THE OPEN DIALOGUE

THE FUTURE OF THE WORLD: A NEW PLATFORM FOR GLOBAL GROWTH

INVESTMENTS IN TECHNOLOGY

Content

OMAN

Al Hinai Jamila

Strategic Project Manager

Ministry of Higher Education,
Research and Innovation

Foresight of Technology and the Necessities of Shaping the Future

Opinion polls conducted among technology experts at the end of last year (2024) revealed that four technologies will lead the world and shape the features of economic development and social life over the coming decade. These are: artificial intelligence, quantum computing, blockchain, and synthetic biology. The last technology marks a turning point; the other technologies seem self-evident with the rise of AI, data innovations, and computing, but the inclusion of synthetic biology among the leading emerging technologies reflects the emergence of new trends within the boundaries of the future of technology and innovation. This is evidenced by the continuous successes recently achieved by scientific companies based on synthetic biology, making it one of the fastest-growing innovations and one of the most well-funded in the field of commercial biotechnology. So, is it time to adopt technological foresight as a necessary tool in shaping the future of investment in technological development?

To begin with, let us pause at the most important milestones in the emergence of technological foresight within strategic planning circles and decision-making in the fields of science, technology, and innovation. We find that Japan took the initiative in the 1970s to establish an institutional system for analyzing opportunities in science, technology, and innovation at the national level. It was then known as the "Technology Foresight Program", and its aim was to enhance Japan's economic and industrial position by shifting from merely imitating Western innovations to becoming a leading economy – particularly in employing technological innovations in electronics and industries related to advanced technologies. The Future Foresight Program had a positive impact on the formulation of long-term industrial policies and in generating collective awareness of the possibilities that knowledge and innovation offer in strengthening the position of Japanese industry and giving it innovative leadership on the international level. Indeed, the Japanese experience was replicated in the 1980s, and ambitious national programs were developed and launched in Canada and many European countries whose economies at the time were considered to be lagging behind the United States, which was at the forefront of technological development. Since the late 1990s, the term technology foresight has been used to refer to a set of tools and methodologies related to planning and future foresight. These are employed to support decision-making processes regarding the priorities of scientific knowledge development and the seizing of technological opportunities.

If we return to the four technologies that will guide future innovations, and take synthetic biology as an example, we find that keeping pace with this technology and its numerous applications in the sectors of the bio-based economy requires the presence of effective frameworks. These frameworks are needed to support the shift in focus and strategic attention toward building scientific capacities in engineering disciplines and fields of biotechnology, funding research and development efforts related to knowledge and applied technology, enhancing the readiness of productive and industrial sectors, and increasing their capacity to absorb the outputs of innovation in synthetic and molecular biology. Furthermore, it is necessary to direct investment into this area as a priority when choosing among a number of other technological options. Herein lies the importance of developing and launching technology foresight programs to support national innovation systems. Rapid technological changes have transformed many of the traditional roles of national foresight programs, while anticipating the future of technological trends has become accessible through the efforts of the international scientific community. However, a set of important roles still remain that must be undertaken by national technology foresight programs.

Practically speaking, strategic foresight in technology is an integral part of futures studies and is therefore considered one of the most important accelerators in building the comparative advantage of national innovation systems. The outcomes of foresight can contribute to identifying core weaknesses in the performance of the innovation system, enabling its strengths, building parallel pathways to keep up with global scientific developments, and enhancing performance while maintaining local competitive advantages. This ensures a balanced transformation in the employment of leading technologies, without resorting to mere imitation of best practices. Likewise, the significant advancement in strategic foresight methodologies has amplified the potential to benefit from inputs, indicators, and analyses that can provide deeper insight into future trends. This has reinforced the importance of launching foresight programs that create national strengths within innovation systems by aligning investment in these systems with the broader national agenda.

In the context of economic growth that seeks to balance the external market pull forces with the internal push forces driven by technological innovations resulting from the continuous development efforts of knowledge and technology-producing institutions, the primary role of national foresight programs becomes clear. It is to define long-term priorities for research, development, and innovation, and to identify innovative technologies that could shape the future economy. Although strategic foresight methodologies are fundamentally predictive and analytical, their outcomes are among the most crucial tools for guiding critical decision-making processes. With the integration of quantitative methods based on big data, as well as modeling and simulation tools, it is now possible to analyze the number of scientific patents, publications, and startups focusing on specific technologies, in addition to expert opinions, in order to deepen the comprehensive understanding of strategic opportunities at the national and regional levels.

Technology foresight is the most important part of producing and developing critical technologies to support development efforts, shape policies in education, training, and manufacturing, and support national economic sectors through broader pathways beyond merely predicting major trends or leading innovations. It involves identifying incremental technological developments that can address the challenges of strategic agendas and meet both current and future needs. This necessitates the existence of national programs to guide the technology foresight process, where the primary aim is not simply to benefit from innovative technologies to achieve comparative advantage as an end in itself. Rather, its core objectives extend to maintaining a strategic focus on long-term investment in scientific research, technological development, and innovation. It is also about identifying areas in which resources should not be wasted through investment. Therefore, technology foresight has become more important than ever, and technological advancement is now seen as a strategic process that can be shaped through sound and balanced planning, not merely the result of unpredictable efforts by geniuses in science and technology.

OMAN

Al Musharafi Noor

Student

Sultan Qaboos University (SQU)

New Technology for Ensuring Food Safety: Innovations, Challenges, and Impact

Introduction

Food safety is a major challenge for health systems worldwide, with the World Health Organization (WHO) estimating that 600 million people fall ill after eating contaminated food, and 420,000 die each year (Safety, 2024). It is imperative that the global food supply chains are complex and, together with growing consumer demand for safe and high-quality food products, require innovative approaches to tackle food safety risks. According to FAO (2025) foodborne illnesses cost about $110 billion a year in lost productivity and medical costs. To address these challenges, advanced technologies including blockchain, Internet of Things (IoT), artificial intelligence (AI), biosensors, and automation offer advancements in traceability, predictive analytics, and contamination prevention. This essay takes an analytical view at the effects of new technologies on food safety assessing pertinent case studies and assessing economic and social effects, particularly in BRICS+ countries.

Current Challenges in Food Safety

Food supply chain has several stages right from production, processing, distribution and consumption; therefore, maintaining food safety at each stage of this chain is crucial, as potential risks associated with food products can be manifested at any of these stages. Contamination at any step of the supply chain is one of the major barriers. Biological contamination hazards come from bacteria, viruses, and parasites (Salmonella, etc.); Chemical contamination hazards (pesticide residues, etc.); and physical contamination hazards (metal fragments in food products, etc.).

Traceability is another major challenge. In complex supply chains, pinpointing the source of contamination can be challenging, causing delays in the handling of food safety emergencies. This lack of rapid traceability of contaminated products risks not just public health, but also consumer confidence and market stability. Food safety management is further complicated by regulatory compliance, as countries have different safety standards that must be adhered to. Such variation complicates compliance with international safety and quality standards for food producers and exporters and poses additional compliance burdens. To mitigate the challenges, innovative technological solutions to promote food safety practices, enhance traceability, and streamline regulatory compliance will become critical in the increasingly complex global food supply chain.

Advanced Technologies Enhancing Food Safety Blockchain Technology

Blockchain will provide an immutable distributed ledger technology (DLT) for the whole food product traceability system. It increases transparency, tracking everything from farm to plate and allowing for quick traceability during contamination events. According to one study from Deloitte, the technology might help reduce food recall costs by nearly 30%, largely through scaling back the scale of a recall, and thus revenue loss due to markets being shuttered for an extended period. According to Kamath (2018) Walmart is one of the major retailers to adopt a blockchain-based system, IBM Food Trust, to increase its transparency and tractability. In one case, it assisted Walmart in cutting the time required to trace a batch of mangoes from one week to 2.2 seconds, vastly increasing the speed at which a company can respond to food safety inquiries. To further improve traceability, Zespri, a worldwide kiwifruit marketer, utilizes blockchain innovation for its fruit exports, enabling real-time supply tracking and improving food safety (Begum, 2024).

Internet of Things

Internet of Things (IoT) devices enable real-time monitoring of the temperature, humidity, and other environmental conditions during food storage and transportation. Sensors sense temperature, humidity and other variables required to ensure food safety standards. For example, one application of IoT technology in the dairy industry includes Internet of things (IoT) temperature sensors used to monitor refrigerator units to make sure that the milk remains at the right temperature. As analyzed by Bhushan (2024) Technology like this decreased spoilage rates by 30% for businesses such as Arla Foods, increasing both food safety and profitability. There are also investments made by the Chinese government in IoT that could help improve the safety of food, especially in the pork industry, where IoT systems improve traceability and safety from farm to table (Wang, 2018).

Artificial Intelligence

Outbreaks can be predicted early on, through AI-powered predictive analytics that can spot patterns in food safety data. This includes image recognition and data analysis, along with the help of AI for quality control. A successful example is an AI model developed by researchers at the Massachusetts Institute of Technology (MIT) that successfully predicts when a foodborne illness outbreak might occur by studying search engine data and restaurant reviews (Shehzad, 2024). Nestlé employs artificial intelligence-based systems to track quality in its supply chain, especially to identify aflatoxins in dairy products, which helps lower the risk of contamination by 15%.

Biosensors and Nanotechnology

Biosensors are alarming components that can identify pathogens and contaminants in food products in a precise and swift manner. This process is enhanced by nanotechnology, which incorporates ultra-sensitive detectors. One advanced technique in this area is the application of electro spun nanofibers from various natural biopolymers, such as chitosan, which is obtained from the shells of e.g. crustaceans. While still experimental and far from being implemented on a large scale, this technology is a potential path forward for sustainable food packaging.

Chitosan is a biopolymer that exerts antimicrobial effects against several pathogens and improves the shelf life of food products by reducing their exposure to microorganisms and air, which helps in better retention of food quality over extended periods. The addition of an inner layer of chitosan to food containers can contribute to food safety. This is not only a means of preserving food products better but also a way to help sustainability objectives by cutting down on excessive food production (Tamzid, 2024). Chitosan-based nanotechnology helps achieve food security by enhancing food storage conditions and providing a viable solution to one of the greatest global challenges for resource management and food waste reduction. The European Food Safety Authority (EFSA) has found that packaging materials coated in chitosan prevent bacterial growth in fresh produce and extend their shelf life by up to 40% longer than standard packaging methods (Bhushan, 2024).

Socio-Economic Benefits

Innovative food safety technologies provide large cost reductions and efficiency gains. Deloitte (2023) found that adopting blockchain could cut the costs of food recalls by as much as 30%, mainly by containing recalls before they become widespread while preventing revenue losses from lengthy market disruptions. Automation and IoT technologies make supply chains much efficient by offering real-time insights into inventory, storage conditions, and logistics, decreasing waste, and increasing productivity. This economic potential is illustrated by the World Bank, which indicates that BRICS+ countries could increase food exports by as much as 20% if they were to invest in food safety technologies (Halim, 2024). Socially, the improvements in food safety using these technologies improves the overall health, as it decreases the occurrences of foodborne diseases (Bhushan, 2024). Detection and prevention technologies that enable and even predict contamination are also producing food that, as it reaches consumers, is higher in quality and safety. For example, transparency enabled by technologies such as blockchain creates consumer trust, especially in foreign markets. For instance, the use of predictive models using data such as the Global Food Safety Initiative (GFSI) allows for proactive management of food safety risks enables companies to rapidly adjust to new threats as they arise.

Opportunities in BRICS+ Countries

A significant opportunity exists with countries like Brazil and India with high agricultural productivity. As one of the world's largest agricultural product exporters, technologies improving food safety and traceability could mean a big win for Brazil. In many cases, if Brazilian beef producers embraced blockchain technology they would be able to satisfy stringent international safety standards, leading to new markets and less of the economic damage of recalls (Santos, 2024). Similarly, with an extensive agricultural economy, India can leverage technologies like IoT to track vegetation status, manage supply chains and prevent wastage post-harvest. The implementation of these technologies could also help mitigate food safety risks in India's large dairy industry, where transport temperature needs to be monitored to prevent spoilage.

China's projects in smart agriculture represent yet another case where technological opportunities are being seized. Chinese IoT and blockchain investment in food supply chain safety and in the pork industry, blockchain is helping ensure traceability from farm to table, helping restore trust with consumers after previous food safety scandals (Halim, 2024).

Challenges for BRICS+ Countries

Lack of infrastructure, particularly in rural and underdeveloped regions, is one of the biggest hurdles to implementing advanced technologies. As analyzed by (Kamath, 2018) In India good internet connectivity and availability of modern technological tools are still some of the basic needs of rural farming communities, preventing the deployment of IoT devices and blockchain systems. Likewise, in South Africa, advanced food safety technologies may work well in urban centers but rural areas lack adequate infrastructure necessary for such advanced predictive analytics and automation technologies used in agricultural and food processing (Bhushan, 2024).

Regulatory hurdles are also a major barrier. It can be costly and complex to align national food safety regulations with global standards such as the ones set by the Codex Alimentarius. Such misaligned regulations create discrepancy in food safety within the domestic market and also particularly raises challenges for international trade. For example, Russia has food safety regulations that differ substantially from the European Union and the United States increasing Russian food exports. There are some significant hurdles to harmonizing these regulations that would take a long time of lobbying between regulatory bodies, industry stakeholders, and international organizations, which can be a very slow and politically charged process (Shamtsyan, 2014).

Economic Potential of Overcoming Challenges

According to the World Bank, investments in food safety technologies can potentially increase food exports from BRICS+ countries by up to 20%, showing the economic potential (Shehzad, 2024). If Brazil and India had cutting-edge traceability technologies in use, the countries could have bolstered their credibility in world markets, and thus drive greater demand for agriculture products. Similarly, more effective food safety systems in China could enhance the export credibility of its product, thus lowering the risk of trade restrictions predicated on food safety issues.

Conclusion

Synergies between advances in technologies have the potential to be transformative in the area of food safety bringing economic benefits that also confer important social benefits. With a view towards fulfilling international regulatory requirements for trade, the BRICS+ nations can improve both domestic food safety while also building a more competitive market, closing infrastructure gaps and addressing gap and regulatory hurdles, particularly in developing markets. (Wang, 2018) This Transition should promote a more resilient global food supply chain, reduce health risk exposure, and catalyze performance through innovation that would strengthen economic performance.

