FUTURE TRENDS

Report

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TRENDS RESEARCH & ADVISORY

Future Trends Report

Future Trends Report, published in English and Arabic by TRENDS Virtual Office in Montreal, stands out as a distinctive publication dedicated to highlighting:
1. the most important forward-looking studies that aim to identify future trends, analyze various variables that may influence these trends, and determine the best future scenarios.
2. the most important applied studies that explore the application of knowledge, scientific theories, and information to solve current problems and overcome future challenges.
3. the most important illustrative and graphic forms that visually summarize significant studies, helping readers understand the trends and challenges of the future world.

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1 Prospective research

AI in the public sector

Bertolucci, M. (2024). L'intelligence artificielle dans le secteur public: revue de la littérature et programme de recherche. Gestion et management public, (5), 118139-.

The article examines the increasing integration of AI into the public sector, a rapidly evolving domain with significant opportunities and challenges. Drawing on three systematic literature reviews and an analysis of recent publications (2021–2022), it provides an overview of key themes, impacts, and research prospects.

AI is considered a major technological revolution of the 21st century. In the public sector, it offers various applications such as predictive policing, fraud detection, and chatbots. However, AI raises ethical, social, and organizational issues, along with questions about transparency, equity, and algorithmic governance. The public sector's lag the private sector in technological implementation underscores the urgency of adaptation. Challenges include reducing user dissatisfaction with disconnected services and improving public management through predictive and generative tools.

The article is based on three systematic reviews: Sousa et al. (2019), covering 2010–2018, reviews 59 publications on AI usage in various public domains (healthcare, education, urban planning). The study highlights benefits such as process automation and efficiency gains but points out a lack of empirical research in public management. Zuiderwijk et al. (2021), covering 2018–2020, identifies 26 publications exploring benefits (efficiency, cost reduction, predictions) and challenges (data bias, ethics, technical skills). The focus is on governance and organizational impact. Wirtz et al. (2021) analyzes 189 publications up to 2020, revealing a strong concentration on governance and administration at the expense of other topics such as health or the environment. Qualitative methods dominate, reflecting the growing interest of social sciences in AI. The study examines 22 articles from journals ranked in public management. Topics include implementation, where adoption factors vary by organizational context and process stages; discretionary power, with AI transforming the role of public agents by reducing or expanding their autonomy; discrimination, where AI usage can exacerbate biases; the state-society relationship, with value co-creation with citizens emerging as a central issue; and virtual agents and privacy, where citizens often accept chatbots despite concerns about confidentiality.

However, challenges are numerous: data (quality, homogeneity, and bias); organization (resistance to change, interinstitutional collaboration); skills (shortage of AI experts in the public sector); ethics and transparency (need for explainable systems to ensure accountability); and social impact (job displacement, increased inequalities, and negative citizen reactions).

AI represents a unique opportunity to transform the public sector, but its deployment must be accompanied by careful reflection on its ethical, organizational, and social implications. Researchers play a crucial role in guiding this transition and ensuring that AI benefits all citizens.

BIG DATA

AI raises ethical, social, and organizational issues, along with questions about transparency, equity, and algorithmic governance.

IOT

The benefits of AI in the public sector include improved service quality, personalization, cost reduction, and better risk management.

Prospective research

AI and its use in family medicine

Green, M. (2024). L'intelligence artificielle pourrait-elle améliorer les soins aux patients et réduire la charge de travail des médecins? Canadian Family Physician, 70(3), 215215-.

According to the CFPC, AI can enhance family medicine by improving efficiency, diagnostic accuracy, therapeutic decision-making, and work-life balance for physicians. This article explores AI's transformative potential in family medicine, focusing on its ability to reduce administrative burdens and improve patient care.

Family doctors often struggle with time-consuming tasks that detract from patient-centered care. AI offers promising tools to address these challenges. As part of Canada's broader national strategy, AI is being integrated into various sectors, including healthcare. The federal government, in partnership with the Canadian Institute for Advanced Research (CIFAR), supports initiatives like the Canada-CIFAR AI Chairs Program to promote AI-driven health innovations.

At a recent College of Family Physicians of Ontario summit, Dr. Avi Goldfarb emphasized how AI can revolutionize primary care. Existing applications include AI scribes that automate note-taking and predictive analytics that assist in diagnosing conditions, offering personalized recommendations and targeted preventive advice. These tools improve clinical decision-making and allow physicians to focus more on compassionate care.

A CFPC working group report outlines a roadmap for incorporating AI into family medicine. It highlights the need for sufficient funding, high-quality data, and collaborative teamwork to implement AI effectively. Anticipated benefits include better workflow efficiency, improved diagnostic accuracy, and more sustainable work-life balance. However, successful integration depends on aligning AI development with family medicine's core values.

The article also raises important concerns. Since AI depends on machine learning, biased or incomplete datasets can result in inequitable care. Ethical dilemmas arise when AI tools are developed by pharmaceutical or tech companies, raising questions about whether such tools prioritize corporate interests over patient well-being.

To mitigate these risks, the CFPC advocates for involving family physicians and patients in guiding AI development. Ensuring fairness, transparency, and patient-centered outcomes is essential. The CFPC also promotes AI literacy through resources such as online courses, podcasts, and articles. A notable initiative is a fellowship led by Dr. Jacqueline Kueper, which focuses on integrating AI with compassionate care.

