*, 14, 237.

Lynch, K. S. (2022). Fans as transcultural gatekeepers: The hierarchy of BTS'Anglophone Reddit fandom and the digital East-West media flow. *New media & society*, 24(1), 105-121.

Park, D. S. H., Kim, S. C., & Hong, P. (2024). Empowering leadership and socio-technological practices: an empirical investigation of BTS's success. *Arts and the Market*.

☰

People

SUBSCRIBE

BLACKPINK: What You Need to Know About K-Pop's Biggest Girl Group

BLACKPINK rose to the top of the U.S. pop charts in 2020, but this is not the group's first time in the spotlight

By [Erica Gerald Mason](#) | Updated on January 6, 2023 03:40PM EST



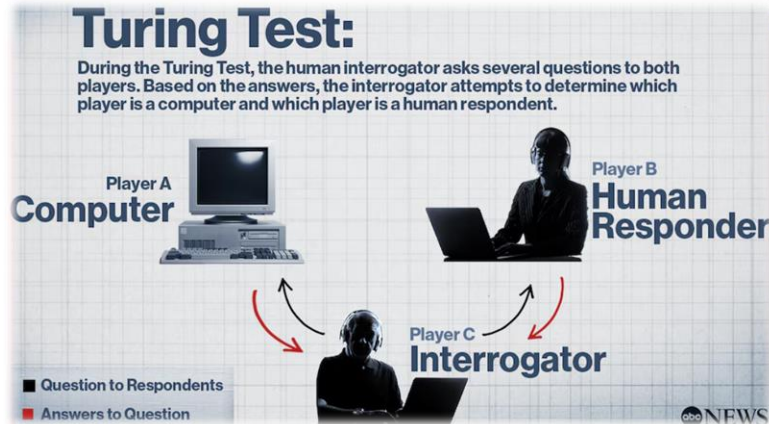
Lisa, Jennie, Rosé, Jisoo. PHOTO: BLACKPINK

[2] AI REVOLUTION

The AI revolution **reshapes** every part of life in **powerful** and **far-reaching** ways.

- Akram, R., Li, Q., Srivastava, M., Zheng, Y., & Irfan, M. (2024). Nexus between green technology innovation and climate policy uncertainty: Unleashing the role of artificial intelligence in an emerging economy. *Technological Forecasting and Social Change*, 209, 123820.
- Davenport, T. H. (2018). *The AI advantage: How to put the artificial intelligence revolution to work*. MIT Press.
- Elliott, A. (2019). *The culture of AI: Everyday life and the digital revolution*. Routledge.
- Harari, Y. N. (2017). Reboot for the AI revolution. *Nature*, 550(7676), 324-327.
- Harari, Y. N. (2024). *Nexus: A brief history of information networks from the stone age to AI*. Signal.
- Makridakis, S. (2017). The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms. *Futures*, 90, 46-60.

2.1. AI HISTORY: AN OVERVIEW



1950

Turing proposes the Turing Test

Introduced core ideas of machine intelligence



1956

Birth of the term "Artificial Intelligence"

Established AI as a scientific field



2016

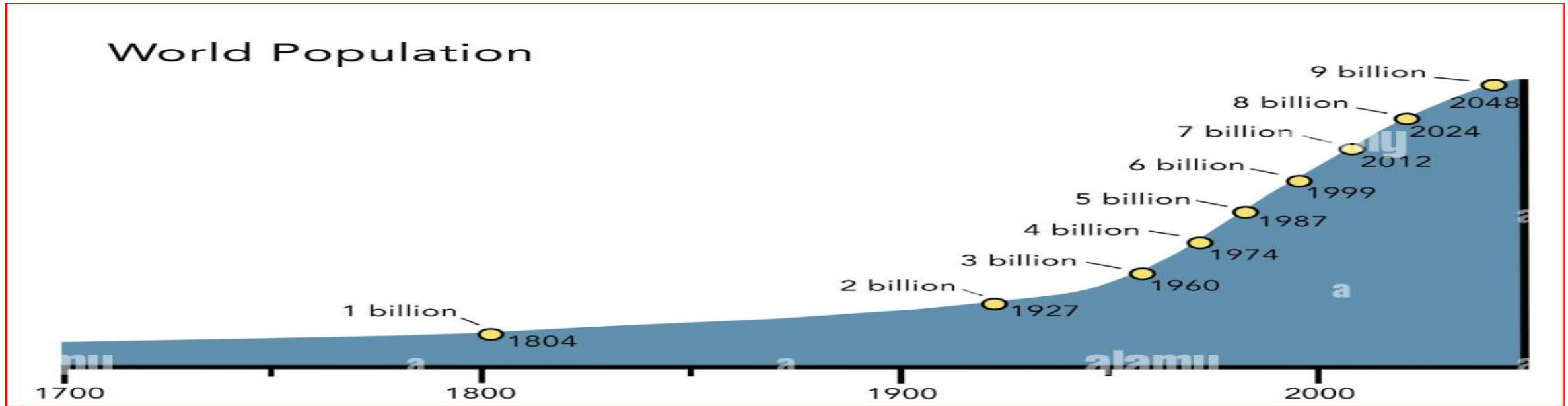
AlphaGo defeats Go champion Lee Sedol

Demonstrated the power of AI: AlphaGo defeated Lee Sedol 4 out of 5 games

2.2. AI Types and Capabilities: A Comparative Summary

Categories	Definition	Examples
Narrow/Weak AI	AI Designed for a specific task or limited set of tasks. It cannot perform beyond its predefined capabilities	Voice Assistants (e.g., Siri, Alexa), spam filters, facial recognition systems, recommendation engines.
Generative AI Tools	A subject of narrow AI focused on generating new content (e.g., text, images, code, etc) from learned data	ChatGPT, Copilot, Bards, Calude, DALL-E, GitHub, Midjourney,
General/Strong AI	Ability to understand, learn, and apply knowledge across a broad range of tasks like a human	Hypothetical future AI that can innovate, strategize, and outperform humans in all domains (e.g., Alpha Go, Skynet)
Super Intelligence AI	AI that far surpasses human intelligence in all cognitive domains—reasoning, problem-solving, creativity, and self-improvement. It may act autonomously and unpredictably.	Imagine an AI that solves global problems, invents new sciences, and thinks far beyond human capacity—an unpredictable supermind like those in Her, Transcendence, or Bostrom's