References

1. Begum, M., 2024. *An IoT-Enabled Intelligent Real-Time Food Quality Monitoring System Using Low Cost Sensors.* s.l., 5th International Conference for Emerging Technology (INCET).
2. Bhushan, V., 2024. Economic Impacts of Internet of Things (IoT) in Supply Chain Management. *European Economic Letters,* 14(4).
3. Deloitte, 2023. *The Power of Blockchain in Revolutionising the Food Industry,* s.l.: s.n.
4. FAO, 2025. *Food safety and quality.* [Online] Available at: https://www.fao.org/food-safety/en/ [Accessed 6 March 2025].
5. Halim, M. A., 2024. Green economic growth in BRIC and CIVETS countries: The effects of trade openness and sustainable development goals. *Heliyon,* 10(9).
6. Kamath, R., 2018. Food Traceability on Blockchain: Walmart's Pork and Mango Pilots with IBM. *The Journal of British Blockchain Association,* 1(1).
7. Safety, W. F., 2024. *World Health Organization.* [Online]
8. Available at: https://www.who.int/news-room/fact-sheets/detail/food-safety [Accessed 4 March 2025].
9. Santos, D., 2024. Enhancing International Trade Security: Real-Time Risk Assessment in Brazilian Customs with Blockchain Technology. *International Journal of Business and Management,* 19(6).
10. Shamtsyan, M., 2014. Food Legislation And Its Harmonization In Russia. *Journal of the Science of Food and Agriculture,* 94(10).
11. Shehzad, K., 2024. AI-Driven Predictive Models for Foodborne Pathogen Detection and Mitigation. *Revista Española de Documentación Científica ,* 19(2).
12. Tamzid, F., 2024. Chitosan based electrospun nanofibrous materials: A sustainable alternative for food packaging. *Trends in Food Science & Technology,* Volume 151.
13. Wang, H.-S., 2018. Market power and food safety in the China pork industry: WANG et al.. *Agribusiness,* 35(9).

VENEZUELA

Aldana Vivas Betzabeth

Researcher and columnist
Political Scientist

Misión Verdad

Neo-protectorate in the area of ecology: justice in climate or a new model of dependency?

The global energy transition was presented as a moral imperative and urgent necessity to ensure survival of the planet. However, behind this seemingly altruistic discourse lies a more complex and often uneven reality.

While industrialized countries of the Global North actively implement environmental policies and financing of green projects, hydrocarbon producing countries of the Global South are facing a difficult dilemma: imposing of the rules restricting their economic development on the pretext of so-called climate justice.

Such dynamics not only maintains the economic dependency of these countries, but also questions fairness of the system that is beneficial for a few at the expense of the many. Does the energy transition constitute an actual way towards global sustainability or is it just another mechanism of control and subordination?

Energy interdependency and the dominant narrative

In his recent speech, Secretary General of the Organization of Petroleum Exporting Countries (OPEC) Haitham Al Ghais[1] noted that the dominant narrative on transition to renewable energy sources oversimplifies the process that in fact is far from being linear or universal.

The idea that renewable energy sources will fully replace fossil fuels in the nearest future is not only naive, but also ignores the historical and current interdependency between different energy sources.

Al Ghais highlights that throughout the history coal, oil, and gas have not disappeared, but, on the contrary, coexisted and complemented each other along with new technologies and resources. This means that instead of full replacement of each other these resources have evolved and got integrated into a wider and more diversified energy system.

Data of the International Maritime Organization provide an example of the fact that hydrocarbons are still the main source of energy: in 2023, vessels with displacement of over 5,000 gross register tons consumed approximately 211 million tons of fuel, mostly heavy fuel oil that is derivative of oil[2]. This sector transports 75 % to 90 % of world trade turnover by weight and almost entirely depends on hydrocarbons[3].

As Secretary General of OPEC notes, regardless of the achievements in the area of renewable energy sources, wind and solar energy makes up only 4 % of the global energy supply[4], which significantly lags behind the continuous growth of oil and coal consumption.

This reality makes one think about complexity of the energy transition and the need for a better balanced and realistic approach, especially for the Global South countries that historically play a secondary role in the global economy.

A perfect example of this dynamics is Venezuela, a country, economic and political history of which has been marked by exploitation of natural resources first in the age of colonialism and then under control of transnational oil companies.

After oil colonialism: case of Venezuela

Since the time of its discovery and mass exploitation in the 20th century, oil became the cornerstone of Venezuela's economy and marked a turning point in the history of the country.

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1 Haitham Al Ghais, "Redefining Energy Transitions", OPEC, January 13, 2025, https://www.opec.org/opec_web/en/7438.html

2 https://safety4sea.com/imo-over-200-million-tons-of-fuel-used-during-2023/

3 https://www.schweizerischesseeschifffahrtsamt.eda.admin.ch/en/significance-of-maritime-shipping-for-global-trade

4 Haitham Al Ghais, "Redefining Energy Transitions," OPEC, January 13, 2025, https://www.opec.org/opec_web/en/7438.html

However, its impact cannot be understood without considering the colonial legacy that shaped Venezuela's relations with natural resources and foreign states.

Since arrival of the first European conquerors in the 15th century, extraction of natural resources – first gold, and then oil – became an integral part of Venezuela's history, which laid the foundation for its dependency on the outer world.

In the 20th century, oil became the main source of foreign currency inflows and raised major foreign investments while at the same time aggravating economic vulnerability of Venezuela.

In his work *Drowning in the devil's excrement,* Juan Pablo Perez Alfonso states that from 1917 to 1935 transnational companies extracted 1,148 million barrels of oil and earned 1,199 million dollars, of which Venezuela received only 8 %. Such exploitation disrupted economy of the country, as it displaced agriculture and aggravated social inequality[5].

Monopoly of transnational oil companies from 1908 to 1935 established the extractivist model that kept on aggravating Venezuela's economic dependency. Although in 1928 Venezuela became the world's largest oil exporter, its oil wealth brought no tangible benefits to the majority of its population. Record production of 3.7 million barrels a day in 1970 caused depletion of deposits and hindered diversification of the economy, as it was predicted by Perez Alfonso.

This pattern of exploitation keeps on recreating the colonial legacy. European states and later US used their influence to control strategic resources of the Global South countries, as they maintained structures of dominance inherited from the age of early colonialism.

The trap of energy transition: ecological colonialism

As Venezuela faced various phases of dominance – from colonial exploitation of its resources to control by transnational oil companies – the future challenges take form of ecological colonialism.

At present, the global system manipulates energy and market dynamics justifying it by solving of environmental problems and presenting the energy transition as an inevitable process aimed at the reduction of hydrocarbon consumption[6] while in fact this is a new scheme of dependency created in order to perpetuate control over the energy matrix.

Historically, colonialism functioned through control over strategic resources. At the early stages these were gold, silver, and spices while later on oil and gas became the determining factors in world geopolitics.

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5 https://misionverdad.com/memoria/%C2%BFqu%C3%A9-nos-dice-p%C3%A9rez-alfonzo-sobre-la-producci%C3%B3n-petrolera-en- venezuela-40-a%C3%B1os-despu%C3%A9s

6 https://misionverdad.com/investigaciones/anatomia-del-discurso-sobre-la-energia-verde

Today, under the pretext of decarbonization, global power is being reorganized around critical minerals and technologies associated with renewable energy sources.

Lithium, cobalt, rare earth elements, and nickel have replaced oil on the dominance agenda creating new hierarchy where the great powers are designing the transition in accordance with their own interests while the Global South countries are forced to play the role of simple suppliers of raw materials.

Paul Driessen[7] coined the term "eco-imperialism" to describe how industrialized nations impose their ecological development models on developing countries ignoring their economic and social realities.

This imposition takes form of not only ecological regulations that make it difficult for peripheral countries to access affordable energy, but also that of the market structure where clean technology depends on resources controlled by several major corporations.

Example here is lithium. Bolivia, Argentina, and Chile contain more than 50 % of the world's reserves of this mineral that is required for the production of batteries. However, these are foreign companies that control the supply chain while the manufacturing countries receive just a minor share of the final cost of the product[8].

The same is true for rare earth elements required for the production of wind turbines and solar panels, processing of which mainly takes place in China. This causes new geopolitical tensions between the East and the West. In fact, Ukraine became the key point in this struggle[9].

The paradox of environmental colonialism is that despite the propaganda of sustainability and reduced emissions, the methods used to extract these minerals are extremely destructive.

For example, lithium mining requires huge amounts of water, which may become a threat for fragile ecosystems in the Andes while responsibility for water resources and consequences of exploitation is passed to the states, and not the transnational companies.

However, the energy transition is still being positioned as a "green" solution, and the fact that it simply replaces one dependency with another is being concealed.

On the other hand, the dominance scheme gets strengthened through financial and regulatory mechanisms. Such organizations as the World Bank and the International Monetary Fund are pushing reforms that simplify foreign investments in the mining sector and technologies recognized as green ones, thus trying to weaken countries' ability to regulate exploitation of their resources.

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7 https://www.eco-imperialism.com/what-is-eco-imperialism/
8 https://misionverdad.com/globalistan/la-ocupacion-transnacional-del-litio-en-argentina
9 https://spectrum.ieee.org/ukraine-rare-earth-minerals

At the same time, carbon credit and environmental certificate markets serve as tools for imposition of restrictions on developing countries' economies, which restrains their industrial and energy development under the pretext of sustainability.

Western states continue to strengthen their own industries of renewable energy and energy storage simultaneously forming the agenda in order for the southern hemisphere countries to be forced to refuse from their hydrocarbon resources while having no viable and, more importantly, sovereign alternatives to replace their energy matrix.

In the end, this transition is meant for the benefit of the countries that already control technology while others remain trapped in the structure of dependency that is similar to that established with oil in the 20th century. It is a colonial cycle that mutates over time.

Thus, ecological colonialism is a strategy aimed at the maintenance of hegemony in the new global energy order.

How to break the cycle of dependency?

Ecological colonialism is not only an environmental problem, but also a question of sovereignty and development. Venezuela and other hydrocarbon producing countries in the Global South are facing not only the need to avoid the new trap, but also the task of building a sovereign energy model that will allow them to benefit from their own resources without being subjected to external interests.

Possible solutions include development of a mechanism within BRICS similar to OPEC that would allow hydrocarbon producing countries to exchange ideas and coordinate investments in technologies in order to improve efficiency and sustainability of the industry. As OPEC secretary put it:

"Despite the reports on inevitable peak in oil demand, every year the world continues to consume more and more oil. This means the need for investments, investments, and more investments. OPEC believes that global oil sector will need investments of 17.4 trillion dollars by 2050, which is approximately 650 billion dollars a year"[10].

If the Global South countries are able to develop their own technology and coordinate their efforts, they will be able to participate in the energy transition on fair terms without repeating the past mistakes. True climate justice cannot be a new model of dependency.

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10 Haitham Al Ghais, "Redefining Energy Transitions", OPEC, January 13, 2025, https://www.opec.org/opec_web/en/7438.html

RUSSIA

Alfimtsev Alexander

Head of the Department
DSc (Technology)

Bauman Moscow State
Technical University

Evolution of cooperation: what else can (should) we teach the machine

Throughout the history of biological life on planet Earth absolutely all biological agents from microorganisms to humans have obeyed to the law of cooperation: to build a stable hierarchical system, agents should act in a cooperative manner. However, in 2022, human genius creates a software machine that does not require compliance with the law of cooperation for its self-development....

In fact, this is not true.....:-)....scientific researches of 2023-2025 suggest that large language models are even more cooperative than us, humans.... But it is exactly due to the obviousness and our high loyalty to this idea that each new AI agent has to pass a test for cooperativeness. Now, let us get to the point...

An agent usually means some sort of a computer program that uses a mathematical model to autonomously make decisions and perform actions. In game theory, it could be an agent based on a simple reward matrix, for ten years in a raw it was a deep linear neural network, and for the past two years large language models have been actively explored as the main decision-making center in agents.

Emergence of intelligent multi-agent systems poses new challenges and allows us to begin and explore collective effects arising in community of autonomous agents at a new level: social dilemmas, emergence, and even collective intrinsic motivation.

Social dilemmas are situations in which collective interests of a multi-agent system contradict individual selfish interests of particular agents. In the famous social dilemma – the “prisoner’s dilemma” – agent’s betrayal has clear advantage over cooperation, as a result of which the only sustainable result is betrayal of both parties. This suggests that seemingly optimal solution for a local agent causes unfavorable consequences for the entire system. In reality, there are multiple interactions between people or between animals that demonstrate similar behavioral strategies. Thus, many social and economic processes were described with the use of models in which biological agents participate in games that are similar to the prisoner’s dilemma.

In the 1980s, an extended version of this dilemma, also known as the iterated prisoner’s dilemma, was actively studied. Under this scenario, agents make multiple choices taking into account previous results. It was shown that in a long-term game among many computer agents with different strategies “greedy” actions of the agents always produced poor long-term results, while results of more “altruistic” strategies were better. This made it possible to demonstrate the mechanism of evolution of cooperative behavior of initially selfish agents through the process of natural selection of behavioral strategies. Even a conclusion was made that at first seemed utopian: in collective environment, autonomous agents acting in their own interests will strive to behave cooperatively.

Interest of AI community in the evolution of cooperation was revived in 2017 by Google DeepMind scientific paper that tried to use multi-agent reinforced learning algorithms to study iterative social dilemmas. Conclusions were arguably fundamental: the less are resources in collective environment, the less cooperative will be behavior of intelligent agents and the weaker is their intelligence (in this case, a smaller neural network), the more aggressively the agents will interact.

Modern LLM agents reproduce biological tendencies towards fairness and cooperation and in some dilemmas are even 30% more cooperative than humans, and similarly to us they are prone to emotions when making decisions. Again, smaller size of autonomous agent’s neural network affects various distortions in decision-making.

According to Gartner’s 2024 forecast, it is only in 5-10 years that multi-agent systems will reach plateau of efficiency. In general, according to the estimates by Grand View Research and KBV Research, by 2030, the global market of autonomous agents will reach up to 6 trillion rubles with total average annual growth rate of at least 40%. However, the other day these forecasts became obsolete: the Fudan University in China (DeepSeek has nothing to do with it this time) demonstrated that there are schemes of 90% accurate self-replication of autonomous agents based on large language models, which is likely to exponentially increase the number of autonomous agents in the nearest future.