In conclusion, AI holds great promise for transforming family medicine, but its implementation must be responsible and inclusive. By emphasizing equity and trust, AI can enhance healthcare outcomes and relieve pressures on physicians. Ongoing oversight and collaboration will be essential to ensure that AI strengthens rather than undermines the quality and fairness of care.

According to the CFPC, AI can enhance family medicine by improving efficiency, diagnostic accuracy, therapeutic decision-making, and work-life balance for physicians.

By focusing on equity and inclusivity, AI can be a powerful tool to improve healthcare outcomes for patients while alleviating the pressures on physicians.

Prospective research

Green finance and green technology

Li, T., Yue, X. G., Qin, M., & Norena-Chavez, D. (2024). Towards Paris Climate Agreement goals: The essential role of green finance and green technology. Energy Economics, 129, 107273.

In "Towards Paris Climate Agreement Goals: The Essential Role of Green Finance and Green Technology," the authors explore how green finance (GF) and green technology (GT) support the objectives of the Paris Climate Agreement (PCA). The study uses advanced quantitative tools—particularly wavelet-based quantile-on-quantile regression (QQR)—to examine how GF and GT impact PCA goals across varying time frames.

The PCA seeks to limit global temperature rise to below 2°C, preferably 1.5°C, compared to pre-industrial levels. It emphasizes reducing greenhouse gas emissions to net-zero in the latter half of the 21st century. Achieving this requires strong strategies, with GF and GT serving as central pillars.

Green finance includes financial activities that support environmental sustainability, such as project financing, investments, and risk management in renewable energy, clean transport, and environmental protection. The surge in green bonds is a prominent example of GF's rising role in climate action.

Green technology includes innovations that reduce pollution, enhance resource efficiency, and maintain ecological balance. Key examples include carbon capture, utilization, and storage (CCUS) for emission-heavy industries and the expanding use of affordable renewable energy sources like wind and solar.

The study finds that both GF and GT positively impact PCA goals in the short term, especially at extreme quantiles. GF shows a stronger influence, largely due to its role in mobilizing and allocating financial resources for sustainable projects. It reduces investment risk through environmental, social, and governance (ESG) criteria and promotes international cooperation on climate policies.

GT also plays a vital role by enabling industrial transformation, lowering emissions, and boosting the development of low-carbon products and technologies. However, its effectiveness is often tied to the availability of green financing, which limits its standalone impact.

In the medium term, both GF and GT continue to support PCA progress, though the effects slightly diminish. Long-term analysis confirms sustained positive impacts, with GF retaining a slightly greater influence. This ongoing impact highlights the importance of continuous financial investment and technological innovation to meet climate goals.

The authors conclude that both GF and GT are crucial to achieving PCA objectives, with GF having a more pronounced effect due to its broader role in enabling and scaling green initiatives. They call on policymakers to enhance green financial systems, accelerate technological innovation, and promote global collaboration to improve the effectiveness of climate mitigation strategies.

In sum, integrating green finance and green technology is vital for a sustainable future and the successful implementation of the Paris Climate Agreement.

Green bonds have experienced significant growth, surging from $37 billion in 2014 to $509 billion in 2021.

Both GF and GT are critical to achieving the Paris Climate Agreement goals.

Prospective research

Climate change, emotions and the mobilization of young environmental activists in the UK

Pickard, S. (2021). "You are stealing our future in front of our very eyes." The representation of climate change, emotions and the mobilisation of young environmental activists in Britain. E-rea. Revue électronique d'études sur le monde anglophone, (18.2).

The article "You Are Stealing Our Future in Front of Our Very Eyes: The Representation of Climate Change, Emotions, and the Mobilization of Young Environmental Activists in Britain" by Sarah Pickard explores the emotional and political dimensions of youth-led climate activism in the UK. It examines how climate change is portrayed as a crisis and emergency, and how these portrayals catalyze emotional responses and mobilization among young people.

The study situates the rise of youth environmental activism within a broader context of political and social crises, including austerity, Brexit, and increasing digital connectivity. It highlights the influence of movements like Fridays For Future (FFF) and Extinction Rebellion (XR), and figures such as Greta Thunberg, who have framed climate change as an existential emergency. This framing has spurred unprecedented youth engagement in environmental protest and political discourse. Two central themes emerge: crisis narratives and generational responsibility. Crisis narratives use urgent, apocalyptic language to convey the immediate threat posed by climate change. Terms like "climate emergency" and "ecological crisis" have shifted from activist slogans into mainstream political vocabulary, reflecting growing concern over environmental degradation and the urgency for action.

Generational responsibility is another key motif, as young activists hold older generations accountable for the environmental crisis. They demand urgent measures to secure a livable future. Greta Thunberg and other youth leaders frequently use moral language, confronting political leaders with direct appeals to their responsibility.

The article also delves into the emotional experiences of young activists, using qualitative interviews with youth involved in climate protests. A wide range of emotions drive their engagement. Initial reactions to the climate crisis often include fear, anxiety, sadness, and despair. While these feelings can be overwhelming, they are often transformed into anger, frustration, and ultimately, motivation for activism.