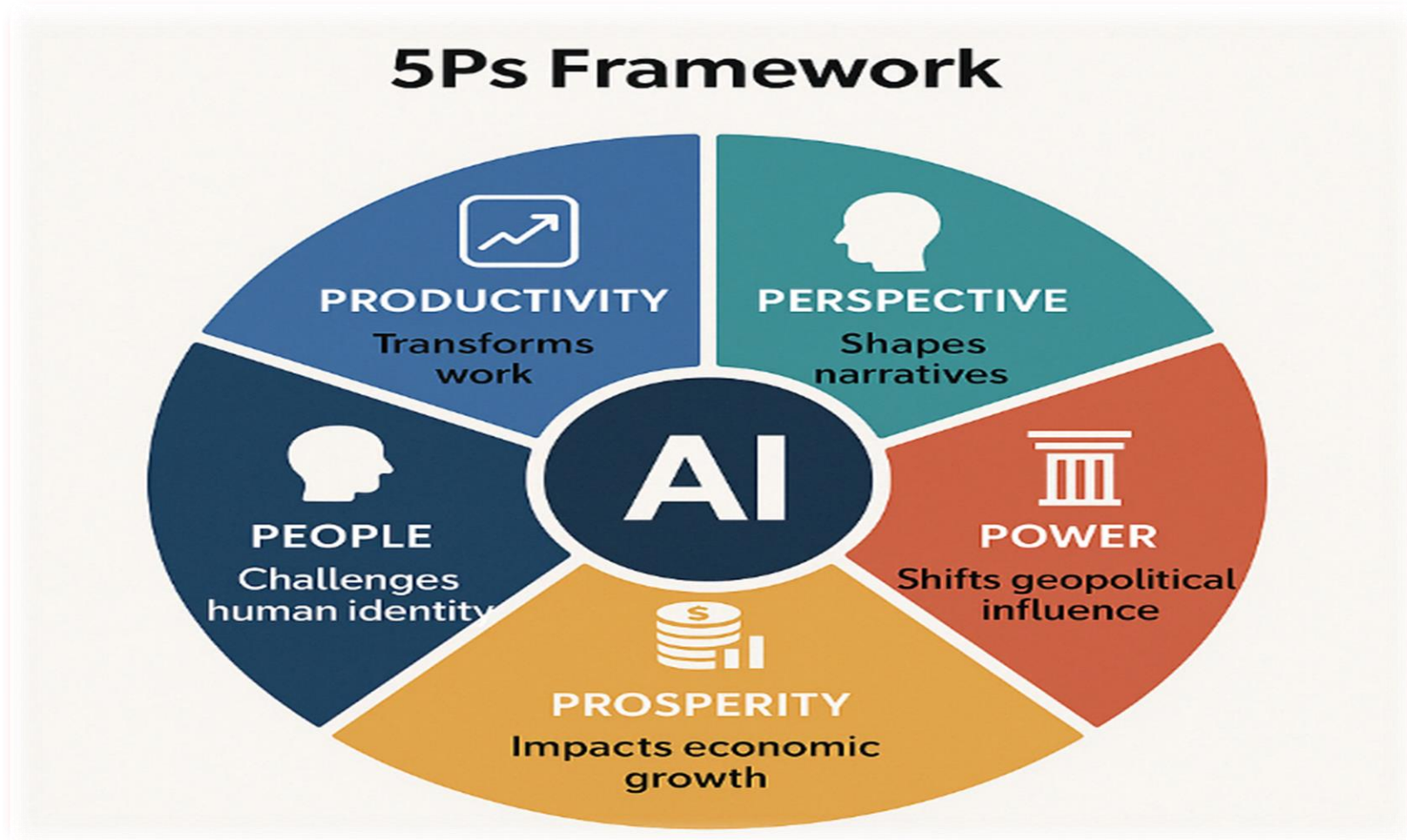
[3] CHALLENGES FOR THE NEXT CENTURY



The exponential rise in world population—from 1 billion in 1804 to over 8 billion in 2024—intensifies pressure on limited food, water, and living resources, heightening the risks of conflict, famine, and social disruptions across the globe.

AI ERA IMPACTS: 5PS

(PRODUCTIVITY, PERSPECTIVE, POWER, PROSPERITY AND PROGRESS)



Source: Paul Hong (2025)

3.1. PRODUCTIVITY REVOLUTION

Work outcomes drastically change:

- **Routine Work: Communications, Reviews, Assessments**
- **Discovery: Idea Generations –R & D; Easy-Quick Access**
- **Delivery: Work Outcomes—Report, Research Results.**



AI-driven automation is projected to contribute up to \$15.7 trillion to the global economy by 2030, boosting productivity by up to 40% across industries. (Source: PwC, 2023)

3.2. PERSPECTIVE REVOLUTION

The scope/scale of reality perception expands

- Reality vs. Perception: Reality is understood in the way we access, assess, and apply information
- The scope of information expands
- The scale of information accelerates