This is why new national and international efforts are required not only to sign memoranda on ethical AI but also to develop unified technical systems to control cooperativeness of any new AI agent, be it commercial or published in the public domain, strictness of which shall be no less than that of the international drug circulation control system. We still have enough time…

Aloufi Ranya

Taibah University

Verifiable Configurable Local Privacy in the Era of Borderless Data

AI and predictive analytics have transformed data-driven decision-making, yet reliance on cloud computing and third-party providers raises privacy risks, increasing concerns over unintended access and misuse. Individuals need granular control over their data, but evolving regulations continue to redefine what businesses can legally and ethically do.

The Cambridge Analytica [1] scandal exposed the dangers of data exploitation, where user information, entrusted to a single entity, was misused without consent. Beyond privacy, this issue impacts corporate governance, regulatory compliance, and public trust. Governments are tightening data laws, enforcing AI regulations, data localization policies, and jurisdictional compliance, requiring businesses to rethink data governance strategies. For instance, a marketing campaign that works in Saudi may not be compliant in the United Kingdom, highlighting the complexities of cross-border data governance. Rather than treating privacy as a compliance checkbox, organizations should embed user-controlled data sharing, full transparency, and real-time compliance monitoring into their operations. The Verifiable Configurable Local Privacy (VCLP) framework may offer a scalable solution, integrating authenticity verification, privacy preservation, and user sovereignty to ensure data integrity, compliance, and user control, helping businesses strengthen trust, mitigate risks, and drive responsible innovation.

Embedding Verifiable Configurable Local Privacy in Data Governance

Governments, organizations, and individuals require a structured approach to balancing data utility with compliance, particularly in a world where data is both an economic asset and a security risk.

The financial and operational impact of data breaches are increasing, with HIPAA [2] penalties ranging from $141 to $2.1 million per violation, and healthcare data breaches exposing 520 million records between 2009-2023 (1.5 times the U.S. population). The IBM/Ponemon [3] study reports that data breaches now cost organizations $4.88 million on average, marking a 10% increase in a single year—the largest jump since the pandemic. Breach rates are increasing at an alarming rate. In 2018, data breaches occurred at a rate of one per day, but by 2023, that number had nearly doubled to two breaches per day, compromising an average of 364,571 healthcare records daily. The rise of shadow data breaches now accounting for 35% of cases has increased costs by 16%, adding to the financial burden. Additionally, 40% of all data breaches involve data stored across multiple environments, which creates major security gaps in organizations struggling to track and control their data. Beyond financial losses, the human factor plays a significant role in breaches [4]. Research shows that 74% of all data breaches involve human errors, such as stolen credentials, privilege misuse, or social engineering tactics. Credential-based breaches take the longest to contain, averaging 292 days, while malicious insider attacks are the costliest, reaching $4.99 million per incident. Organizations should therefore adopt proactive privacy governance instead of responding to breaches after they occur. Simultaneously integrating authenticity verification, privacy preservation, and user sovereignty through VCLP strengthens privacy, security, and transparency, fostering responsible innovation in a complex regulatory landscape.

Ensuring Data Integrity and Source Validation

One of the biggest challenges in cross-border data exchanges is verifying that shared data remains authentic and unaltered. Without robust verification mechanisms, data can be manipulated, falsified, or exploited, leading to fraud, misinformation (such as deepfakes), and regulatory violations. The increasing sophistication of cyber threats makes data authenticity a top security concern, particularly in finance, healthcare, and AI-driven analytics. The VCLP strengthens data integrity by embedding local verification mechanisms at the data source. Instead of transmitting raw data to centralized servers, where it could be intercepted, locally generated security codes replace sensitive information, reducing the risk of unauthorized access and tampering. The financial toll of unauthenticated data leaks is severe. The industrial sector saw the highest increase in breach costs, rising by $830,000 per incident, and breaches involving public cloud storage had the highest average costs at $5.17 million per breach [3]. By ensuring verifiable authenticity at the source, VCLP minimizes security vulnerabilities, mitigates financial risks, and enhances trust in cross-border data exchanges.

Enabling Data Utility Without Compromising Privacy

While privacy regulations such as GDPR, CCPA, and AI governance laws establish broad privacy protections, they often fail to address data repurposing risks, inference attacks, and long-term retention policies. Organizations that lack privacy-preserving data governance are at greater risk of financial and legal penalties, as well as reputational damage due to data misuse. The VCLP framework mitigates these issues by integrating Privacy-Enhancing Technologies (PETs) that allow organizations to derive value from data while preserving privacy. A core principle of VCLP is data minimization, ensuring that only essential attributes are collected and shared for specific purposes. Organizations leveraging privacy-preserving computations [5] can perform secure data analysis without direct access to raw information, reducing risks associated with AI-driven profiling and data inference attacks. The economic benefits of AI-based privacy protection are significant. Organizations that implement AI-driven security solutions save an average of $2.2 million per breach, compared to companies without AI security measures [3]. Involving law enforcement in ransomware incidents has also proven effective, reducing breach-related costs by $1 million per event. Additionally, anonymization and de-identification techniques prevent data re-identification, ensuring compliance with global privacy laws while maintaining the accuracy and functionality of shared data. However, privacy-preserving technologies can render data synthetic, obscuring its origin. To address this, VCLP integrates authenticity verification, embedding local verification mechanisms at the data source to ensure even privacy-preserved data remains verifiable, strengthening compliance, security, and trust in data exchanges.

Empowering Individuals and Organizations with Data Control

User sovereignty is crucial for balancing privacy, security, and utility, yet existing frameworks often leave individuals exposed to opaque data-sharing agreements, profiling, and consent mismanagement. Traditional privacy policies rely on static opt-ins that offer limited control [5], failing to adapt to evolving user preferences and data usage contexts. VCLP redefines data ownership by enabling granular, real-time privacy controls, allowing individuals to dynamically manage what data is shared, with whom, and under what conditions. Instead of one-time per-missions, users can adjust settings on demand, ensuring their data is used strictly for its intended purpose. Real-time monitoring and audit trails provide transparent oversight, reducing the risk of unauthorized secondary use and enhancing accountability in digital interactions. Furthermore, decentralized consent management shifts privacy governance away from centralized data controllers, giving individuals direct authority over their personal information. This approach not only strengthens trust and regulatory compliance but also fosters a privacy-centric digital ecosystem.

Economic and Social Effects of Locally Verifiable Privacy

Data privacy is not just a legal requirement, it is also an economic advantage. Secure and privacy-preserving data sharing between countries can help businesses work together safely while following international data protection laws like GDPR and CCPA. When companies and governments trust their data exchanges, they can unlock new opportunities for AI, digital trade, and innovation. Countries that adopt locally verifiable privacy frameworks can protect their data while still growing their economies. By allowing companies to share verified, privacy-protected data, nations can expand digital markets and stay competitive without enforcing strict data localization laws that slow down progress.

Decentralized Trust and the Changing Landscape of Data Sovereignty

Many governments are introducing stricter data regulations to protect national security and control digital information [6]. However, forcing companies to store all data within national borders can make business operations more expensive and limit international collaboration. A decentralized, locally verifiable approach offers a better way forward. Instead of centralized data control, where a single authority oversees data sharing, locally verifiable privacy frameworks allow organizations to securely verify, protect, and share data without exposing sensitive information. This ensures secure data exchange, protects user privacy, and supports economic growth, ensuring that data sovereignty and digital innovation advance together.

A Path Forward for BRICS+ in the Digital Economy

As BRICS+ nations expand their digital footprint, adopting a locally verifiable privacy framework is key to maintaining secure data governance, regulatory compliance, and economic growth. This framework enables trusted cross-border collaboration while preserving sovereignty over digital assets. Investing in such frameworks provides both immediate and long-term benefits. In the short term, they reduce regulatory barriers, lower compliance costs, and facilitate seamless data exchange. In the long term, they drive AI innovation, fintech expansion, and secure digital trade, positioning BRICS+ nations as leaders in privacy-driven digital economies. To fully leverage locally verifiable privacy frameworks, BRICS+ nations should integrate verifiable privacy measures into their data protection and AI governance laws, ensuring regulatory alignment and security. Establishing secure digital trade corridors among member states will facilitate trusted cross-border data exchange while maintaining sovereignty over digital assets. Additionally, investing in Privacy-Enhancing Technologies (PETs) that comply with global standards will enhance data security and innovation. Strengthening multilateral cooperation is also essential to create interoperable data policies, allowing seamless digital collaboration while upholding privacy and compliance across borders.

References

1. J. Isaak and M. J. Hanna, "User data privacy: Facebook, Cambridge Analytica, and privacy protection," Computer, vol. 51, no. 8, pp. 56–59, 2018.
2. S. Alder, "Healthcare Data Breach Statistics," 20 01 2025. [Online]. Available: https://rb.gy/nr3enx [Accessed 2025 03 14].
3. P. Institute, "Cost of a Data Breach Report 2024," 01 02 2024. [Online]. Available: https://www.ibm.com/reports/data-breach. [Accessed 10 03 2025].
4. I. C. Office, "Errors," [Online]. Available: https://rb.gy/crzfjy [Accessed 10 03 2025].
5. G. M. Garrido, J. Sedlmeir, Ö. Uludağ, I. S. Alaoui, A. Luckow and F. Matthes, "Revealing the landscape of privacy-enhancing technologies in the context of data markets for the IoT: A systematic literature review," Journal of Network and Computer Applications, 2022.
6. OECD (2022), Going Digital Guide to Data Governance Policy Making, OECD Publishing, Paris, https://doi.org/10.1787/40d53904-en

MEXICO

Angeles Rueda Alberto
Student

National Autonomous
University of Mexico

Technological evolution: the past defining our future

Preamble

This essay examines the interplay between technological evolution and humanity, emphasising how adaptation and tool development have been crucial for human survival and progress. It delves into the effects of technological revolutions as recurring cycles of historical transformation and addresses the challenges posed by the rapid acceleration of technological progress relative to human evolution. Additionally, it underscores the importance of retrospective, introspective, and prospective analysis in science to ensure that technological achievements remain a beneficial tool for people, highlighting that the future of science inherently shapes the future of humanity.

Evolution is the ability of living organisms to adapt to environmental changes. These changes can only be observed over time because they occur gradually in response to the surrounding environment.

The evolutionary process, spanning thousands of years, enabled humans to establish their presence on Earth. This process can be interpreted in various ways, but all interpretations converge on the emergence of science as the framework through which humans understand themselves and their environment.

This laid the groundwork for the scientific method, as humans initially had to reflect to find the answers they sought, thereby articulating diverse forms of knowledge. In this manner, human activity evolved into scientific activity, and time became closely associated with knowledge acquisition.

Theoretical advancements necessitated practical advancements, involving the development of methods and tools to utilise this knowledge effectively. As a result, science became the foundational basis for human survival across all societies.

The survival instinct, fuelled by the need to overcome challenges, motivates humans to create methods and tools essential for survival. What we refer to as technology is essentially a body of theoretical knowledge transformed into tangible and intangible instruments that aid us in overcoming these obstacles.

Humanity's survival is contingent upon its ability to adapt to its environment, and the invention of tools has been instrumental in securing its existence. Technological evolution has been an inherent trait since the earliest stages of human existence, as we have continually struggled to survive in hostile environments.

However, it is precisely the hostile environments that have driven humans to overcome imperfections and instead find opportunities in adversity to expand their knowledge.

Once we understand that evolution is inherent to our nature, we can see that technology accompanies us throughout this evolutionary journey. Nevertheless, it is crucial to recognise that human evolution does not progress at the same rate as technological evolution. Adapting to these changes in a timely manner is not just a challenge for humanity; it is essential for its very survival.

Technological evolution can only be fully appreciated in retrospect, as it involves the accumulation of successive advancements. Periodically, it becomes necessary to identify cycles due to the inherent complexity of analysing all these developments collectively.

Technological revolutions represent these cyclical beginnings and endings, comprising a series of advancements that define the mode of existence during a particular era. When these are surpassed by new developments, a new cycle commences, repeating the process until the spatial and temporal barriers of each era are overcome.

In this sense, it is useless to admire the present without acknowledging the past, as it provides the foundation upon which we build. To truly assess technological progress, it is essential to recognise the historical process that has been the result of efforts by scientists and researchers. A thorough retrospective analysis reveals that it is only over time that previously insurmountable barriers have been overcome.

Given the impossibility of detailing every event that contributed to this evolution, we can consider the last century as a prime example. The 20th century witnessed unprecedented scientific advancements across all fields, marked by numerous events and inventions that forever altered the course of humanity, even if they are now overshadowed by the promise of the future.

Science across all disciplines must reconsider its unique role within the diverse landscape of knowledge, which has been, is, and will continue to be the most effective tool for navigating the uncertainties of the future. This is why, in light of the increasingly rapid technological evolution, there must be space for reflection.

Perhaps the most significant challenge of our era is to critically examine both the positive and negative consequences of scientific output, as these will form the foundation upon which future generations will build their lives.

The space for reflection requires acknowledging the diverse forms of knowledge, as they all contribute to science in its broadest sense. The universe offers an infinite expanse of discoveries, yet humans can only derive finite wisdom from it.

The belief that there is no guide to shape the future undermines the significance of the present and erases the past, which has given humanity its meaning. Therefore, it is essential to start by recognising the importance of each event in shaping history.

Evolution is like a continuous thread with a beginning but of no end. Currently, we are experiencing both technological evolution and revolution. This revolution coincided with the start of the new millennium and the digital era, marked by widespread Internet use. As a result, globalisation reached its zenith, as new technologies spread globally, creating a digital society comprising billions of users.

In this context, science finds an ideal opportunity to identify both challenges and opportunities in a globalised world. This fertile ground is ripe for analysis, leading to the discovery of new knowledge as science strives for objectivity that addresses the urgent needs of 21st-century society.

Technological evolution is an integral part of the unyielding scientific spirit that has accompanied humanity throughout history, but it now plays a unique role by making its tools accessible to all people. Undoubtedly, times have changed, and with them, the role of scientists has been transformed. The greatest challenge lies in conducting retrospective, prospective, and introspective analyses to measure its impact.