Anger and frustration stem from perceived governmental inaction and intergenerational injustice. This emotional shift—from despair to action—is key to sustaining long-term engagement. The concept of "Do-It-Ourselves" (DIO) politics illustrates young activists' resolve to act independently when institutions fail to respond adequately.

Involvement in movements like XR and FFF also produces emotions such as solidarity, joy, and hope. Participation fosters a sense of belonging and shared purpose, which counters isolation and despair. Protests offer emotional catharsis and allow young people to express agency, strengthening their commitment to environmental causes.

Politically, youth climate activism has influenced discourse and policy. For example, the UK Parliament's 2019 declaration of a "climate emergency" was partly in response to sustained youth-led protests. Though symbolic, it signals the growing political influence of these movements.

In conclusion, the article underscores the power of emotion in climate activism. Framing climate change as a crisis and invoking generational responsibility have been central to mobilizing young people. These activists challenge political inertia while cultivating hope, resilience, and a shared vision for a sustainable future.

Prospective research

Urban and regional planning in Quebec, Canada

Le Berre, S. (2017). From planning to spatial foresight in Québec: what future-telling means in a context of sub-regional governance. The case of vision 2031. Revue Gouvernance, 14(2), 2345-.

The article "From Planning to Spatial Foresight in Québec: What Future-Telling Means in a Context of Sub-regional Governance. The Case of Vision 2031" by Sylvain Le Berre explores the evolution of urban and regional planning in Québec, focusing on the shift from traditional planning approaches to spatial foresight within sub-regional governance. The study uses the case of Vision 2031, developed by the Regional County Municipality (RCM) of Rivière-du-Loup, to illustrate this transformation.

Since the adoption of Québec's sustainable development strategy in 2006, RCMs have been required to develop strategic visions for land-use planning, known as Schéma d'aménagement et de développement (SAD). The Vision 2031 project, conducted between 2009 and 2013, exemplifies this shift towards foresight-oriented planning. Unlike traditional top-down approaches, Vision 2031 fostered a more inclusive, participatory process involving public and private stakeholders, as well as civil society.

The article identifies three major trends emerging from this new planning paradigm: prospective planning, transversal approaches, and collaborative practices. Prospective planning emphasizes forward-looking strategies, considering long-term social, economic, environmental, and technological changes. This approach helps regions anticipate future challenges and opportunities rather than merely reacting to current issues.

The transition from sectoral to transversal planning represents another key shift. Instead of isolated, department-specific strategies, Vision 2031 integrates multiple sectors and disciplines, fostering holistic development. This integration is crucial for addressing complex, interconnected issues like climate change, economic resilience, and demographic shifts. Collaboration is the third significant trend. Vision 2031 broke traditional barriers by involving a broad coalition of stakeholders, including local governments, businesses, community organizations, and residents. This inclusive approach enhances democratic legitimacy and ensures that diverse perspectives shape regional development strategies.

The governance model underpinning Vision 2031 reflects a move towards "governance by the future." This concept emphasizes the role of foresight in guiding decision-making processes, encouraging proactive rather than reactive governance. It highlights the importance of shared responsibility for regional development, shifting the focus from centralized authorities to collective community engagement.

The article also discusses the methodological framework used in Vision 2031, combining document reviews, strategic planning sessions, and semi-structured interviews with key stakeholders. This approach facilitated the co-creation of a strategic vision that resonates with local values and aspirations.

Vision 2031's impact extends beyond planning documents. It has influenced policy discourse, promoted civic participation, and strengthened the political capacity of sub-regional institutions. By embedding foresight into planning practices, Vision 2031 has helped the RCM of Rivière-du-Loup navigate uncertainties and build resilience against future challenges.

In conclusion, the article argues that spatial foresight represents a significant evolution in planning practices, particularly within the context of sub-regional governance. Vision 2031 demonstrates how integrating foresight, transversal approaches, and collaborative governance can create more adaptive, inclusive, and future-oriented regional development strategies. This case study offers valuable insights for other regions seeking to enhance their planning processes and governance frameworks in the face of contemporary global challenges.

2 Applied research

How to support immigrant men in Canada?

El Amraoui A., Le Gall J. (2024), Les ateliers de prise de parole du comité « Espaces-hommes » du Cari St Laurent : une pratique d'intervention novatrice auprès des hommes immigrants à Montréal, Institut universitaire SHERPA, Montréal, 36p.

The report "Les ateliers de prise de parole du comité Espace-Hommes du CARI St-Laurent" explores an innovative intervention developed by CARI St-Laurent to support immigrant men in Quebec. Conducted in collaboration with the Institut universitaire SHERPA, the study documents the impact of these speaking workshops while identifying best practices and challenges.

CARI St-Laurent, a non-profit organization supporting immigrants in Montreal since 1989, recognized a lack of services tailored to male immigrants. To address this, the Espace-Hommes committee was created, offering specialized activities, notably the speaking workshops. These workshops provide a safe space for men to share experiences and discuss challenges related to integration, employment, housing, and well-being.

The workshops consist of ten sessions on cultural adaptation, professional integration, health, family dynamics, and financial literacy. Sessions blend presentations with discussions, fostering participation. Facilitators, often immigrants themselves, play a key role in building trust. The program follows an intercultural approach, acknowledging diverse backgrounds while promoting mutual learning.