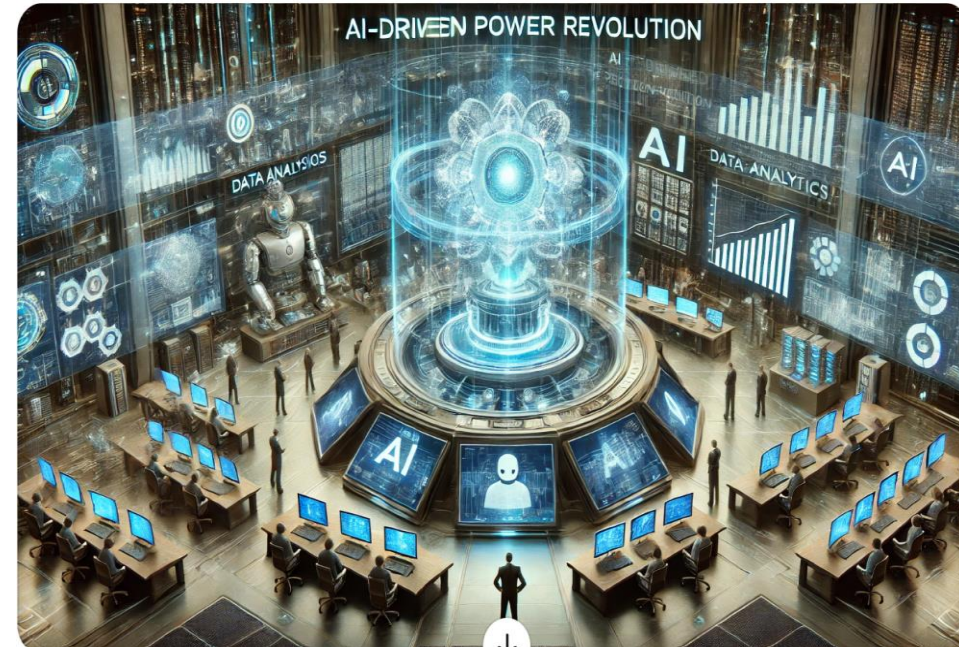


The global datasphere, which was 44 zettabytes in 2020, is expected to exceed 200 zettabytes by 2030, driven by the rapid expansion of IoT devices, real-time data generation, AI advancements, and edge computing.

3.3. POWER REVOLUTION

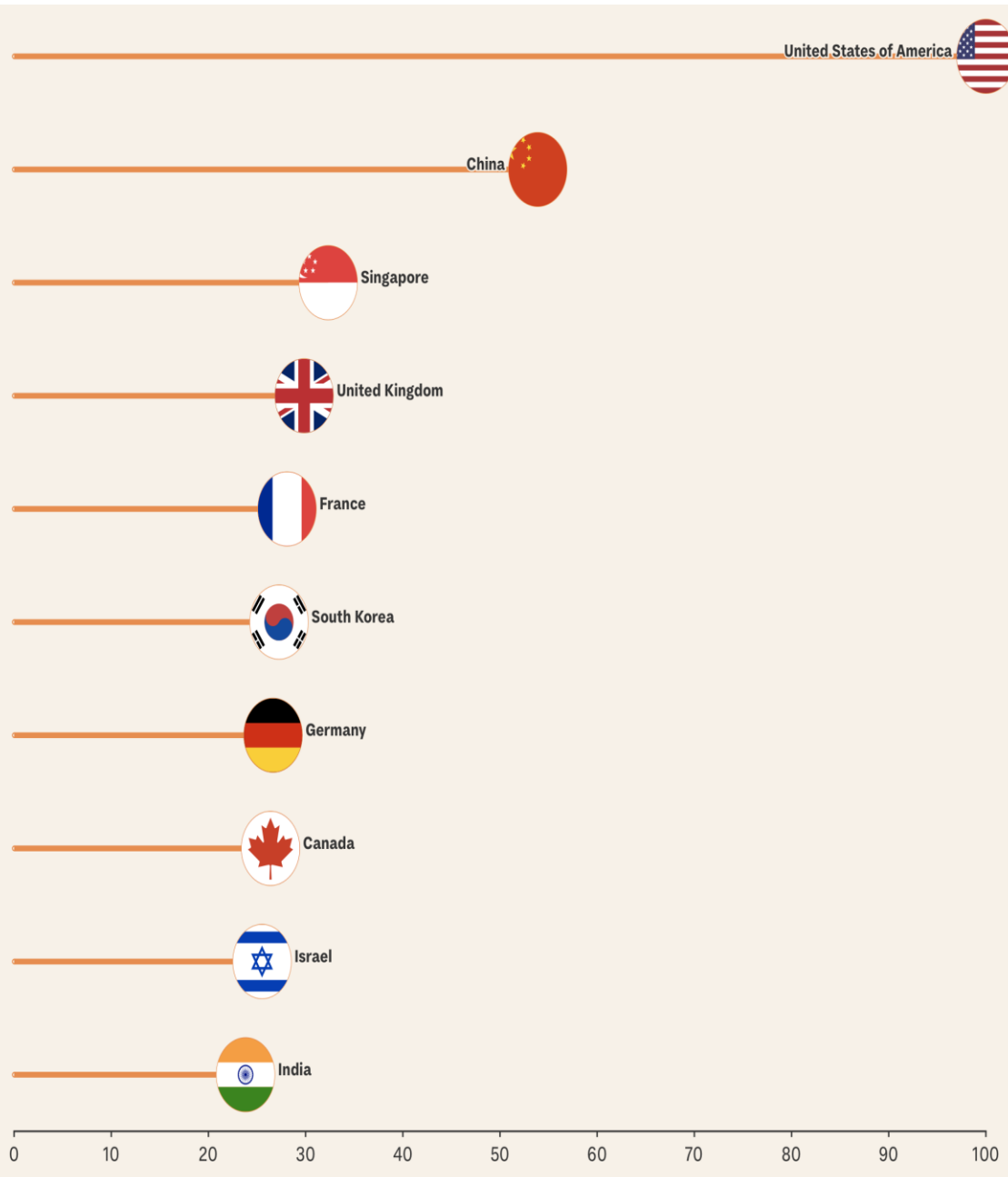
More control = More Power

- Bigger Identity: Expanding Roles
- AI is a transformative force that expands human capabilities, enhances decision-making, and reshapes power structures in the digital era.