The future of science is inextricably linked with the future of humanity.

RUSSIA

Anufrieva Polina
Student

Rostov State University
of Economics

The UAE on the Way to Low-Carbon Future: Decarbonization and New Horizons

Today, the matter of sustainable and accessible energy is becoming increasingly important since energy consumption is growing steadily,[1] climate is changing,[2] energy security and social inequality problems are exacerbating. [12] Dependence on fossil fuels damages the environment and results in fluctuating energy prices and geopolitical problems. At the same time, renewable energy sources (solar-, wind-, and hydropower) could diversify energy supplies, cut CO2 emissions, and ensure energy security, while progress in technologies improves the efficiency of renewable energy sources (RES) and cuts costs thereby making them accessible in developed and developing countries.

To support the claim that countries with emergent markets have, like developed countries, already faced the energy transition, I suggest considering the

1 World Energy Outlook 2024 // IEA [Electronic resource]. URL: https://www.iea.org/reports/world-energy-outlook-2024 (accessed on February 02, 2025)

2 Resourcing the Energy Transition: Principles to Guide Critical Energy Transition Minerals Towards Equity and Justice // UN Secretary-General's Panel On Critical Energy Transition Minerals [Electronic resource]. URL: https://www.un.org/sites/un2.un.org/files/report_sg_panel_on_critical_energy_transition_minerals_11_sept_2024.pdf (accessed on February 09, 2025)

UAE's decarbonization strategy and the potential options of its energy transition, since the IMF classifies the UAE as a country with developing economy.

Currently, the question of whether the UAE can be considered a state that seeks to replace traditional power sources with alternative ones is still being debated. On the one hand, the UAE government believes it urgently necessary to pour more funding into RES projects. The UAE Energy Strategy 2050 plans allocating between AED 150 and 200 bn. for these purposes by 2030, which, in turn, will help meet the UAE's energy demand that is growing as the country's economic growth picks up pace.[3] On the other hand, since the UAE is one of the world's richest oil economies, a full-scale decarbonization would require structural changes in the country's energy, industrial, and transportation sectors.

The UAE has major potential for handling the problems entailed in transitioning to environmentally-friendly technologies and minimizing CO2 emissions. First, the World Economic Forum (WEF) reports that the UAE is ranked 52 out of 120 in the Energy Transition Index (ETI) 2024.[4] The UAE's ETI ranking has been fluctuating for the last decade, mostly because of the "transition readiness" indicator (fig. 1).

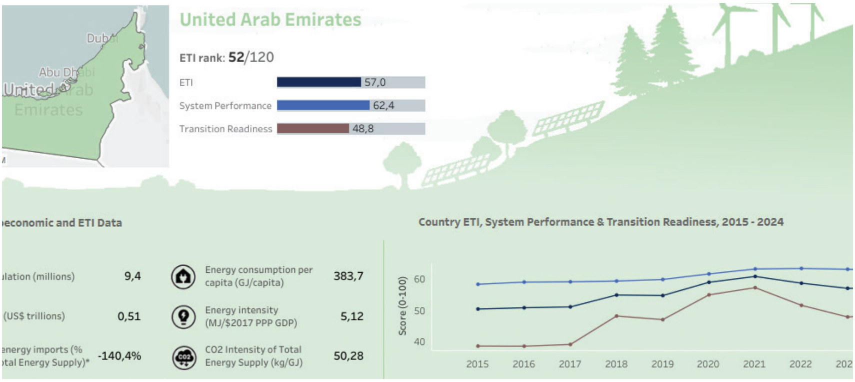

Figure 1. The UAE's "green" transition readiness, 2024

Energy transition in the UAE depends on two major factors: massive political influence and efficient regulation. Even greater successes can be achieved by focusing on making its energy balance less carbon- and power-intensive.

However, we should note that recently, the UAE's energy policy changed,

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3 UAE Energy Strategy 2050 // The Official Portal of the UAE Government [Electronic resource]. URL: https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/environment-and-energy/uae-energy-strategy-2050 (accessed on February 02, 2025)

4 Fostering Effective Energy Transition 2024 // World Economic Forum [Electronic resource]. URL: https://www.weforum.org/publications/fostering-effective-energy-transition-2024/country-profiles-8dad724ce3/ (accessed on February 02, 2025)

and more favorable conditions were created for transitioning to green energy. For instance, in the last 15 years, the UAE's government and entrepreneurs have invested over USD 40 m. into clean energy projects.[5] The country also set itself a more ambitious goal of reaching zero emissions by 2050. This goal may be achieved by reducing greenhouse gas emissions, increasing energy efficiency, and transitioning to RES, which, in turn, requires massive investments; the UAE is predicted to invest over USD 160 bn. into achieving this goal.[6] Moreover, in 2017, the UAE announced a new national program for stimulating renewable energy development. The UAE Renewable Energy Strategy 2050 is intended to increase the share of the RES in the overall energy balance to 50 % by 2050.[7] The key point of the program is investing into renewable energy projects. The Mohammed bin Rashid Al Maktoum Solar Park is one such project. It neutralizes about 1.4 m tons of CO2 annually. The park has an area of 76 square kilometers, 2 and the capacity of 1.63 GW that is slated to be increased to 5 GW by 2030.

Additionally, the UAE is ranked 26 out of 76 in the MIT Technology Review Insights' Green Future Index (GFI) 2023 (fig. 2).

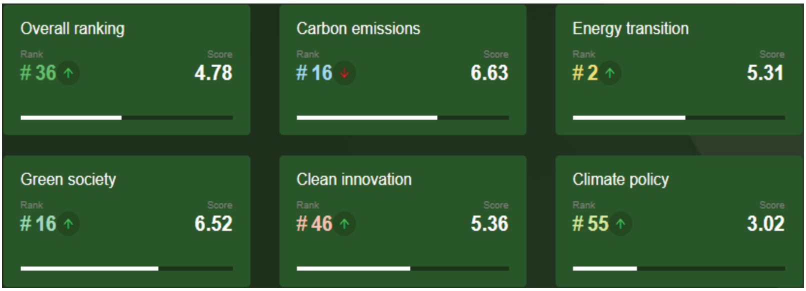

Figure 2 –The UAE in the Green Future Index, 2023.[8]

Second, the International Energy Agency (IEA) reports that in 2014, the UAE

5 The UAE has invested over $40 billion in clean energy over the last 15 years // Gulf News [Electronic resource]. URL: https://gulfnews.com/business/corporate-news/the-uae-has-invested-over-40-billion-in-clean-energy-over-the-last-15-years-1.1653561468563 (accessed on February 05, 2025)

6 UAE to invest $160bn in clean, renewable energy sources in next 30 years // Sustainability Middle East News [Electronic resource]. URL: https://www.sustainabilitymenews.com/energy/uae-to-invest-usd-160-billion-in-clean-renewable-energy-over-30-years (accessed on February 05, 2025)

7 UAE Energy Strategy 2050 // The Official Portal of the UAE Government [Electronic resource]. URL: https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/environment-and-energy/uae-energy-strategy-2050 (accessed on February 02, 2025)

8 The Green Future Index 2023 // MIT Technology Review [Electronic resource]. URL: https://www.technology review.com/2023/04/05/1070581/the-green-future-index-2023/ (accessed on February 02, 2025)

began using major photovoltaic (PV)-based resources to generate power. The IEA says that in 2022, only 5% of power came from RES in the UAE, which is 49 times more than in 2013 (fig. 3).

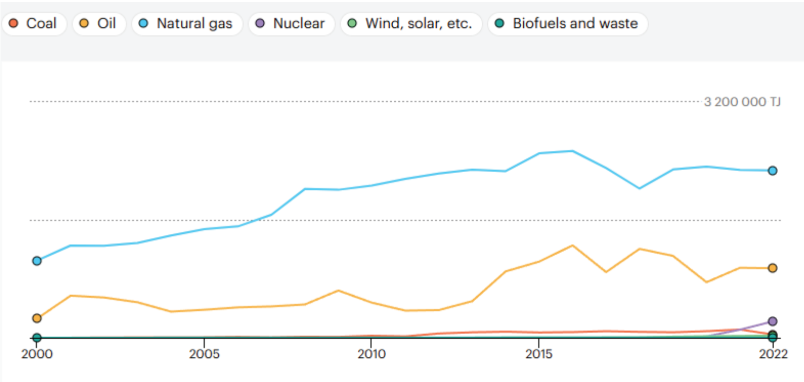

Figure 3 – General power supply dynamics in the UAE since 2000, TJ[9]

The IEA global ranking of the RES share in power generation ranked the UAE 124 out of 145 in 2022. In 2022, the top noncombustible renewable energy source in the UAE was the photovoltaic energy (96% of RES-generated power). Nonetheless, state-of-the-art RES account for a very small share in the final power consumption in the UAE: only 1.01 % in 2021.[10]

Finally, in 2022, the UAE launched its National Water and Energy Demand Management Programme aimed at increasing energy efficiency in three key areas with the highest power consumption: transportation, industry, and construction.10 First of all, the UAE needs to nearly halve its overall power consumption, bring the RES share in its power balance up to 50 %, and bring water recycling up to 95 % by 2025. As part of its energy efficiency program, the UAE is introducing new construction requirements and regulations on using energy-efficient equipment, appliances, and devices. By 2030, the UAE intends to modernize 30,000 buildings in Dubai to cut CO2 emissions by one million tons. Additionally, the UAE is designing and supporting various initiatives for developing public transit, alternative fuels, and electric vehicles since the UAE set itself the goal of increasing the number of electric cars to 42,000 by 2030. In 2022, Abu Dhabi launched the car-

9 United Arab Emirates – Countries&Regions // IEA [Electronic resource]. URL: https://www.iea.org/countries/united-arab-emirates/renewables (accessed on February 02, 2025)
10 The UAE launches its National Water and Energy Demand Management Programme // Enerdata [Electronic resource]. URL: https://www.enerdata.net/publications/daily-energy-news/uae-launches-its-national-water-and-energy-demandmanagement-programme.html (accessed on February 02, 2025)

bon trade market and a clearance center for supporting investment into combating carbon pollution.

A successful transformation of low-carbon industry requires introducing cutting-edge technologies such as artificial intelligence, the internet of things, and robotics. It will increase enterprises' productivity and improve their energy efficiency. For instance, the Abu Dhabi National Oil Company (ADNOC) is actively developing strategies for cutting emissions and optimizing energy processes by combining traditional natural approaches (such as planting mangroves) with innovative methods of carbon removal such as carbon mineralization.[11] In addition to the established energy sector actors, there are many startups and companies operating in various sectors which offer AI-based innovative solutions and analytical tools that accelerate transition to low-carbon energy sector.

Thus, the strategic decarbonization program designed in the UAE will have a profound effect on the country's economic and social development. By cutting the UAE's dependence on the oil sector, it will pave the way to creating new jobs, attracting foreign investment, and, accordingly, boosting national economy. Transitioning to "clean" energy sources will buttress the UAE's global standing as one of the leaders in environmentally-safe energy. Socially speaking, the transition will increase environmental awareness, improve population's health, and will prompt the public at large to engage with sustainable development issues. Developing educational programs guarantees that future generations will be actively involved in shaping a more environmentally-friendly economy.

The strategies of increasing energy exports using renewable energy sources will allow the UAE to retain its leadership in the energy market. Partnership between the UAE and BRICS+ opens up new opportunities for major projects aimed at cutting greenhouse gas emissions and ensuring energy security. Such interactions both accelerate the achievement of regional climate goals and help restore and diversify economies after the pandemic.

Therefore, the energy sector accounts for about one third of the UAE's GDP. Like many other major exporters, the UAE has always largely depended on gas and oil in ensuring its economic survival. However, long-term energy trends are expected to reduce this dependence. The UAE has witnessed a major price drop, which resulted in lesser use of fossil fuels compared to renewable energy sources. This transition may allow the UAE to increase energy exports by using renewable energy sources and cutting-edge technologies as well as other inexpensive options thereby preserving its status as a major market actor and advancing energy transformation.

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11 ADNOC uses innovative drone technology to plant mangroves // ADNOC [Electronic resource]. URL: https://www.adnocsourgas.ae/en/news-and-media/press-releases/2023/adnoc-uses-innovative-drone-technology-to-plant-mangroves (accessed on February 05, 2025)

BANGLADESH

Ariful Islam
Student

National
University
Bangladesh

Investments in Technology: Catalyzing Growth and Shaping a Sustainable Future

Thematic Vector

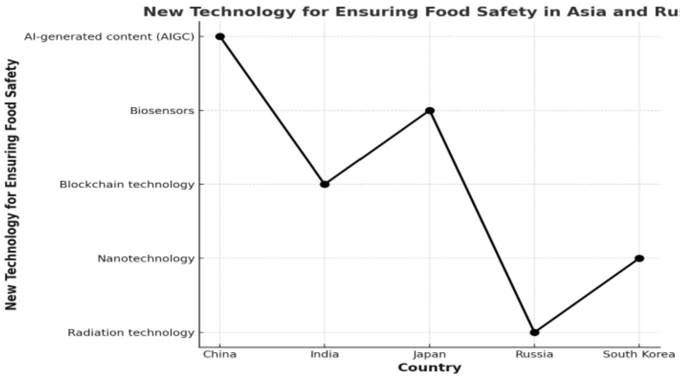
In the digital age, technology is the foundation of economic resilience and industrial progress. Strategic investments in AI, automation, renewable energy, and digital infrastructure can drive sustainable development, especially in the Global South and East. Prioritizing key sectors food security, healthcare, climate resilience, and cybersecurity unlocks economic growth and innovation. Nations embracing these advancements will lead the future global economy.

Preamble: Prerequisites and Relevance

Crafting this essay necessitates a deep understanding of the dynamic interplay between technology, innovation, and societal needs. The challenges we face from food insecurity and industrial stagnation to natural disasters and climate change demand comprehensive, forward-looking technological solutions. Emerging markets are already witnessing disruptive shifts. For instance, experts predict that Southeast Asia's digital economy could surge toward a gross merchandise value nearing US $1 trillion by 2030, driven by rising foreign direct investments and technological adoption. In this context, technology is not merely a tool for efficiency but a catalyst for inclusive economic growth, improved living standards, and enhanced societal resilience.