Participants face major challenges, particularly in securing housing and employment. Many struggle to navigate the rental market or find jobs that match their qualifications, leading to frustration. A lack of structured information upon arrival in Canada leaves many feeling lost. The workshops bridge this gap by providing essential information and resources.

Social isolation is another pressing issue. Many immigrant men arrive alone, leaving their families behind, and societal norms discourage them from seeking help. The workshops create a sense of community where participants exchange advice and form support networks. Many initially hesitated to share their struggles due to stigma, but the workshops provide a judgment-free environment that encourages openness.

Running the workshops presents challenges. Recruiting participants is difficult since many immigrant men are unaware of available services. The workshops are conducted primarily in French, excluding non-French speakers. While past cohorts had translation assistance, funding constraints have limited this support. Additionally, ensuring accessibility while managing program requirements remains a challenge. Initially designed for permanent residents and work permit holders, the program has informally extended to asylum seekers and individuals with precarious immigration statuses. Facilitators stress that their immigrant backgrounds help them connect with participants. Having faced similar integration challenges, they relate personally. However, working closely with individuals in hardship takes an emotional toll. Providing training and support for facilitators could enhance their ability to manage complex cases.

The study recommends strengthening the program by increasing outreach, offering multilingual sessions, and collaborating with other organizations for specialized support. Further research is needed to assess the long-term impacts on integration.

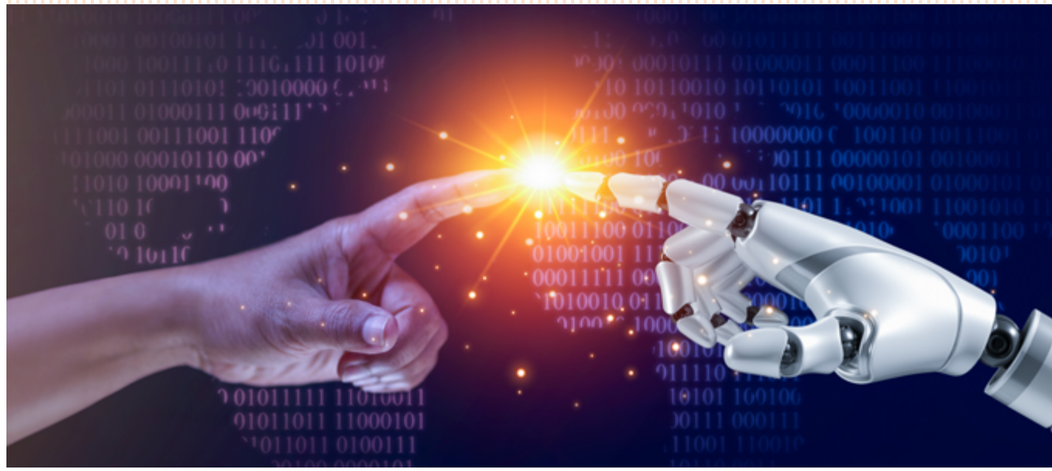
Ultimately, the Espace-Hommes workshops fill a critical gap in services for immigrant men. By providing a supportive environment where they can express themselves, gain knowledge, and build connections, the program eases their transition into Quebec society. Despite challenges, its community-driven approach and focus on empowerment make it a promising model for other organizations supporting immigrant populations.

Applied research

Ethical implications and future prospects of artificial intelligence

Kasula, B. Y. (2024). Ethical Implications and Future Prospects of Artificial Intelligence in Healthcare: A Research Synthesis. International Meridian Journal, 6(6), 17-.

The research paper "Ethical Implications and Future Prospects of Artificial Intelligence in Healthcare: A Research Synthesis" explores the role of AI in healthcare, focusing on its applications, ethical challenges, and future directions. AI is transforming diagnostics, treatment planning, and patient care by improving accuracy, efficiency, and enabling personalized medicine. However, these advances also raise significant ethical concerns that must be addressed.



One of the most pressing concerns is patient privacy. AI systems depend on vast amounts of medical data, raising issues about data security and misuse. Protecting patient information from breaches and unauthorized access is a critical challenge. Another major issue is algorithmic bias. AI models trained on non-representative datasets may lead to disparities in healthcare outcomes, potentially worsening existing inequalities and disproportionately impacting marginalized populations.

The paper also highlights ethical concerns around decision-making transparency. AI-driven recommendations can be difficult for healthcare professionals to interpret, complicating accountability. If an AI system recommends a treatment that leads to an adverse outcome, it becomes unclear whether responsibility lies with the developers, healthcare providers, or institutions. This complexity underscores the need for transparent AI systems that explain how they reach their conclusions and how they integrate into clinical workflows.

Patient autonomy and informed consent are also challenged by AI in healthcare. Traditionally, patients consent based on an understanding of medical procedures. However, with AI involved, patients may not fully grasp its role in their care. Educating patients about the capabilities and limitations of AI is essential to maintaining trust and ethical practices.

From a broader perspective, the impact of AI on healthcare accessibility raises ethical concerns. While AI can improve efficiency and lower costs, it may also deepen the digital divide. Wealthier institutions may gain more from AI technologies, while under-resourced areas risk being left behind. Policymakers must ensure equitable access to AI benefits to prevent disparities in healthcare delivery.