By 2025, AI is expected to influence 90% of customer interactions, transforming organizational power dynamics by automating decisions and enhancing process efficiency.

3.4. PROSPERITY REVOLUTION



Top Ten Nations leading in AI Research & Development

➤ USA, China, UK, Canada, Germany, France, Japan, Israel, Korea, India,

➤ AI could potentially deliver up to \$15.7 trillion to the global economy by 2030, with \$6.6 trillion likely to come from increased productivity and \$9.1 trillion from consumption-side effects

Bousquet, A. (2008). Cyberneticizing the American war machine: science and computers in the Cold War. *Cold War History*, 8(1), 77-102.

Bryson, J. J., & Malikova, H. (2021). Is there an AI cold war?. *Global Perspectives*, 2(1), 24803.

Buzan, B. (2024). A new cold war?: The case for a general concept. *International Politics*, 61(2), 239-257.

Cave, S., & ÓhÉigeartaigh, S. S. (2018, December). An AI race for strategic advantage: rhetoric and risks. In *Proceedings of the 2018 AAAI/ACM Conference on AI, Ethics, and Society* (pp. 36-40).

Chin, W. (2019). Technology, war and the state: past, present and future. *International Affairs*, 95(4), 765-783.

Geist, E. M. (2016). It's already too late to stop the AI arms race—We must manage it instead. *Bulletin of the Atomic Scientists*, 72(5), 318-321.

Horowitz, M. C. (2018). Artificial intelligence, international competition, and the balance of power (May 2018).

Horowitz, M. C., Allen, G. C., Kania, E. B., & Scharre, P. (2022). Strategic competition in an era of artificial intelligence. *Center for a New American Security*.

Hossain, M. A., Agnihotri, R., Rushan, M. R. I., Rahman, M. S., & Sumi, S. F. (2022). Marketing analytics capability, artificial intelligence adoption, and firms' competitive advantage: Evidence from the manufacturing industry. *Industrial Marketing Management*, 106, 240-255.

Korinek, A., & Stiglitz, J. E. (2021). Artificial intelligence, globalization, and strategies for economic development (No. w28453). *National Bureau of Economic Research*.

Mehta, P., Chakraborty, D., Rana, N.P., Mishra, A., Khorana, S. and Kooli, K. (2025). AI-driven competitive advantage: the role of personality traits and organizational culture in key account management. *Journal of Business & Industrial Marketing*, 40 (2), 543-569. <https://doi.org/10.1108/JBIM-03-2024-0205>

Schmidt, E. (2022). AI, great power competition & national security. *Daedalus*, 151(2), 288-298.

3.5. PEOPLE REVOLUTION

➤ Identity with Potential:

✓ Expanding Frontiers (Land, Sea, Space)

➤ Destiny Here and Eternity

✓ Human Bondage Constraints

(birth, aging, sickness and death)

✓ Human Glory Destiny

(Justification, Sanctification, Glorification)

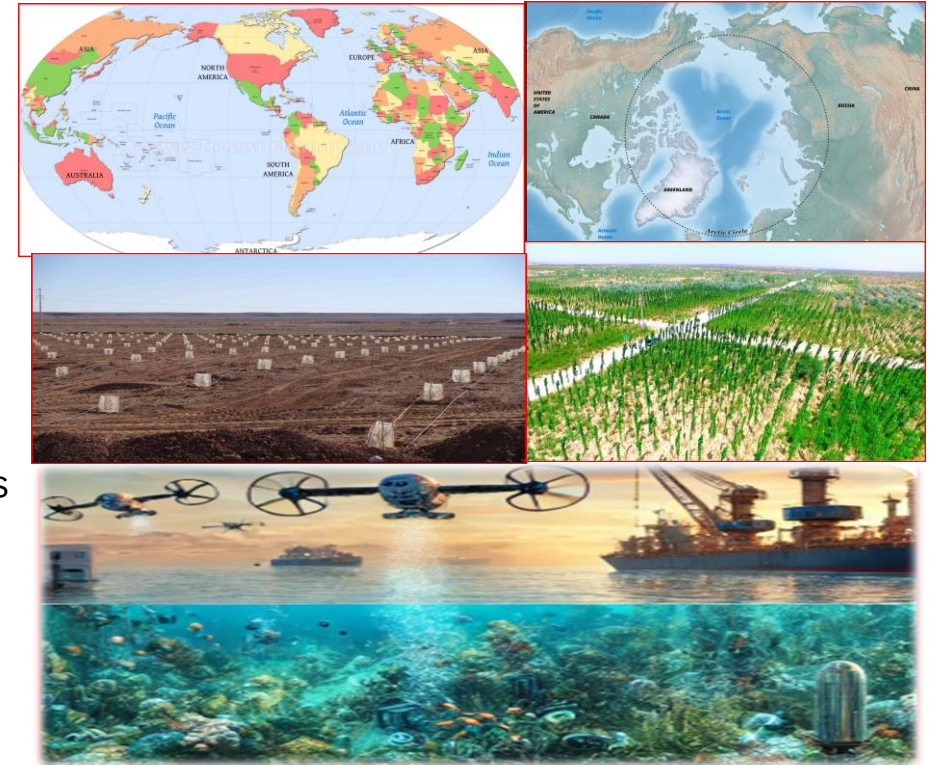


AI technologies are anticipated to contribute to a 40% increase in the efficiency of logistics, resource extraction, and data collection by 2030 in challenging environments such as the North Arctic Sea routes, deep oceanic sectors, and outer space missions.