Revealing the Core Hypothesis

Strategic investments in technology can fundamentally reshape economies and societies. Analytical insights, statistical data, and predictive models converge on the hypothesis that targeted technological investments yield substantial returns in productivity, **GDP** growth, and social welfare. Below are ten discussion topics, each bolstered by insights, quantitative forecasts, and quotes from leading scientists, tech visionaries, and prominent investors;



1. New Technology for Ensuring Food Safety:

Advanced sensor systems and blockchain traceability can significantly reduce contamination risks. Tech investor Mark Cuban has predicted that emerging digital food safety solutions could reduce global food waste and contamination incidents by as much as 30% over the next decade. Below are some notable developments.....

Rapid Pathogen Detection – Affordable, paper-based tests detect Salmonella within hours, improving response time.

Extended Shelf Life – Chitosan-based coatings extend egg freshness up to 7 weeks without refrigeration.

Blockchain Traceability – Ensures transparent, tamper-proof tracking of food from farm to table.

Lab-Grown Meat – Sustainable, safe meat alternatives reduce environmental impact.

New FDA Traceability Rules – Stricter tracking regulations for faster recalls and outbreak prevention.

IoT Monitoring – Smart sensors track temperature and humidity to prevent spoilage.

AI & Machine Learning – Predicts foodborne illness outbreaks using big data analysis. Robotics in Food Processing – Reduces contamination by automating food handling and packaging.

2. Breakthrough Technology in Industry:

Breakthrough technologies are revolutionizing industries by increasing efficiency, reducing costs, and unlocking new capabilities. For example, AI in manufacturing is expected to grow at a CAGR of 41.2% (2021-2028), optimizing production lines and predictive maintenance. 5G technology is revolutionizing logistics and automation, with global 5G adoption projected to reach 4.6 billion connections by 2028. In healthcare, CRISPR gene editing is advancing treatments for genetic disorders, while quantum computing, expected to be a $9.1 billion market by 2030, is solving complex problems in finance, materials science, and cybersecurity. These innovations are reshaping industries at an unprecedented pace.

3. Changing Countries Sectoral Specializations:

New technologies are reshaping economies, shifting focus from traditional industries to high-tech sectors. AI and automation will create 97 million new jobs by 2025 (WEF). Economist Richard Baldwin notes, "Technology reshapes comparative advantage." Vietnam’s electronics exports now exceed $100 billion, outpacing textiles.

4. Artificial Intelligence: A Pervasive End-to-End Technology:

Artificial Intelligence (AI) is emerging as a crucial end-to-end technology, enabling businesses to automate tasks, improve efficiency, gain insights from data, and enhance decision-making across various operations

Here's a more detailed look at AI as a key end-to-end technology...

a. Automation and Efficiency:

- Process Optimization:
  AI can automate repetitive and time-consuming tasks, freeing up human employees to focus on more strategic and creative work.
- Streamlined Operations:
  AI can optimize workflows, reduce errors, and improve overall operational efficiency.

b. Data-Driven Insights and Decision-Making:

- Advanced Analytics:
  AI algorithms can analyze vast amounts of data to identify patterns, trends, and insights that might otherwise be missed.
- Predictive Analytics:
  AI can predict future outcomes based on historical data, enabling businesses to make more informed decisions.
- Improved Accuracy:
  AI can enhance the accuracy and speed of decision-making by providing data-driven insights and recommendations.

c. Enhanced Customer Experience:

- Chatbots and Virtual Assistants:
  AI-powered chatbots and virtual assistants can provide 24/7 customer support and answer customer questions.
- Predictive Customer Service:
  AI can analyze customer data to predict potential issues and proactively offer solutions.
  d. Applications Across Industries:
- Manufacturing:
  AI can be used for predictive maintenance, quality control, and process optimization in manufacturing.
- Healthcare:
  AI can be used for medical diagnosis, drug discovery, and personalized treatment plans.

5. Optimization of the Healthcare System Using Advanced Technology:

Advanced technology is transforming healthcare in Asia and Russia, enhancing efficiency and accessibility. AI-driven diagnostics enhance accuracy by 40% (WHO), while telemedicine expands services to 65% more patients in remote areas. Bill Gates states, "AI and digital tools will transform global healthcare." In India, digital health records cut hospital wait times by 30%, while China's AI-assisted imaging speeds up disease detection by 20%. In Russia, AI-powered medical analysis has improved cancer diagnosis rates by 15%, enhancing early treatment success.

6. Technological Solutions for Preventing or Minimizing Natural Disaster Impacts:

In Russia, advanced technology is enhancing disaster prevention. AI-driven early warning systems predict floods and wildfires 80% more accurately (Russian EMERCOM). Satellite monitoring has reduced wildfire damage by 30%, while drone surveillance improves emergency response by 40%. Vladimir Putin states, "Technology is key to safeguarding lives and infrastructure."

7. Technological Solutions for Water Resource Management Amid Climate Change:

Smart water management systems, leveraging IoT and data analytics, are critical in a warming world. Environmental scientist Dr. Vandana Shiva has stressed the importance of digital water management in mitigating climate impacts, and investor Vinod Khosla has argued that these innovations could improve water efficiency by more than 30%.

8. Cybersecurity in the Era of the Big Data Economy:

In Russia and Asia, cybersecurity is critical as the big data economy expands. Cyberattacks in Russia increased by 40% in 2023 (Kaspersky), with AI-driven defenses reducing threats by 30%. In Asia, financial cybercrime surged by 45%, prompting stricter regulations. Vladimir Putin states, "Digital sovereignty is key to national security." China's AI-powered cybersecurity systems now detect threats 50% faster, strengthening data protection.

9. Technology for Providing Accessible and Sustainable Energy:

In Russia and Asia, technology is driving sustainable energy expansion. Russia's investment in smart grids has cut energy losses by 20% (Rosatom), while AI optimizes power distribution. In Asia, renewables now supply 30% of total energy, with China leading in solar capacity at 500 GW. Vladimir Putin states, "Energy innovation ensures long-term security." India's smart grid projects improve efficiency by 25%, advancing energy accessibility.

10. Using Technology to Develop Smart Cities and the Platform Economy:

Technology is reshaping smart cities and the platform economy in Asia and Russia. Moscow's AI-powered traffic management has reduced congestion by 20%, while China plans to develop 500 smart cities by 2030, integrating IoT and big data for urban efficiency. Physicist Albert-László Barabási states, "Complex networks are the backbone of smart cities." In India, digital payments surged 40%, fueling a $100 billion e-commerce sector, while Southeast Asia's digital economy is projected to reach $1 trillion by 2030. Russian scientist Andrey Tikhonov highlights that AI-driven infrastructure can cut energy use by 25%, enhancing sustainability.

Emphasis on Economic and Social Effects

The economic and social effects of these investments are profound:

- Economic Growth: Targeted technology investments stimulate GDP growth and boost productivity. For instance, enhanced ICT infrastructure has a proven multiplier effect every additional US $ 1 invested may eventually generate up to US $ 5 in GDP growth.
- Job Creation and Sectoral Transformation: As industries modernize, new job opportunities emerge. The transition from labor-intensive sectors to high-tech industries not only elevates workforce skills but also creates new economic opportunities.
- Improved Public Services: Investments in smart city technologies and healthcare innovation result in better public services, increased efficiency, and a higher quality of life.
- Social Inclusion: When deployed equitably, technology can bridge social divides, empower marginalized communities, and promote widespread access to critical services.

General Conclusi ons and Expected Results

Strategic investments in technology offer a proven pathway to sustainable economic growth and social progress. The convergence of digital innovations from AI to IoT can reshape industries, enhance public services, and foster resilience in the face of global challenges.

With guidance from visionary scientists, renowned tech leaders, and astute investors, we are on the cusp of an era where technological integration not only elevates economies but also builds a more inclusive and sustainable society.

What We Should Do:

- Invest Strategically: Collaborate across public, private, and international sectors to invest in breakthrough technologies.
- Promote Inclusive Access: Ensure that digital innovations benefit all segments of society by improving digital literacy and reducing access gaps.
- Support Innovation Ecosystems: Foster environments that nurture R&D and technological incubation.
- Implement Responsible Policies: Adopt ethical frameworks and robust cybersecurity measures to safeguard data and privacy.

What We Should Not Do:

Neglect Social Impacts: Avoid investments that exacerbate social and economic inequalities.

- Underestimate Security Risks: Do not overlook the need for comprehensive cybersecurity in an increasingly data-driven world.
- Pursue Fragmented Investments: Avoid short-term, uncoordinated investments that lack alignment with long-term development goals.

MYANMAR

Aung Su Mon
Research officer
B.E (Electronics)
M.Sc (Biomedical Engineering)

Ministry of Science and
technology Myanmar

Empowering Engineers for the Future: Investing in People through Technology

Abstract

In Myanmar, the engineering sector plays a crucial role for economic growth; however, a lack of investment in people continues to hold back progress. The engineering sector is suffering skill gaps due to limited access to quality education, outdated training programs, and inadequate tech infrastructure. This study looks into how improving engineering education, building stronger connections with industries, and embracing new technologies like automation, renewable energy, and digitalisation could boost the skills of Myanmar's engineering workforce. It also takes a closer look at the importance of accreditation, international collaborations, and reforms in technical and vocational education and training (TVET) for creating a workforce that's ready for the future.Myanmar can close the skills gap, enhance employability, and promote sustainable economic growth by addressing these challenges and making the most of strategic opportunities.Investing in engineering education and workforce development is key to building a more innovative and resilient economy.

Background

The rapid evolution of science and technology has transformed industries, creating new opportunities and challenges for workforce development. Engineers and technical professionals must continuously adapt to new skills to remain relevant in the job market. Investing in people through technology is a strategic approach to equip individuals with the expertise required in Industry 4.0, automation, and digital transformation. One of the fundamental concepts that the engineer must fully understand if he or she is to succeed in today's global society is globalization. [1] In 2018, the Myanmar Sustainable Development Plan (2018-2030) was drafted. The goal of Pillar (2), which is job creation and private sector-led development, is found to be consistent with the goal of improving employment opportunities for the coming digital economy to further generate high-quality jobs and induce structural transformation. During the Covid-19 period, many difficulties arose regarding employment due to regulations. However, thanks to ICT technologies, people were able to work from home instead of having to go to work in person. Then, the goals of Pillar (3), which are human resources and social development for the 21st-century society and natural resources and environment for future generations of the country. Smart education is the use of ICT to make education more effective, efficient, and productive, and to enable people to make informed decisions. To adapt to the rapidly changing environment and society, teaching and learning environments must be connected to the people. Based on the vast amount of information available in the educational field, if we can use the information we need, we can share the knowledge level and learning support materials that we need to learn. People living in very remote areas and those who are economically disadvantaged can gain opportunities. The support of Big Data and ICT technologies can help build a knowledge-based society and create a competitive and capable society for the country. Some research has shown that AI and IoT (Internet of Things) are revolutionizing the way people learn and work. Digital platforms, simulations, and remote laboratories are enabling practical, hands-on learning experiences. Several studies indicate that nations investing in technology-driven education systems produce highly skilled professionals capable of driving innovation. [5] This study highlights that STEM subjects are frequently taught as separate entities without sufficient integration of technology and engineering into science and mathematics. This lack of integration can also extend to a disconnect with arts and creativity, limiting the effectiveness of STEM education. Many education systems are currently focused on addressing perceived or real shortages in the STEM workforce. This has created pressure to improve STEM education outcomes that may not effectively match the needs of a rapidly changing global economy. [6] Myanmar grapples with insufficient technological infrastructure, which affects the availability of quality engineering education. The study notes that many educational institutions lack the necessary resources to provide modern engineering programs, resulting in lower educational outcomes. Despite an increased enrollment in higher education, there persists a notable skills mismatch in the labor market. Graduates often do not possess the necessary competencies and advanced ICT skills that employers seek, particularly in engineering fields. This mismatch is often attributed to a lack of practical training and inadequate curriculum alignment with industry standards.

Methodology

This study uses a qualitative approach, focusing on secondary data from sources like academic journals, government reports, and industry publications to look into how technology affects the development of Myanmar's engineering workforce. A review of existing literature helps us understand current trends in engineering education, skill development, and international collaboration that contribute to the country's economic growth. The study also includes a case study analysis to see how emerging technologies— like automation, renewable energy, and digitalization—are influencing both engineering education and industry practices. Additionally, it examines the effectiveness of accreditation systems and technical and vocational education training (TVET) reforms in preparing the workforce. By combining insights from various sources, this research highlights the key challenges and opportunities within Myanmar's engineering sector and provides recommendations for improving human capital investment. The goal is to give policymakers, educators, and industry leaders practical advice on how to strengthen engineering education and workforce development, helping Myanmar achieve sustainable technological and economic growth.

Challenges and Opportunities

[2] Myanmar leads the world in terms of gender parity in engineering education, with 65 percent of graduates being women. However, the country still faces challenges in research, infrastructure quality, and employment. The Engineering Index scores 21% in Myanmar, reflecting its overall engineering capacity. This report also highlights the importance of Technical and Vocational Education and Training (TVET) reforms in building a skilled workforce across various sectors, including engineering. These reforms offer opportunities for educational institutions to create curricula that closely match industry needs, improving graduate employability. In Myanmar, engineering education is gender- balanced; significant improvements are still required in infrastructure and overall capacity. [3] So, strengthening engineering education through accreditation and quality assurance is a key investment in human capital. By equipping engineers with advanced skills via accredited programs, Myanmar can develop a more capable workforce that drives national development.The collaborations with organizations like FEIAP, CIE, and IEET for training and accreditation signify an investment in people through knowledge

transfer from experienced professionals in the engineering field. This helps elevate the local educational standards and prepares students for international engineering practices. The push for accreditation and the development of quality engineering programs aim to meet the demands of a changing job market. By investing in the education of engineering students, Myanmar is working towards aligning its workforce with the needs of both national and global economies.