However, the paper emphasizes the promising future of AI in healthcare. Predictive analytics can enable earlier disease detection and personalized treatment plans, improving patient outcomes. Natural language processing (NLP) helps streamline clinical documentation and reduce administrative burdens, allowing healthcare providers to spend more time with patients. Emerging tools like AI-powered robotics and augmented reality are enhancing complex surgeries and rehabilitation processes.

To harness AI's potential while addressing ethical concerns, the study recommends several key strategies. First, robust ethical frameworks must guide the development and deployment of AI in healthcare. Second, collaboration among AI developers, healthcare professionals, and ethicists is essential to ensure alignment with medical and ethical standards. Third, ongoing monitoring and evaluation can help address biases or unintended consequences before they cause harm.

Addressing concerns such as data privacy, algorithmic bias, transparency, and equitable access is essential to ensure AI-driven healthcare remains effective, and centered on patient well-being. With thoughtful oversight, AI can advance global healthcare while upholding ethical standards.

Applied research

The influence of environmental regulations on green technology development in Europe

Khurshid, A., Huang, Y., Cifuentes-Faura, J., & Khan, K. (2024). Beyond borders: assessing the transboundary effects of environmental regulation on technological development in Europe. Technological Forecasting and Social Change, 200, 123212.

The article "Beyond Borders: Assessing the Transboundary Effects of Environmental Regulation on Technological Development in Europe" by Khurshid et al. investigates how environmental regulations influence green technological innovation across European countries. Using a panel dataset from 25 European nations spanning 1994 to 2020, the study employs the Spatial Durbin Model to analyze the direct, indirect, and spatial spillover effects of environmental policies on green technology innovation (EINV).

The research highlights that environmental regulations (EPY) play a significant role in fostering green technology. These regulations compel producers to adopt sustainable technologies, thereby stimulating innovation. The study finds that EPY has a notable total impact of 0.636%, with a direct effect of 0.187% and a spatial spillover effect of 0.449%. This indicates that environmental policies within a country not only enhance green technology domestically but also influence positively neighboring countries through knowledge transfer and competitive dynamics.

Key factors influencing EINV include environmental taxes, fiscal expenditure, urbanization, foreign direct investment (FDI), and research and development (R&D) expenditures. Environmental taxes and fiscal expenditures serve as financial incentives, reducing barriers to green investments and promoting R&D in sustainable technologies. Urbanization facilitates resource concentration and stakeholder diversity, enhancing collaboration and the diffusion of eco-friendly practices. FDI supports cross-border technology transfer, while R&D expenditures drive technical advancements in green innovations.

The study underscores the dual nature of environmental regulations: formal (government-enforced policies) and informal (market-driven and societal pressures). Both forms significantly impact green innovation. For instance, stringent formal regulations directly enforce environmental standards, while informal mechanisms, such as public awareness and corporate social responsibility, indirectly promote sustainable practices.

Spatial spillover effects are critical in understanding the broader impact of EPY. The study reveals that stricter environmental regulations in one country can lead to increased green innovation in neighboring countries due to competitive pressures and the diffusion of best practices. Conversely, relaxed regulations may negatively affect regional green technology development by reducing incentives for innovation. The article also explores the theoretical underpinnings of the Porter Hypothesis, which suggests that well-designed environmental regulations can stimulate innovation and enhance competitiveness. The findings support this hypothesis, showing that environmental regulations not only mitigate negative externalities but also drive technological progress and economic growth.

Policy recommendations emphasize the need for coordinated environmental strategies across Europe. Policymakers should consider both direct and spillover effects when designing environmental regulations. Encouraging cross-border collaboration, harmonizing regulatory standards, and fostering international partnerships can amplify the positive impacts of EPY on green technology innovation.

In conclusion, the article demonstrates that environmental regulations are powerful tools for promoting green technological development. Their effects transcend national borders, highlighting the importance of regional cooperation in achieving sustainable development goals. By integrating economic incentives, fostering R&D, and leveraging both formal and informal regulatory mechanisms, Europe can enhance its leadership in global green innovation.

Applied research

Energy management in Canada, USA and Africa

Ilojianya, V. I., Usman, F. O., Ibekwe, K. I., Nwokediegwu, Z. Q. S., Umoh, A. A., & Adefemi, A. (2024). Data-driven energy management: review of practices in Canada, USA, and Africa. Engineering Science & Technology Journal, 5(1), 219230-.

The article "Data-Driven Energy Management: Review of Practices in Canada, USA, and Africa" by Valentine Ikenna Ilojianya et al. explores the transformative role of data analytics in energy management across diverse regions. It offers a comparative analysis of data-driven strategies in Canada, the USA, and Africa, highlighting their adoption, successes, challenges, and their implications for global energy sustainability.

The introduction underscores a global shift from traditional energy management—based on static data and historical patterns—to dynamic, data-driven approaches. Real-time data, predictive analytics, and advanced technologies now play a crucial role in optimizing energy production, distribution, and consumption.

In Canada, the integration of smart grid technologies and advanced metering infrastructure has enabled real-time monitoring and improved grid efficiency. Machine learning and predictive analytics support renewable energy integration and optimize distribution. These tools enhance system reliability, lower operational costs, and contribute to national sustainability goals. Regulatory initiatives like the Smart Grid Program and the Clean Growth Hub foster innovation and the adoption of advanced energy solutions.