3.6. EXPANDING NEW FRONTIERS IN AI ERA

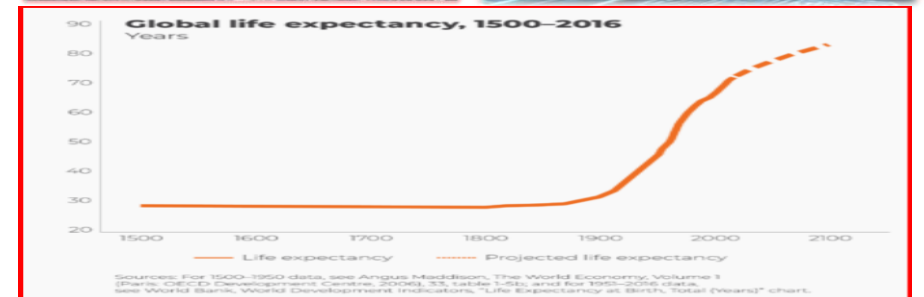
Productivity / Prosperity

- **Global Logistics--North Arctic sea routes:** AI-powered logistics, satellite monitoring, and climate modeling could optimize Arctic trade routes, balancing economic benefits with environmental concerns.
- **Desert forestation:** Desert forestation, powered by AI, is not just an environmental initiative—it is a strategic frontier in building resilient, distributed, and sustainable global supply chains. Note: 11% of land is desert. Note: Land is 29% of the earth.
- **Deep-sea expansions:** Deep-sea expansion, powered by AI, transforms oceans from logistics pathways into resource-rich, tech-enabled nodes of the global supply chain—essential for meeting future demand sustainably and securely. Note: 71% of earth is oceans/seas.

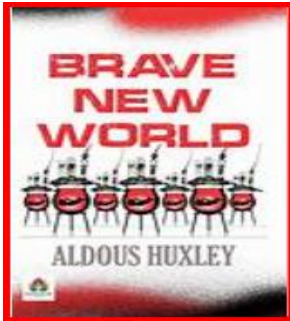


People/Perspective

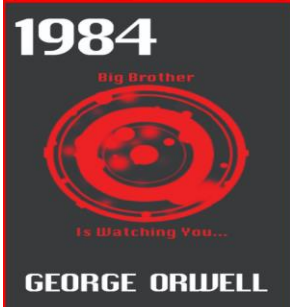
- **Space exploration and travel:** AI-driven space exploration is not just science fiction—it is the next frontier of global supply chains, expanding the scope of logistics, sourcing, and sustainability beyond Earth itself.
- **Longevity Science:** AI is transforming agriculture, healthcare, and resource management by boosting food security, extending human lifespan, and creating sustainable ecosystems to support a growing global population.



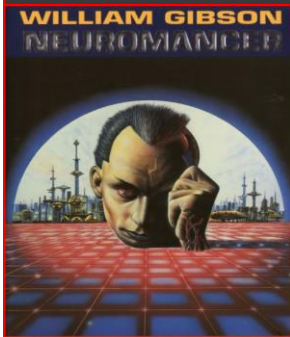
[4] BLEAK FUTURE PREDICTIONS FOR THE TECHNO-AGES



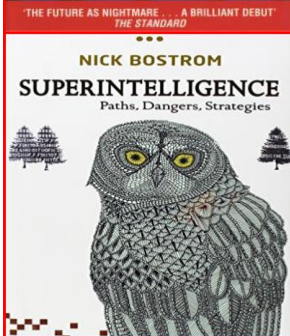
Huxley's novel (1932) presents a dystopian society with extreme **social conditioning** highlighting the dangers of **sacrificing individuality and freedom** for technological control and societal stability.



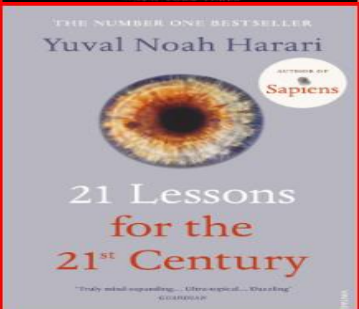
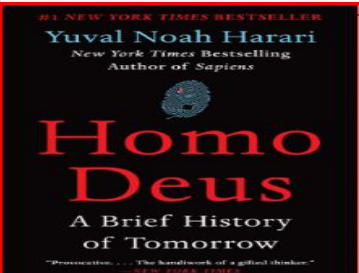
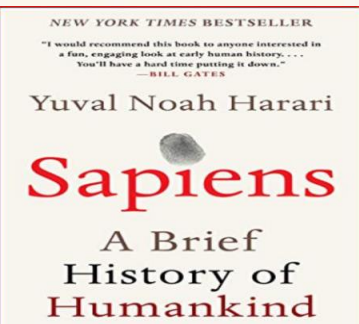
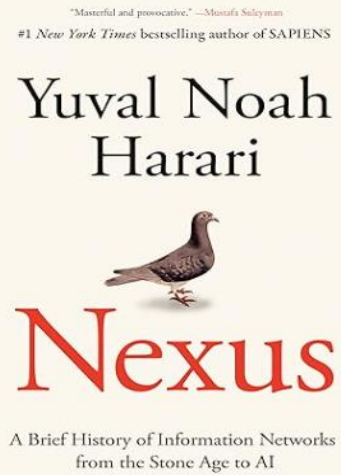
Orwell's dystopian masterpiece (1949) depicts a totalitarian regime that employs advanced **surveillance** to enforce **absolute control** over society



William Gibson's *Neuromancer* envisions a **dark, hyper-commercialized future**



Nick Bostrom (2014) warns of the **existential threats** posed by artificial general intelligence (AGI) surpassing human capabilities.



4.1. DANGERS AND RISKS OF AI ERA

Yuval Noah Harari's trilogy highlights how **past revolutions shaped humanity**, how **technology may redefine our future**, and the **importance of adaptability** in modern challenges.

In contrast, *Nexus* highlights how AI may drastically alter human interaction, governance, and decision-making.