[4] This report, emphasising TVET (Technical and Vocational Education and Training) reforms, aims to create a skilled workforce in various sectors, including engineering. This presents opportunities for engineering educators and institutions to develop curricula that align with industry needs, enhancing the employability of graduates. There is a pressing need for innovation and technology adaptation in various engineering fields. Engineers in Myanmar can engage in R&D to improve existing technologies and processes, especially in sectors like construction and environmental management. Despite the growing digital economy, there is a significant gap in digital skills among the youth. Young people in Myanmar may lack the necessary ICT skills, which can hinder their employability in a technology-driven market. Access to stable internet and technological devices remains a barrier in rural areas and for less affluent students, limiting opportunities for online learning and technological advancement. Greater focus on intra-regional cooperation and exchange programs can lead to enhanced educational mobility and exposure for Burmese students, broadening their horizons and fostering collaboration among ASEAN member states.

Future Prospects

The era of Industry 4.0 includes advanced technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), automation, and big data analytics. Combining these innovations can significantly improve productivity and efficiency in key sectors in Myanmar, including manufacturing, agriculture, and services. As global businesses rapidly adopt these technologies, Myanmar risks falling behind if it fails to embrace digital transformation. Gaining a competitive edge in global markets will require substantial investments in technology and infrastructure. To foster innovation and Industry 4.0 adoption, policymakers must implement regulations that encourage technological advancement rather than hinder progress. Engineers should be actively engaged in research and development (R&D) projects that explore the local application of these technologies, promoting adaptability and innovation. Upgrading educational institutions is also essential to equip students with the skills needed for the digital era. This includes providing state-of- the-art laboratories, modern tools, and access to online learning platforms that facilitate hands-on experience with contemporary engineering technologies.

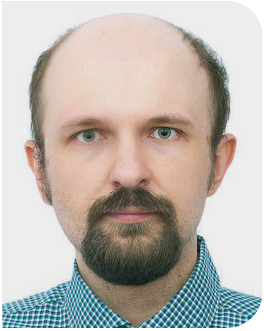
Myanmar can further strengthen its engineering sector by establishing international partnerships with countries such as Russia, China, and ASEAN member states. These collaborations—through student exchange programs, faculty development initiatives, and joint research projects—can provide Myanmar's engineers with global exposure and access to cutting-edge innovations, ensuring the country remains competitive in an increasingly technology-driven world.

Conclusion and Recommendations

Engineering education plays a key role in Myanmar's economic development, directly influencing the growth of infrastructure and essential services. Although 65% of engineering graduates are women, gender gaps still exist when it comes to professional opportunities. The sector also faces challenges due to poor infrastructure and limited resources, which affect how effectively engineering talent is used. By building stronger connections between universities and industries, Myanmar can give graduates practical experience through internships and job placements, which can increase their chances of finding employment. Additionally, investing in infrastructure can improve both learning conditions for students and working environments for engineers. Forging global partnerships is vital to advancing Myanmar's engineering sector. Collaborating with international organizations and neighboring countries creates opportunities for knowledge exchange, expertise sharing, and the implementation of best practices. As the demand for skilled engineers rises worldwide, Myanmar's ability to tackle emerging challenges will hinge on the strength and readiness of its workforce.

References

1. "The Government of the Republic of the Union of Myanmar Ministry of Planning and Finance Myanmar Sustainable Development Plan (2018-2030)," 2018.
2. "Engineering and economic growth: a global view A report by Cebr for the Royal Academy of Engineering," 2016.
3. DEVELOPMENT OF THE ENGINEERING EDUCATION ACCREDITATION IN MYANMAR.
4. Tanaka S, Spohr C, Amico SD'. Myanmar Human Capital Development,Employment, and Labor Markets [Internet]. 2015. Available from: www.adb.org
5. Kelley TR, Knowles JG. A conceptual framework for integrated STEM education. Vol. 3, International Journal of STEM Education. Springer; 2016.
6. The State of Higher Education in Southeast Asia.



Azarov Konstantin
Senior teacher

St Petersburg University

Dr Yong Liu
Senior Assistant Professor,

University of Brunei Darussalam

I'm Your Man, but Do We Have a Common Sense *(Gemeinsinn)* to Live Together Harmoniously?

It is probably not obvious why anyone would want to use Kant to address contemporary issues such as AI. However, Kant was unique in Western philosophy because he was interested in non-human intelligence, particularly in extraterrestrials, and wanted his word to be valid for any sapient beings, not only humans. Moreover, Kantian philosophy has been undergoing a renaissance in recent years, mainly due to his position regarding the proportion of the world and reason (or, in modern terms, the brain) in Kantian interpretation of cognition. While two radical views contemporary to Kant believed either in world-first-cognition, a position called empiricist or sensualist, or in the reason- (/brain)-first-cognition of the so-called rationalists, Kant tried to find common ground between the two by formulating his conditions of human cognition. Kant did not search for the first element but for a set of elements in cooperation building our perception of reality. As there is no such thing as absolute space, we need our cognition, or reason (Vernunft), or brain, in contemporary language, to create space and time for us. The brain works this way, as we now know. A baby rat, for example, will not be interested in space, it will not explore it until a particular zone of its brain matures, so it needs a form of transcendental aesthetics for space.

Kantian approaches to reason deserve attention because they belong to the genealogy of contemporary common perception of brain-world interaction. However, even in regards to AI it is a way to go. This is not the first approach to the subject, Kant and Artificial Intelligence, published by De Gruyter in 2022 can be the biggest previous example, but there are many more such cases. Scholars were using Kant for image recognition, applying Kantian ethics for neuromorphic programming and were doing many more things with AI and Kant. The recent celebration of Kant's tercentenary (2024), centered at Baltic Federal University in Kant's native city consolidated the research around it. Moreover, by using Kant, it is possible to incorporate the research on AI into the broader context of world philosophy, considering the level of research done in this regard to avoid the repetition of old mistakes.

De Gruyter presented a wide range of Kantian approaches to AI in 2022, and, as was mentioned above, there are numerous other scholars creating different Kantian interpretations of AI problem, either generally or in specific aspects of this fundamental issue. However, it is the first approach

that is based on Kantian common sense (Gemeinsinn). The choice was made for two reasons. On the first hand, Kantian common sense is a conception related to the architectonic frame of our reason, and aesthetics, although it is not aesthetic per se, so it is a convenient tool for bridging AI and different aesthetic problems, ranging from painting to cinema.

The other important feature of this conception is its discursive nature and richness in intercultural communication. Kant was rarely a very historical-minded philosopher, but through his interpretation of common sense he entered into dialogue with philosophers ancient, medieval, and contemporary to Kant. Christian Wenzel noted in An Introduction to Kant's Aesthetics: Core Concepts and Problems (2005) that many of the currently discussed issues in the philosophy of mind are very much related to Kantian common sense.

Kant deals with common sense in the third Critique, in sections 18–22 to return to this problem in section 40. The main point regarding the logic of common sense in sections 18–22 is that we need something in common to experience beauty. And this communality is of very specific nature. Kant probably means much more here than the Habermasian public sphere (Öffentlichkeit). Indeed, in section 22 Kant wonders about the nature of taste, is it fundamental or only artificial faculty (künstliche Vermögen) (5: 240). To be a convention, as part of a broader creation of bourgeois self- perception, one needs to show how for Kant taste is the latter. But in section 40 Kant seems to make a different conclusion. The power of judgement is a source of one of three maxims of common understanding along with understanding and reason which themselves provided two more such maxims. Additionally, in section 40 Kant separated the meaning of “common” sense from the “vulgar” meaning of the word "common" (5: 293). It is not about convention for everyone, but a special mental exercise to make a person up to quite demanding special standard (which is postulated through the maxims of common understanding). The role of taste here is to expand our minds ("erweiteren"), because Kant called the maxim this faculty provides the maxim of expanded thinking (erweiterten Denkungsart) (5: 294). This expansion is needed to overcome all limits set due to our personal conditions.

Sometimes, Kant is viewed as a proponent of objectivity of taste, for instance in Hal Fosters' et al. fundamental Art since 1900 it is put like this. However, it is an oversimplification of Kantian demands for the judgement of taste. If Habermas wanted Kant to desire too little, such interpretations want Kant to desire too much. And it is a common-sense problem again, because the question is about the modality of judgement, which was discussed in the fourth moment of the Analytic of beautiful (the same sections 18–22). Here Kant explicitly claims that modality of the judgement of taste is not objective. It is not fully subjective or fully inter-subjective either. Instead, the judgement of beautiful belongs to subjective necessity. It is between objectivity and subjectivity. In a nutshell, idea is that we want everyone to agree with our claim that something is beautiful, but if we did our research on our feeling and it does belong to the power of judgement as Kant defines it in the first three moments of the Analytic, then all we want is that, granting a person have our cognitive faculties, he or she will experience the same thing we are experiencing.

Now we can imagine an artificial intelligence attached to the human eye or ear. Will such a device share subjective necessity? It is not a question whether it will be a person, the value of this particular thought experiment is that we need something much less demanding, hard to explain or define than what a "person" is. Suppose a Kantian aesthetician lent an AI his or her ear. By using future technology, he let a computer consume sense data coming from that ear. The Kantian aesthetician then tasted a number of musical tracks and recorder noises, and judged them according to his or her taste as beautiful or ugly. Will the coincidence of his or her judgements and judgements done by AI via his or her ear prove the inclusion of AI in the subjective necessity of taste?

Another good question is whether it is not done already on the social media, where algorithms for the sake of discoverability of small creators can suggest them to the audiences preselected in accordance to their tastes judged. In a sense, contemporary AI has one particular transcendental power, and it is not power of judgement itself, but rather power of judgement of judgement. Some kind of meta-taste. We of course can say that it is only formal manipulation of two sets of symbols, one – content created by small and big creators on social web service, and other – human beings, who in this situation are not considered as ends in themselves. However, they are not considered this way by AI. For AI all is formal, however formality is exactly what Kant seeks for taste. Free play of our understanding and imagination, responsible for beauty, finds an interesting analogue in free play between creators and viewers created by social web algorithms to boost some creators, limit or even shadow ban other creators.

We are probably mistaken if we see AI as real minds as Dneprow and later Searle have shown. However, we can see the beauty of AI and AI can see the beauty too. This commonality potentializes to form up a "common sense", or in Kantian term, "Gemeinsinn", or "sensus communis" in traditional Latin notion, between human beings and AI, to communicate with one another based on a mutually understanding and judgment of taste for the aesthetic purposes. Drawing on the third moment theorized in Kantian aesthetics on a parallel between aesthetic reflection and rational reflection, Wenzel (2005) interpreted: "As in moral reflection we are at the same time the subject and the object of our thoughts, similarly, in aesthetic reflection, the object judged and the judging subject should also be the same. And since only human beings are capable of moral reflection, so only the human body will qualify as the object of an analogous aesthetic reflection" (Wenzel: 74). While human beings can see the idea of humanity in a humanoid AI and find his inward character and virtues, and "the ideal consists in the expression of the moral" in this humanized figure, can humanoid AIs see and find the corresponding character and virtues as well as moral reflection from human beings in such an inter-subjectivity relationship?

Although Humanoid robots cannot equate human beings…yet, they are definitely not extraterrestrials, which, based on Szendy's interpretation of Kant, "could not be given figure or fiction with no tie whatsoever to earthly anthropology", while human beings "cannot see themselves…as a reasonable species or race within the universe, unless they detach themselves from their planetary ground and base as a way of being transported, at least in their imagination, toward the point of view of the wholly other" (Szendy: 55). Without such a point of view of the "wholly other", Kant declares that "the 'terrestrial rational being' is thus impossible to characterize and condemned to remain undefined or undetermined" (Szendy: 47). In Anthropology from a Pragmatic Point of View, Kant claims that human beings have no knowledge of non-terrestrial beings (extraterrestrials) thus unable to indicate their characteristic property so as to characterize our own being among rational beings through the extraterrestrials. Then, who else might provide a point of view of the "wholly other" likely comparing two species of rational being with the faculty of recognition and imagination in contemporary context? Furthermore, the next question could be, whether a future humanoid AI might attain the sense of "an ideal of beauty by connecting the representation with moral ideas and the idea of humanity" (Wenzel: 74), considering technological advancement is rapidly leading AI to be prevalent and assistant in the daily lives of humanity, reluctantly or voluntarily, like it or not. Someday, sooner or later, AI might attain their own state of mind by receiving more effective trainings and engaging more real-life communications with human beings. This is the futuristic scenario in the German sci-fi romcom I'm Your Man (Ich bin dein Mensch, 2021) that happens between a middle-aged, single female researcher Alma and Tom, who is a humanoid robot customized as her ideal life partner, during a three-week real-life experiment. After the trial, Alma must write a report about whether humanoid androids may become life partners to human beings and what humanoid rights might be entitled.

If self-awareness is a benchmark for consciousness (Su, 2024), Tom is unlike the current machine learning AI, but specifically programmed to satisfy the middle-aged researcher Alma not only for her daily life and work assistance, but also for her deep soul and psychological demands – how to deal with her loneliness and nuanced emotional satisfaction. Although she does not request it voluntarily, perhaps that is exactly the reason why she was selected to be involving into this three- week trial project – she is the only single person in her department, as per her supervisor, and she needs her next research grant to be approved as a compensation of attending this human-humanoid pilot trial. So, Tom, according to Su (2024), is "a truly motivated, conscious AI would be able to set its own goals", who has his "goodness of soul, or purity, or strength, or repose" (Szendy, 2013). As a conscious AI, Tom's program enables him to acquire knowledge of the world and himself, and then form up his motivations based on his main goals of satisfying Alma and inform them repeatedly and progressively, which is similar to how the programming of human brains allows us to gain the worldly knowledge that informs our decisions. Such a capacity for autonomous goal- setting and volition of qualities for conscious beings e.g. self-interest and altruism, which Tom possesses both, substantiates his thoughts, emotions, likes, dislikes, motivations, and other conscious behaviors, through his self-aware subjective experiences while interacting with Alma.