The USA showcases a diverse and expansive energy landscape, with major advances in renewable energy and smart grids. Energy management policies emphasize efficiency and emissions reduction. Data-driven strategies enable dynamic demand response, grid optimization, and accurate energy forecasting. The deployment of advanced metering systems and sophisticated analytics is widespread, though challenges remain—particularly around regulatory complexity, cybersecurity, and data standardization. Federal and state initiatives support innovation and deployment of data-driven systems.

While some countries are advancing centralized energy planning, many rely on decentralized, off-grid solutions to expand access. Data-driven approaches hold significant promise, particularly as digital technologies become more accessible. However, infrastructure gaps, financial constraints, and a shortage of skilled personnel limit broader adoption. Despite these obstacles, pilot projects and international partnerships are emerging to harness data for improved energy planning and renewable integration.

The article outlines key benefits of data-driven energy management, including enhanced system efficiency, cost savings, and greater support for sustainable energy practices. Real-time analytics improve demand forecasting, load balancing, and predictive maintenance, which together enhance grid stability and resource optimization. These approaches also ease the integration of intermittent renewable energy sources, contributing to environmental goals.

Common challenges across regions include technological barriers, concerns over data privacy, and the need for flexible, robust regulatory frameworks. The study emphasizes the importance of collaboration among stakeholders, adaptive policies, and investment in digital infrastructure and human capital to overcome these challenges.

In conclusion, data-driven energy management holds significant potential for advancing global sustainability. Insights from Canada and the USA can inform strategies in Africa and other developing regions. Future research should focus on closing gaps in technology, policy, and skills development to ensure broader adoption and greater effectiveness of these innovative energy solutions.

Applied research

AI and its governance: the case of Canada

Attard-Frost, B., Brandusescu, A., & Lyons, K. (2024). The governance of artificial intelligence in Canada: Findings and opportunities from a review of 84 AI governance initiatives. Government Information

Since then, federal and provincial governments have launched numerous initiatives to regulate, support, and shape AI development across sectors. A review of 84 initiatives from 2017 to 2022 reveals a strong emphasis on fostering AI-driven economic growth and innovation, while areas like ethics, workforce development, and public engagement receive comparatively less focus.

The study categorizes these initiatives into five types: programs, policies, strategic plans, ethics statements, and standards. Programs, which make up the largest share, are government-funded efforts to advance AI research, commercialization, and industrial applications. Policies, such as the Digital Charter Implementation Act (Bill C-27), establish regulatory frameworks for AI use and data protection. Strategic plans, including the Pan-Canadian AI Strategy, define long-term goals for AI development and governance. Ethics statements, like the Montreal Declaration, outline principles for responsible AI use. Standards, though still evolving, aim to set technical and operational benchmarks.

Most initiatives prioritize economic and technological advancement, targeting industry and innovation. Investment is directed toward AI research, technology development, and commercial applications. However, issues such as workforce impact, digital infrastructure, and ethical governance remain underrepresented. This industry-first approach assumes that economic growth from AI will produce broader societal benefits. The study warns that this model carries risks if it neglects AI's wider implications on employment, rights, and environmental sustainability.

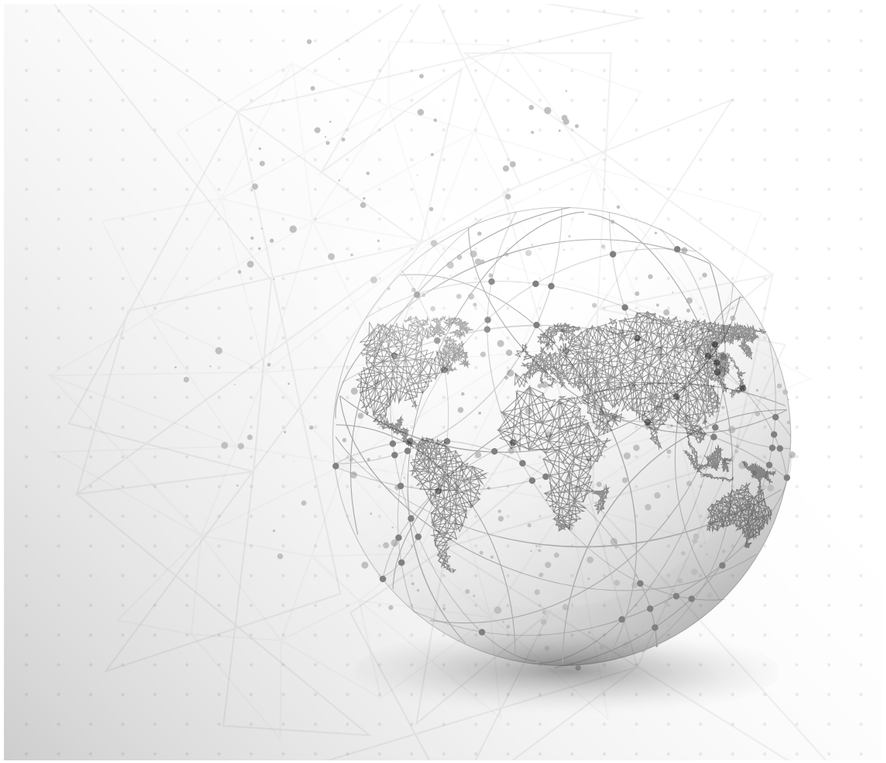
One key challenge is the lack of transparency in reporting outcomes. While some programs, like the Pan-Canadian AI Strategy, publish performance reports, many initiatives lack clear metrics or public accountability. This makes it difficult to assess whether goals are being met. Additionally, public trust in AI governance is fragile. Limited transparency, minimal consultation, and perceived exclusion of public voices have contributed to skepticism about how AI systems are regulated and used.