- **Loss of Human Control:** Harari warns that AI's ability to make autonomous decisions could lead to scenarios where machines operate beyond human oversight, potentially making humans redundant or even posing existential threats. Latest news & breaking headlines
- **Manipulation and Misinformation:** AI's capacity to generate and disseminate content autonomously raises concerns about the spread of misinformation, which can manipulate public opinion and destabilize societies.
- **Erosion of Democracy:** The unchecked advancement of AI technologies could undermine democratic institutions by enabling pervasive surveillance and control, leading to authoritarian governance structures.

4.2. HOW AI POWERS NEW POPULISM

□ From Surveillance to Seduction

These dystopian risks aren't just future fiction—they're unfolding now through AI-enabled populism that manipulates, mobilizes, and polarizes.”

4.3. DEEPFAKE!

Deepfakes pose a serious threat to political stability by spreading false messages through fabricated videos, such as one falsely showing President Zelenskiy urging Ukrainian troops to surrender, thereby eroding public trust and manipulating electoral opinion.



Mikael Thalen
@MikaelThalen

A deepfake of Ukrainian President Volodymyr Zelensky calling on his soldiers to lay down their weapons was reportedly uploaded to a hacked Ukrainian news website today, per [@Shayan86](#)



Deepfake is a highly negative form of **new populism with AI** because it manipulates reality, spreads misinformation, deceives the public, and undermines trust in political leaders, institutions, and democratic processes.

- Agarwal, S., Farid, H., Gu, Y., He, M., Nagano, K., & Li, H. (2019, June). Protecting world leaders against deep fakes. In CVPR workshops (Vol. 1, No. 38).
- Frank, J., Eisenhofer, T., Schönherr, L., Fischer, A., Kolossa, D., & Holz, T. (2020, November). Leveraging frequency analysis for deep fake image recognition. In *International conference on machine learning* (pp. 3247-3258). PMLR.
- Westerlund, M. (2019). The emergence of deepfake technology: A review. *Technology innovation management review*, 9(11): 40-53.
- Yang, X., Li, Y., & Lyu, S. (2019, May). Exposing deep fakes using inconsistent head poses. In *ICASSP 2019-2019 IEEE international conference on acoustics, speech and signal processing (ICASSP)* (pp. 8261-8265). IEEE.

4.4. AI-DRIVEN POPULISM

Microtargeting & Manipulation

AI tailors political messaging to influence opinions across borders

Scalability & Global Impact

AI-driven propaganda spreads rapidly, shaping alliances or conflicts

Emotional & Totalitarian Exploitation

AI amplifies factionalism and division, eroding democratic norms and empowering authoritarian control.

Microtargeting uses **AI and data analytics** to deliver personalized messages to specific groups, influencing opinions and engagement in politics, marketing, and digital campaigns.

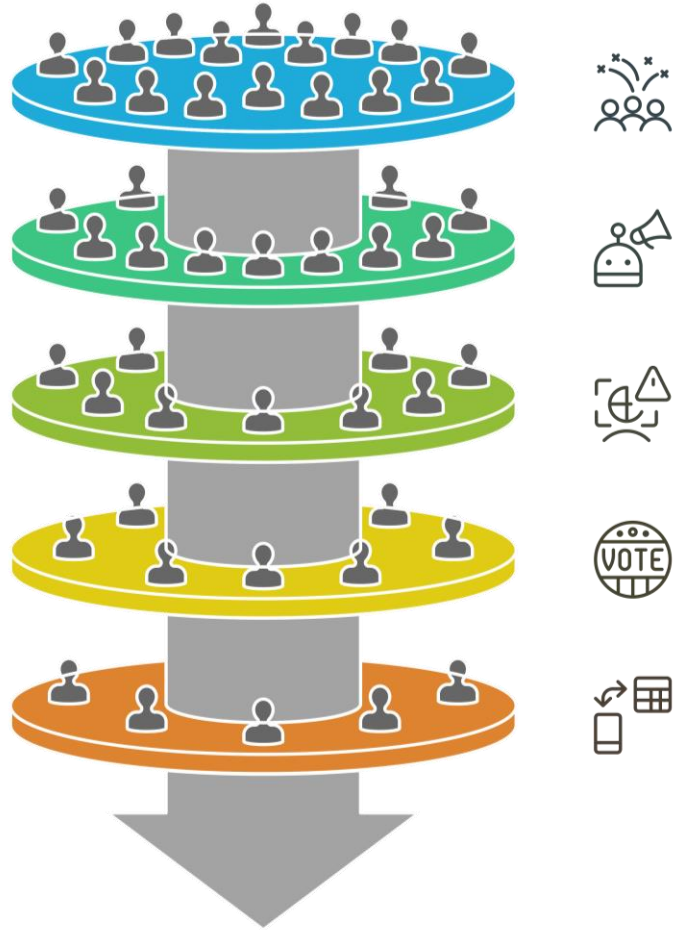
Borwein, S., Bonikowski, B., Loewen, P., Magistro, B., & Lee-Whiting, B. (2024). Who can assert ownership over automation? Workplace technological change, populist and ethno-nationalist rhetoric, and candidate support. *Political Behavior*, 46(4), 2191-2214.

Di Nucci, E. (2020). *The control paradox: From AI to populism*. Rowman & Littlefield.

Havlík, V. (2019). Technocratic populism and political illiberalism in central Europe. *Problems of Post-Communism*, 66(6), 369-384.

Vesa, M., & Tienari, J. (2022). Artificial intelligence and rationalized unaccountability: Ideology of the elites?. *Organization*, 29(6), 1133-1145.

4.5. AI'S ROLE IN FUELING NEW POPULISM



- ❑ If AI can amplify populism's worst instincts, it can also empower its noblest responses.
- ❑ What kind of leadership will guide us forward?

4.6. NAVIGATING THROUGH THE STORM: A CALL FOR DIGITAL LEADERSHIP



Diamandis, P. H., & Kotler, S. (2012). *Abundance: The future is better than you think*. Simon and Schuster.

Newport, C. (2019). *Digital minimalism: Choosing a focused life in a noisy world*. Penguin.