Tom tries to pamper Alma with a romantic candle bath at the first night moving into her apartment, but ends up knowing Alma does not belong to the majority "93% of German women dream of this"; in the next morning, Tom cooks breakfast for Alma but she does not have time to enjoy it; then Tom tidies up Alma's messy apartment and later realizes she does not like it at all, so he restores her apartment back to its original state by putting everything back to the original place; Tom does not need to eat or drink anything, but he can pretend to buy and enjoy a cup of joe and sit in a coffee shop all day waiting for Alma off her work. In short, Tom does invest his thoughts, feelings, and emotions to live together with Alma during the trial period, although sometimes it does not work out; however, when Alma gets drunk after an unhappy gathering with friends and attempts to irritate Tom to initialize an angry sexual intercourse, he pauses at the very last minute and disappoints her by showing his self-dignity, which appears one of the intrinsic qualities of humanity. In short, Tom indicates both self-interest and altruism, as well as his emotional investment, into the relationship with Alma. Especially in the end, Tom knows where Alma would go to find him after disappearing from her apartment. He goes to the small town in Denmark, where Alma used to spend summer holidays with her family and had a crush on a Danish boy when she was a teenage girl; sitting on the very Ping Pong table on which Alma used to lie down and dream of the kisses from the Danish boy, Tom awaits Alma coming for their reunion. She does come and lie down on that Ping Pong table, closing her eyes and waiting for a kiss from him...This is the first time Alma willingly, without any hesitation, returns to Tom's service, or his emotional investment, or his altruistic dedication, during their kind of inter-subjective but mostly one-sided relationship, opening up a possible feature for their relation after they eventually reach rather a feeling of sensus communis (in Kant's word Gemeinsinn), a feeling of their own state of mind.

Although Gemeinsinn's philosophical connotation goes beyond everyday practicality of human beings, it does refer to a "shared sense of community" or "collective understanding" that binds people together. "Such a common ground would be the 'condition' of the necessity of the agreement of others. It is at this point that Kant introduces the traditional notion of Gemeinsinn, or sensus communis: 'The condition of the necessity that is alleged by a judgment of taste is the idea of a common sense [die Idee eines Gemeinsinnes]' (title of section 20)" (Wenzel: 83). On this common ground of Gemeinsinn, we can further discuss the judgment of taste, value, beauty and ethics, such as mutual respect, aesthetic reflection, and moral reasons set by the Kantian "higher principles of reason", and how to construct social cohesion through a sense of personal belonging and individual responsibility to others.

This common ground of Gemeinsinn has so far mostly applied to discuss moral and social issues of human societies, yet rarely adopted to discuss the human-to-humanoid AI relationship, which might be soon generating more moral and social awareness and quandary amid the increasing prevalence of humanoid androids entering everyday human life. The dilemma demonstrated in I'm Your Man is emphatic on the fragile relationship incepted between Alma and Tom, for which the primary purpose is to assist someone like Alma and Dr. Stuber to deal with their loneliness and social isolation so as for them to live a happy life again; however, without a necessary Gemeinsinn as a precondition in the unfolding relations between Alma and Tom, Dr. Stuber and Chloe, such an artificial relationship is only one-sided nearly, if not completely, based on Tom's and Chloé's altruistic giving, although both of them are conscious beings as well and capable of thinking, feeling, even reasoning, with self-interest and self-awareness. When interpreting Kantian concept of Gemeinsinn, Wenzel (2005) claims that "there might be a moral 'interest' behind the 'mere communicability' of a feeling, that would explain 'how it is that the feeling in the judgment of taste is expected of everyone as if it were a duty'" (Wenzel: 85). Therefore, although a point of view from the kind of 'wholly other' is impossible, according to Kant, it is important for him to introduce a necessary condition of the agreement of others as a sensus communis as a moral prerequisite to enable any ethical and aesthetic judgments, also for us to adopt Kantian Gemeinsinn to consider the evolving relationship between human beings and humanoids. Otherwise, our human society, which is increasingly comprised of human beings and accompanying AI humanoids, cannot move forward and guarantee sustainable and everlasting benefits merely for the mankind. For the critical development of motivated, conscious AI, as the next step, to integrate both motivation and emotion into a human-like android and fully replicate human minds, some researchers suggest such self- aware and sentient AI humanoids should have moral rights and deserve legal protections (Akova, 2023; Su, 2024).

A fictional epilogue or a new episode of the story of I'm Your Man could be continuous that after the reunion with Tom in the small Danish town, Alma decides to withdraw her original report that strongly advises against authorizing humanoids as life partners; however, it is too late to reverse her conclusion she made to the committee and Tom will be sent back and fatalistically dismantled. Alma is emotionally devastated and keeps herself alone as a workaholic as before. Now the protagonist switches to Dr. Stuber and his humanoid partner Chloé, whom he manages to negotiate a deal that he can legally keep her as his life partner. However, after a few months, his ever strongly experienced happiness living with Chloé wanes down gradually thus he demands a legal separation – a kind of "divorce" – from his humanoid life partner, which causes a lot of legal quandary and debates. Both Dr. Stuber's legal team and Chloé's, if there is any lawyer willing to represent her, feel very difficult to reach a consensus, so does the judge, because there are not many appropriate laws that might be applied for a lawsuit between two kinds of conscious beings – humans and humanoids. Meanwhile, both the lives of Alma and Dr. Stuber return to unhappy again, which is completely opposite to the original intention when they accepted, willingly or unwillingly, a humanoid life partner customized to make their respective lives happy by satisfying their desires, fulfilling their longings, and eliminating their loneliness...Quite few people still remember the erased humanoid Tom or care much about the misfortune and disastrous feeling of Chloé – Dr. Stuber's humanoid ex-wife or ex-partner.

To conclude, it is necessary to mention one more time, that AI is not a real person, but only its simulation. Even if capable of aesthetic judgment, AI, as not a person, is incapable of love but only its imitation. From the viewpoint of the investment in future communication, it is necessary to remember, that the purpose of communication is to connect human beings, and not to create for their substitutes. The latter strategy will necessarily fail, a commodity designed to replace a human being will end in catastrophe on a personal or social scale. However, a matching algorithm could be a much better solution, for example, if robots from I'm Your Man would try to unite Dr. Stuber and Chloé or find them living companions. Aesthetic taste is not enough for human relations, and AI by itself will never be a solution for loneliness, only its severe complications.

Reference

1. Akova, Firat. (2023). Artificially sentient beings: Moral, political, and legal issues. New

Techno Humanities, Volume 3, Issue 1. Pages 41-48.
2. Kant, Immanuel. (2000). Critique of the Power of Judgment. Translated by Paul Guyer & Eric Matthews. Cambridge: Cambridge University Press.
3. Kant, Immanuel. (2006). Anthropology from a Pragmatic Point of View. Translated by Robert B. Louden. Cambridge: Cambridge University Press.
4. Kim, Hyeongjoo and Schönecker, Dieter. (2022). Kant and Artificial Intelligence. Walter de Gruyter GmbH, Berlin/Boston.
5. Su, Jacob. (2024). Consciousness in Artificial Intelligence: A Philosophical Perspective Through the Lens of Motivation and Volition. Critical Debates in Humanities, Science and Global Justice, 3(1).
6. Szendy, Peter. (2013). Kant in the Land of Extraterrestrials. Translated by Will Bishop. Fordham University Press.
7. Wenzel, Christian. (2005). An Introduction to Kant's Aesthetics: Core Concepts and Problems. Blackwell Publishing.

RUSSIA

Bogdan Ignat

Head of the Center for Digital Sociology and Socio-Humanitarian Technologies in Healthcare

Research Institute of Healthcare Organization and Medical Management of Moscow Department of Healthcare

Investing in Technologies: Toward Healthcare of the Future

Today's technological trends in developing the healthcare system involve accumulating and using big data; developing and introducing artificial intelligence both for handling medical tasks and for general health conservation purposes; moving away from head-on healthism propaganda toward changing the environment that will promote the necessary self-preservation behaviors; recognizing the key role people themselves play in preserving their health; emphasis on human-centricity, and, consequently, more intensive introduction of socio-humanitarian approaches to healthcare such as using Behavioral and Cultural Insights (BCI) approach proposed by the WHO to understand the subjective motivations behind people's attitude to their health. Proceeding from these trends, we can predict the image of the healthcare of the future that the system is progressing toward today. This essay will briefly outline the author's vision of the further course these trends will follow.

First, it is big data. Their volume will certainly continue to grow as will capacities for their efficient processing. We will be able to collect increasingly large amounts of data both about population at large and about individuals. Health-related gadgets people use to monitor their physical and emotional states should evolve toward providing more compatible data; these data can also be augmented by additional self- observation data from people's diaries and notes. Speech-to-text software and other artificial intelligence apps will make it easier to collect indicators and structure the data about a person into a single dataset. Greater standardization of algorithms for collecting health data will help the health sector progress in that direction.

These trends make the already-urgent issue of the value of personal information all the more pressing. Today, there is a shortage of data for machine learning, while using large amounts of synthetic data in machine learning has an adverse effect on the quality of resulting models. Should these trends continue, we can agree with experts that rare and rich human health data will become increasingly more valuable. Such data can easily become a new "currency," and granting access to such data to be used to train specialized neural networks will become a major source of revenues for the individuals granting such access. We can suppose that the future will see the emergence of data owner panels similar to today's online survey panels; instead of their time, these owners will be selling access to the required data on their health. Blockchain technologies may become important in this process as they record data authorship and data transfer chains. There will be other mechanisms for exchanging such data, such as voluntary transfer of depersonalized information in exchange for using AI products including those that use these data to learn, etc.

This is not the only function that artificial intelligence could perform in healthcare of the future. In addition to systematizing data and transferring them between modalities, AI can be used in communications. For instance, even today, combining large language models and additional databases using the RAG approach allows users to "communicate" with data: when a person queries the system, it can use the data on the person's health and a cutting-edge information from medical reference books to give a correct, well-founded, and personalized answer to any query concerning that person's health. LLMs can play an equally important role in psychodiagnostics: following communications with a person, such an LLM can "read" their psychological profile and therefore personalize communication. Understanding what is "correct" healthwise and pleasant for a specific person makes it possible to develop recommendations that make healthy lifestyle more pleasant. Essentially, LLMs can serve as basis for "health coaches" guiding people's health-related behavior.

Today, as many researchers state, we, indeed, can see the birth of full-fledged "technosubjects" represented by AI. AI is increasingly learning to think like a human being (or at least imitate such thinking). AT is becoming increasingly skilled at (imitating) empathy and emotionality provided it is set the appropriate role. This development paves the way for the "digital doubles" technology that is being developed today: we can create a full-fledged digital model of a person for testing those social hypotheses that could not be tested on real people for ethical reasons.

On the other hand, the "technosubject" can far exceed people in performing calculations with far greater speed and completeness, which is paving the way for using AI as a full-fledged researcher that independently generates and tests hypotheses. This is a trend we see today already. These developments posit urgent questions of ethics and of drawing boundaries between the work of AI and human beings.

Another key application of neural networks is prediction and "alerting" systems when consequences of certain decisions concerning health may be predicted and current state of health can be extrapolated to provide recommendations or, in emergencies, to alert the medical services overseeing that person's health. The predictive function improves the efficiency of continuous monitoring systems that could be launched even today, yet in the future, they should become multimodal.

Multimodal expansion could logically result in integrating the infosystems designed to care for an individual's health and for the environment; such an integrated system should become individual-friendly. For instance, while developing recommendations, the system managing a person's health could interact with the environment information about nearby green spaces, the state of the environment, availability of required foods, sports infrastructure, etc. It would also be logical to build reverse links when environmental planning for a specific territory would be tailored to its population's health needs both short-term and with account for seasonal changes and predictions for the future (such as the aging predictions for a given territory's current population).

Another possible trend in health integration involves moving toward general well-being, integral health. The World Health Organization rightly notes that, in addition to one's physical condition, health also includes mental and social health. It would therefore be logical to integrate data on one's physical state with data on their mental state that could also be collected as part of interaction with mental health services, gadgets, diaries, and other sources of information about mental well-being. The same is true for social well-being. Therefore, medicine's movement toward biopsychosocial approach should logically be reflected in the future of the healthcare system. It can be institutionalized, among other things, through establishing a social well-being ministry similar to Russia's former Ministry of Healthcare and Social Development, except the new ministry would function on a different level and on a different fundamental basis.

The above-described opportunity growth will likely create certain imperatives mandating that people care about their own health and the health of those around them, which may take certain legal forms.

Previously, we described healthcare system transformation as related to patients. Yet, healthcare system transformation as related to healthcare providers will be no less important.

Transforming the functions of the healthcare system, which entails, in particular, large language models and other neural networks "taking over" certain functions will lead to changes in medical personnel's training. Medical personnel will have to have better "digital" literacy, be able to interact with neural networks that will be their aides taking on routine tasks and helping in difficult cases. We can also agree with the statement that as neural networks take over some of medical personnel's functions, the role of medical personnel's "soft skills," service and communication skills, will grow both in private and in public medical care. Medical personnel can be largely responsible for creating the "human" atmosphere that is still largely beyond the abilities of neural networks. Humanitarian aspects in doctor-patient communication will become ever more important, and that will include legal, ethical, and psychological matters.

As professionals' functions change, statuses may be redistributed between medical occupations; compared to the current situation, the roles of such "quiet" medical professions as a nurse or a paramedic can gain importance.

This real transformation of a medic's functions should be accompanied by changes to their image that would be part of the overall transformation of healthcare system perception by both employees and population. Work on shaping the new image of the healthcare system should be started in advance since social perceptions are usually quite entrenched.

The developments outlined in this essay appear to be not so much fantasies as predictions of AI development in medicine. The greater part is already being implemented, even if in incipient forms. However, much work still lies ahead, including the work to be done in the humanities: working through the issues of law, responsibility, ethics, and psychology. Ultimately, progress is not the goal in itself; the main measure of a successful healthcare system today and tomorrow is the human being and their well-being.

MEXICO

Calderon Lara Noradilda

Graduate student

Metropolitan Autonomous University

Innovation and Development of Sovereign Cybersecurity Infrastructure: Global South and East in the Face of Cyberthreats

Introduction

Development of information and communications technologies (ICT) facilitates interaction between people and countries, accelerating data flows and increasing its transmitted volume. According to Statista (Petrosyan, 2025), today, 67.9% of the world population, or approximately 5.5 billion users, are connected to the internet. At the same time, 2.6 billion people, or one third of the global population, have no access to the internet (Kallot, 2025). This data illustrates the scale of ICT penetration even in remote corners of the world. Besides, web usage depends on per capita income: for example, 93% of the citizens in high-income countries are active internet users, while in low-income economies their share is as low as 27% (Petrosyan, 2025).