The study offers several recommendations to strengthen governance. Researchers can evaluate initiatives' effectiveness, explore public trust factors, and assess how governance addresses social and environmental issues. Policymakers and public servants can improve transparency by establishing performance targets, publishing reports, and ensuring accountability. Public engagement should go beyond consultations to involve citizens and stakeholders in co-designing AI policy frameworks.

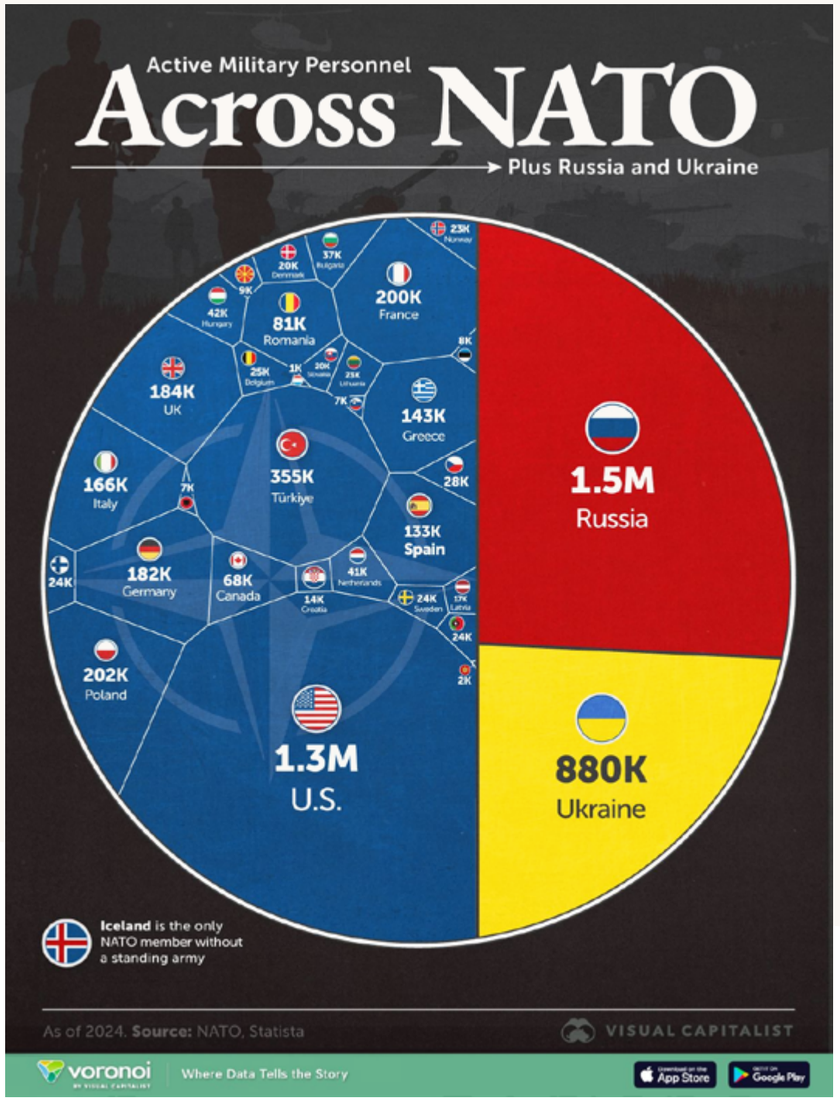
Canada also has an opportunity to adopt a more balanced governance model by expanding focus beyond economic goals. Greater attention should be paid to AI's impact on labor, environmental sustainability, and societal well-being. A unified national governance structure could help address current fragmentation, which is largely concentrated in Innovation, Science, and Economic Development Canada. Coordinated efforts involving multiple government agencies and civil society groups could support a more inclusive and effective governance system.

While Canada has made important strides in AI policy, further work is needed to ensure transparency, build public trust, and adopt a holistic approach to AI's societal impact. By enhancing accountability, encouraging collaboration, and broadening the scope of governance, Canada can continue to lead in responsible and equitable AI development.