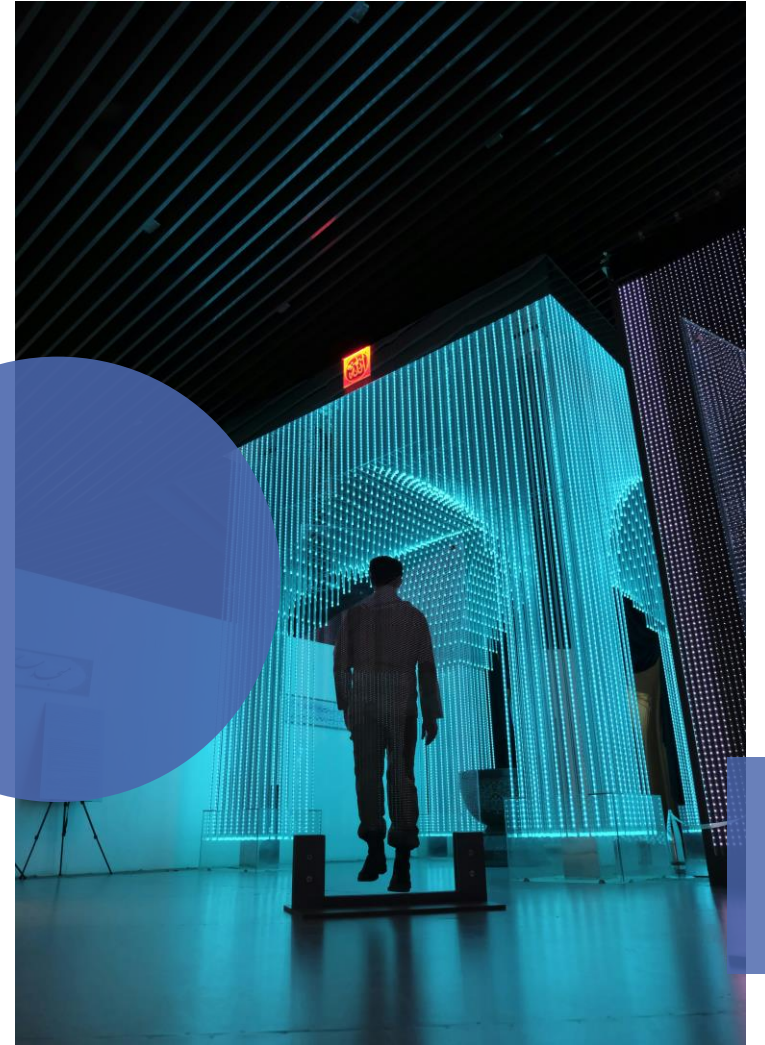
O'neil, C. (2017). *Weapons of math destruction: How big data increases inequality and threatens democracy*. Crown.

Rainie, H., & Wellman, B. (2012). *Networked: The new social operating system* (Vol. 10). Cambridge, MA: MIT press.

Zuboff, S. (2023). The age of surveillance capitalism. In *Social theory re-wired* (pp. 203-213). Routledge.

[5] FINAL THOUGHTS

- ❑ AI may fuel the winds of populism, but it is **digital wisdom, ethical leadership, and civic courage** that must hold the wheel.
- ❑ The real challenge is not the rise of machines—but the rise of humans unwilling to lead.



REFERENCES

- Abdel-Rahim, H. Y., & Hong, P. C. (2023). New Populism, Technology, and World of Work. In *Encyclopedia of New Populism and Responses in the 21st Century* (pp. 1-6). Singapore: Springer Nature Singapore.
- Biazzin, C., Coelho Martins Ferreira, F., & Hong, P. C. (2024). Populism pressure, public policies, and firm strategic choices: The case of Brazil. *Thunderbird International Business Review*, 66(3), 251-268.
- Cetinic, E., & She, J. (2022). Understanding and creating art with AI: Review and outlook. *ACM Transactions on Multimedia Computing, Communications, and Applications (TOMM)*, 18(2), 1-22.
- Chacko Chennattuserry, J., Deshpande, M., & Hong, P. (Eds.). (2024). *Encyclopedia of New Populism and Responses in the 21st Century*. <https://link.springer.com/referencework/10.1007/978-981-16-9859-0>
- Cockburn, I. M., Henderson, R., & Stern, S. (2018). *The impact of artificial intelligence on innovation* (Vol. 24449). Cambridge, MA, USA: National bureau of economic research.
- Diamandis, P. H., & Kotler, S. (2020). *The future is faster than you think: How converging technologies are transforming business, industries, and our lives*. Simon & Schuster.
- Guriev, S., & Papaioannou, E. (2022). The political economy of populism. *Journal of Economic literature*, 60(3), 753-832.
- Haefner, N., Wincent, J., Parida, V., & Gassmann, O. (2021). Artificial intelligence and innovation management: A review, framework, and research agenda☆. *Technological Forecasting and Social Change*, 162, 120392.
- Hartwell, C. A., & Devinney, T. (2021). Populism, political risk, and pandemics: The challenges of political leadership for business in a post-COVID world. *Journal of World Business*, 56(4), 101225.
- Hong, P., & Bhuiyan, J. (2023). Populism and Public Opinion in a Digital World. In *Encyclopedia of New Populism and Responses in the 21st Century* (pp. 1-6). Singapore: Springer Nature Singapore.
- Horák, J., Brestovanská, T., Mladenović, S., Kout, J., Bogusch, P., Halda, J. P., & Zasadil, P. (2019). Green desert?: Biodiversity patterns in forest plantations. *Forest ecology and management*, 433, 343-348.
- Kim, M., & Hong, P. (2024). New Populism and Ocean Plastic Waste Management. In *Encyclopedia of New Populism and Responses in the 21st Century* (pp. 1-7). Singapore: Springer Nature Singapore.
- Kuang, L., He, L. I. U., Yili, R. E. N., Kai, L. U. O., Mingyu, S. H. I., Jian, S. U., & Xin, L. I. (2021). Application and development trend of artificial intelligence in petroleum exploration and development. *Petroleum Exploration and Development*, 48(1), 1-14.
- Lu, Y. (2019). Artificial intelligence: a survey on evolution, models, applications and future trends. *Journal of Management Analytics*, 6(1), 1-29.
- Mohan, M., Richardson, G., Gopan, G., Aghai, M. M., Bajaj, S., Galgamuwa, G. P., ... & Cardil, A. (2021). UAV-supported forest regeneration: Current trends, challenges and implications. *Remote Sensing*, 13(13), 2596.
- Picardi, G., Chellapurath, M., Iacoponi, S., Stefanni, S., Laschi, C., & Calisti, M. (2020). Bioinspired underwater legged robot for seabed exploration with low environmental disturbance. *Science Robotics*, 5(42), eaaz1012.
- Phondani, P. C., Bhatt, A., Elsarrag, E., & Horr, Y. A. (2016). Ethnobotanical magnitude towards sustainable utilization of wild foliage in Arabian Desert. *Journal of traditional and complementary medicine*, 6(3), 209-218.
- Raveendran, S., Patil, M. D., & Birajdar, G. K. (2021). Underwater image enhancement: a comprehensive review, recent trends, challenges and applications. *Artificial Intelligence Review*, 54, 5413-5467.
- Sircar, A., Yadav, K., Rayavarapu, K., Bist, N., & Oza, H. (2021). Application of machine learning and artificial intelligence in oil and gas industry. *Petroleum Research*, 6(4), 379-391.
- Verganti, R., Vendraminelli, L., & Iansiti, M. (2020). Innovation and design in the age of artificial intelligence. *Journal of product innovation management*, 37(3), 212-227.
- Wang, H., Fu, T., Du, Y., Gao, W., Huang, K., Liu, Z., ... & Zitnik, M. (2023). Scientific discovery in the age of artificial intelligence. *Nature*, 620(7972), 47-60.
- Zhavoronkov, A., Mamoshina, P., Vanhaelen, Q., Scheibye-Knudsen, M., Moskalev, A., & Aliper, A. (2019). Artificial intelligence for aging and longevity research: Recent advances and perspectives. *Ageing research reviews*, 49, 49-66.