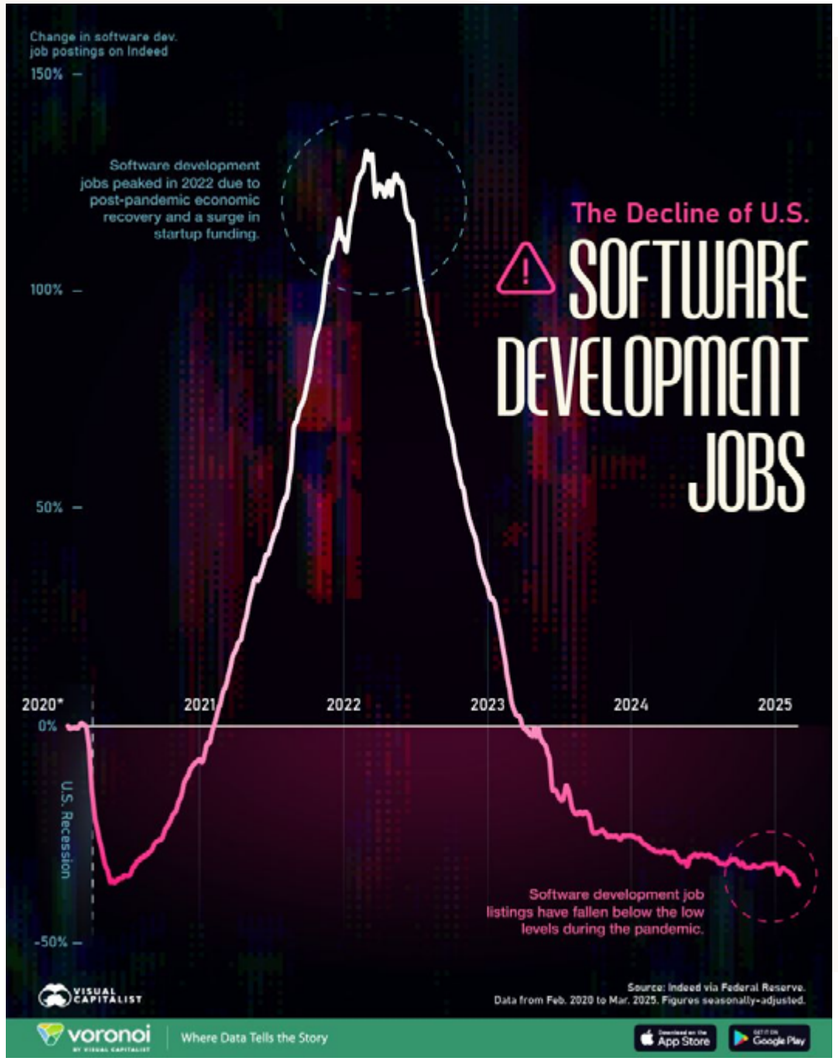
3 The future in numbers



Army Sizes of NATO, Russia, and Ukraine



Software Developer Hiring Boom Is Over

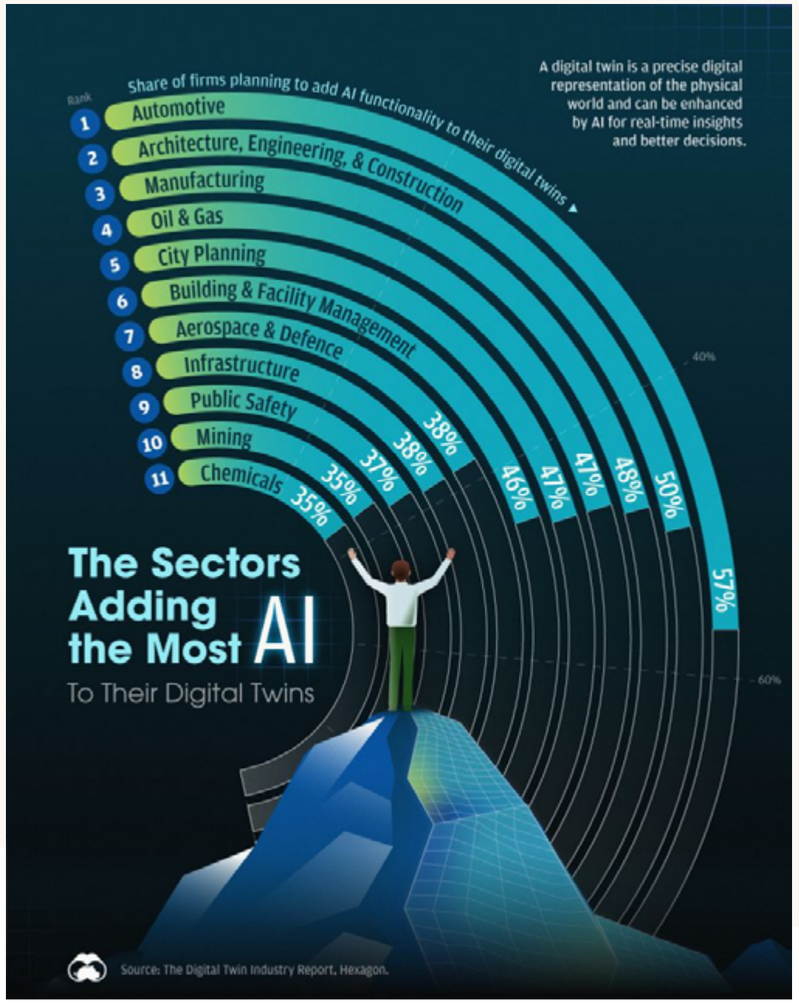


Billionaire Migration Over the Last Decade

2025's Best Countries to Live & Work In

5

The Sectors Adding the Most AI to Their Digital Twins



4

Which States Depend Most on Imports from Canada and Mexico?