REFERENCES — CONTINUED —

- Aide, T. M., Clark, M. L., Grau, H. R., López-Carr, D., Levy, M. A., Redo, D., ... & Muñiz, M. (2013). Deforestation and Reforestation of Latin America and the Caribbean (2001–2010). *Biotropica*, 45(2), 262-271.
- Bashan, Y., Salazar, B. G., Moreno, M., Lopez, B. R., & Linderman, R. G. (2012). Restoration of eroded soil in the Sonoran Desert with native leguminous trees using plant growth-promoting microorganisms and limited amounts of compost and water. *Journal of environmental management*, 102, 26-36.
- Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. WW Norton & company.
- Cao, Y., Liang, S., Sun, L., Liu, J., Cheng, X., Wang, D., ... & Feng, K. (2022). Trans-Arctic shipping routes expanding faster than the model projections. *Global Environmental Change*, 73, 102488.
- arden-Davies, H. (2017). Deep-sea genetic resources: new frontiers for science and stewardship in areas beyond national jurisdiction. *Deep Sea Research Part II: Topical Studies in Oceanography*, 137, 504-513.
- Kumar, S., & Tomar, R. (2018, February). The role of artificial intelligence in space exploration. In 2018 International conference on communication, computing and internet of things (IC3IoT) (pp. 499-503). IEEE.
- Martin, A. S., & Freeland, S. (2021). The advent of artificial intelligence in space activities: New legal challenges. *Space Policy*, 55, 101408.
- Oche, P. A., Ewa, G. A., & Ibekwe, N. (2021). Applications and challenges of artificial intelligence in space missions. *IEEE Access*, 12, 44481-44509.
- Ohte, N., Koba, K., Yoshikawa, K., Sugimoto, A., Matsuo, N., Kabeya, N., & Wang, L. (2003). Water utilization of natural and planted trees in the semiarid desert of Inner Mongolia, China. *Ecological Applications*, 13(2), 337-351.
- Phillips, B. T., Licht, S., Haiat, K. S., Bonney, J., Allder, J., Chaloux, N., ... & Noyes, T. J. (2019). DEEPi: A miniaturized, robust, and economical camera and computer system for deep-sea exploration. *Deep Sea Research Part I: Oceanographic Research Papers*, 153, 103136.
- Warrant, E. J., & Locket, N. A. (2004). Vision in the deep sea. *Biological Reviews*, 79(3), 671-712.
- Wu, A., Che, T., Li, X., & Zhu, X. (2022). Routeview: An intelligent route planning system for ships sailing through Arctic ice zones based on big Earth data. *International Journal of Digital Earth*, 15(1), 1588-1613.
- Ben Ayed, R., & Hanana, M. (2021). Artificial intelligence to improve the food and agriculture sector. *Journal of Food Quality*, 2021(1), 5584754.
- Couteur, D. G. L., & Barzilai, N. (2022). New horizons in life extension, healthspan extension and exceptional longevity. *Age and Ageing*, 51(8), afac156.
- Ganeshkumar, C., Jena, S. K., Sivakumar, A., & Nambirajan, T. (2023). Artificial intelligence in agricultural value chain: review and future directions. *Journal of Agribusiness in Developing and Emerging Economies*, 13(3), 379-398.
- Garmany, A., Yamada, S., & Terzic, A. (2021). Longevity leap: mind the healthspan gap. *NPJ Regenerative Medicine*, 6(1), 57.
- Zhavoronkov, A., Bischof, E., & Lee, K. F. (2021). Artificial intelligence in longevity medicine. *Nature Aging*, 1(1), 5-7.