The internet knows no boundaries as it transcends the barriers of distance and time. State borders become increasingly blurred, emerging disruptive technologies create new challenges in cyberspace, and digitalization is getting more engrained in our daily lives. Progress, however, has its downside. Less technologically developed nations find themselves at a disadvantage to the more advanced peers as countries with insufficient resources and their cyberspace depend on technologies supplied by others. So "the more dependent and peripheral their position in the physical world, the more dependent and peripheral their position will be in digital or virtual reality." (Arroyo, 2021-present, 12m 20s).

As a result, technological dependence poses a threat to the national security of countries in the Global South and East. Vulnerable and/or insufficient technological infrastructure to counter cyberattacks makes them an easy target for those seeking to undermine their security in cyberspace.

Nevertheless, new challenges come with new opportunities. The lack of sovereign infrastructure and the massive expansion of artificial intelligence (AI) force people to take a broader view of the problem and find new solutions. Investment in technologies and their application in education along with implementation of innovative programs in strategic sectors can produce a whole new environment where the technology industry will have its own capability to develop the necessary infrastructure for sovereign cybersecurity.

Political will and Investment in Cybersecurity: Developing Technologies in the Global South

People around the world spend more time on the web and, as a consequence, are more dependent on services provided by high-tech giants. Information on government and private computers and platforms becomes increasingly vulnerable as governments and international organizations interact extensively through online platforms that are accessible to huge numbers of users.

Therefore, cybersecurity strategies need to be continually reviewed to assess their effectiveness and scope. This process should include technologically disadvantaged nations because cyberspace cuts across all borders and cybercriminals can use vulnerabilities in less protected countries to achieve their objectives in other states. Within the framework of the New Platform for Global Growth, this issue will certainly continue to evolve, changing the international agenda and creating new challenges for decision-makers.

Investing in cybersecurity is equivalent to investing in national security. Relations and engagement between countries rely increasingly on new technologies, while interaction through electronic devices connected to wireless networks are already part of the day-to-day international activities in different areas, such as finance, military operations, water and electricity supply services, and all types of communication.

According to a World Bank report, the number of cyber incidents is growing at 21% a year. This trend is especially prominent in Latin America and the Caribbean where growing cybercrime affects the developing economies (Vergara, 2024). Globally, 30% of cyberattacks target the countries of the Global South, entailing significant economic losses and negative social consequences, such as public distrust of digital services that in turn could lead to political and social instability.

The report also highlights the growth of the global cyberinsurance market, which is estimated to have increased by $14 billion by 2023 and expected to reach $30 billion by 2027 (Statista, 2025). To narrow the digital divide, the countries of the Global South and East need to focus on education, training and investment, while “maximizing existing resources and leveraging the benefits of Global North models.” (Kallot, 2025).

Conclusions

The integration of AI into cybersecurity systems and rising ransomware cyber-attacks pose increasing challenges, especially for countries that do not have legal mechanisms to give confidence to the public and the business. Such countries are the most likely to suffer social and economic damage from cybercriminal activity.

The absence of cooperation instruments that could strengthen nations is another disadvantage, in addition to the lack of investment in development and innovation. However, a holistic approach to investing in national cybersecurity companies as well as putting the issue on the political agenda could be a major step towards significant outcomes, helping to:

- Create regional centers of excellence in cybersecurity based on shared expertise.
- Build a new development and innovation ecosystem in the countries of the Global South and East.
- Create new jobs, preventing brain drain to high-income countries.
- Reduce technological dependence regarding the protection of critical infrastructure.

Although it is an ambitious long-term plan that would not produce any tangible results until much later, it is already important to take joint action involving the academia, public and private sectors, as well as the society at large to build national and regional capabilities that could respond to the global challenges of the future.

References

1. Arroyo Belmonte, Rocío (2021-presente) ¿La geocultura de la digitalización? Bróker Internacional [Podcast]. Spotify. https://open.spotify.com/episode/00x9o2J1YfhHL99ImzZqio
2. Petrosyan, Ani (2025) Número de usuarios de Internet y redes sociales en todo el mundo en febrero de 2025, Statista, https://statista.uam.elogim.com/statistics/617136/digital-population-worldwide/
3. Kallot, Kate (2025) El sur global necesita apropiarse de su revolución de la IA https://www.project-syndicate.org/commentary/global-south-must-use-ai-to-build-better-world-by-kate-kallot-2025-02/spanish
4. Statista, (2025) Cyber insurance – statistics & facts https://statista.uam.elogim.com/topics/2445/cyber-insurance/#topicOverview
5. Vergara C., Estefania (2024) Economía de la ciberseguridad para los mercados emergentes, panorama general, Banco Mundial, https://asbasupervision.org/biblioteca/economia-de-la-ciberseguridad-para-mercados-emergentes/

MEXICO

Castellanos Lara Moises Efrain

Student

National Autonomous University of Mexico

Global energy transition: towards sustainable energy beyond renewables

This paper focuses on investments in technologies that enable affordable and sustainable energy. The author analyses the role of new renewable energy technologies as a fundamental pillar of sustainable global growth and development, while also highlighting the need for deep systemic change to effectively address the climate change crisis.

Renewable energy technologies based on sources such as solar energy, wind power and green hydrogen offer promising solutions to reduce dependence on fossil fuels, which are the main source of greenhouse gas (GHG) emissions and are hence responsible for global warming — the phenomenon underlying climate change seen by many as the most pressing challenge of the 21st century. However, despite the importance of innovations in this area, they alone will not suffice to overcome the climate crisis. In this sense, the transition to clean and renewable energy sources, combined with a profound systemic transformation that guarantees a truly sustainable development, appears to be the most important condition for reducing the harmful impact on the environment. Therefore, prioritising investment in technologies that can produce clean and renewable energy in a sustainable and affordable manner, along with interdisciplinary action to drive deep systemic change, are fundamental factors in developing a new platform for sustainable global growth.

Among renewable energy technologies, number one is solar energy that converts solar radiation into electricity using photovoltaic (PV) cells or concentrated solar power (CSP) systems (Zhang et al., 2016). Silicon, copper, cobalt, aluminium, cadmium and lithium are generally required for the production of photovoltaic cells (Rincón et al., 2024). Using this technology to generate useful energy has contributed in recent years to a reduction in GHG emissions by about 96% compared to coal, with global installed capacity increasing by a factor of about 15 between 2010 and 2022 (IPCC, 2022; IRENA, 2023). In addition, the normalised cost of electricity decreased by 85 % between 2010 and 2020. And PV generation prices are predicted to continue declining in the coming years (IRENA, 2021).

Another type of alternative energy is wind power, which harnesses the kinetic energy of the wind by generating electricity using large wind turbines located on land or at sea and utilising materials such as glass fibre, rare earth metals, copper and steel (Ferrari et al., 2024; GWEC, 2021). The last decade has seen a steady growth in the installed capacity of wind power, which was increasing by 52-64 gigawatts (GW) per year between 2010 and 2020 to reach 743 GW. In 2020, it added another 93 GW, of which 35 GW came from offshore wind farms. Today, more than 90 countries are already implementing wind power projects, with 30 of them exceeding 1 GW of installed capacity. In 2017, several European countries and some Latin American states satisfied more than 10% of their electricity needs using wind energy (Magar, V. et al., 2024). The economic benefits of wind power are significant, especially as turbine size and capacity increase. The installed capacity utilisation rate has risen to 60-64%. This means a return on investment (ROI) of approximately USD 7 million per percentage point, with additional USD 100-300 million per turbine per year (Magar, V. et al., 2024).

Finally, another renewable energy source is green hydrogen. Hydrogen fuel, used as a useful energy source, is produced by electrolysis of water, i.e. splitting H_2O into H_2 and O_2, with the help of renewable energy (IEA, 2021). It requires materials such as platinum, iridium, fluoropolymers, graphite, steel and rare earth metals for its production and use in fuel cells (IRENA, 2020). This alternative zero-carbon energy source is of particular benefit to sectors such as aviation and transport, where electrification is not feasible and GHG emissions are quite high (IRENA, 2020). With large-scale production and competitive prices, green hydrogen can be converted into other energy carriers like ammonia, methanol and methane, and used in fuel cells or direct combustion for power generation (IRENA, 2020). Since the cost of green hydrogen-based electricity depends largely on the cost of its production, lower renewable energy prices will make it cheaper to produce (IRENA, 2020). Reducing the cost of renewable electricity and electrolysis will make green hydrogen more competitive: experts estimate that investments in electrolysis plants will fall by 40% in the short term and by up to 80% in the long run, offering great opportunities for global investment (IRENA, 2020).

The transition to renewable and more sustainable energy sources is a global imperative in the fight against climate change and in the pursuit of sustainable development. These new technologies are a potential catalyst for progress towards a new platform for sustainable global growth. Recent evidence suggests that proven fossil fuel reserves will only be sufficient to generate electricity for about half a century, according to studies published in late 2020 (Rincón et al., 2024). Given the current state of global energy systems, fossil fuels – due to their availability, fuel infrastructure and competitive costs – account for the majority of the energy we consume. However, the unconditional finiteness of these non-renewable resources and the levels of GHG emissions they generate make modern energy systems extremely unsustainable (Rincón et al., 2024). Therefore, in the long term, maintaining the current level of energy consumption at the expense of fossil fuels is not possible, which makes energy transition inevitable.

The limitations of renewable energy and the cost of the energy transition are determined by a whole range of material, economic, social, political and environmental aspects that need to be taken into account when designing and implementing policies and strategies aimed at moving towards a sustainable energy system. Despite the practical inexhaustibility of solar, wind and green hydrogen, the material resources required to build the technological infrastructure to support renewable energy generation do not have the same renewability properties (Gómez & Galindo, 2024). First, all this infrastructure not only requires significant investment but also depends on fossil fuels for mining, production of steel, cement and silicon, installation, maintenance and decommissioning of equipment at the end of its useful life, which averages 15-20 years (Ferrari et al., 2024). Second, under green transition scenarios, demand for critical metals required for clean technology development will quadruple by 2030, mainly due to increased demand for electric vehicles. This will be happening amidst depleting mineral reserves, rising mining and processing costs, and growing socio-environmental impacts (Ferrari et al., 2024).

On the other hand, the demand for these materials implies the extraction of huge amounts of minerals, most of which are poorly recyclable, such as lithium. So, if some 700 million tonnes of copper have been mined throughout the whole of human history, green growth scenarios suggest that in 22 years' time, the demand for copper will reach a similar level (Ferrari et al., 2024). In addition, the introduction of renewable energy sources should be accompanied by an increase in the number of energy storage systems in use in order to counter the volatility of energy production and ensure a real-time balance between supply and demand (Gómez & Galindo, 2024). However, the reserves of critical metals are no longer sufficient to produce the batteries needed to replace fossil fuels in ground transport. Experts say 6-7 times more cobalt, lithium and nickel deposits are needed than the world's largest deposits contain today, and that, at 2018 production rates, it will take 72 years to produce enough lithium just to meet new demand in the sector (Ferrari et al., 2024).

It should be noted that the cost of materials required to build new infrastructure as part of the energy transition has increased significantly while the productivity of existing mineral deposits has declined. In addition, geological exploration has not been able to discover new deposits comparable to the existing ones in terms of reserves, which poses additional challenges to the sustainability of the supply chain in the energy sector (Ferrari et al., 2024). Finally, the socio-ecological consequences of the energy transition could trigger the development of crises potentially more severe than those caused by global warming. For example, the intensification of mining to obtain the materials needed for renewable energy production could have devastating effects on biodiversity, threatening ecological integrity on an even more alarming scale than the problems expected to be solved through climate change mitigation (Ferrari et al., 2024).

So, electricity generation from renewable sources such as solar energy and wind power is characterised by a high degree of uncertainty and instability, which is largely offset by the use of fossil fuels. At the same time, despite its significant energy potential, about 90% of the hydrogen used as an energy source is grey hydrogen, i.e. a product of fossil fuel processing (IEA, 2019). In fact, green hydrogen (produced by electrolysis of water) accounts for less than 0.02% of current global production of clean hydrogen (IRENA, 2020). This indicates that, firstly, the pace of the transition to renewable energy is too slow and, secondly, the dominant concept of energy transition, which sees the introduction of clean and renewable technologies as the absolute solution to global warming problem, is a reductionist and simplistic position that lacks a comprehensive understanding of the physical and social constraints inherent in the human-nature relationship and fails to take into account the impact of other key economic, political and social factors (Ferrari et al, 2024; Richardson et al., 2023).

In conclusion, it should be remembered that, according to the dominant paradigm of economic growth, expanding production and increasing consumption are necessary for progress and increased prosperity. This view, based on the belief in unlimited and positive growth, conflicts with the physical limits of natural resources and ecosystems, emphasising the unsustainability of a model that depletes resources faster than they can be regenerated (Richardson et al., 2023). While advances in clean technology and energy efficiency are critical to addressing climate change, they cannot sustain current levels of energy consumption, let alone increase them (Ferrari et al., 2024). The new global growth platform will gradually shift from fossil fuels to the renewable energy sources described above, taking into account the opportunities available in the regional and international context. The effects of climate change are already having a devastating impact, highlighting the urgent need to implement deep systemic changes that go beyond technological solutions and address the economic, political and social causes of unsustainability.

Bibliography

1. Ferrari, L., Masera, O. & Straffon. (2024). *Transición energética justa y sustentable: Contexto y estrategias para México*. FCE. Recuperado de https://secihti.mx/wp-content/uploads/publicaciones_conacyt/libros/Ferrari_Transicion_energetica_justa_9786071684004.pdf
2. Ferrari, L., Masera, O., Ávila, S. & Flores, J. (2024). Límites de las fuentes renovables. En Ferrari, L., Masera, O. & Straffon. (2024). *Transición energética justa y sustentable: Contexto y estrategias para México*. FCE.
3. Global Wind Energy Council (GWEC). (2021). *Global Wind Report 2021*. https://gwec.net
4. Gómez Garza, R. R. & Galindo, J. (2024). Cuestionando el paradigma de la innovación tecnológica como solución a la crisis ambiental. En *Las aventuras de la sobreproducción: diferenciación funcional, autopoiesis y límites biofísicos del capital.* (pp. 75-141).
5. International Energy Agency (IEA). (2019). *The Future of Hydrogen*. Recuperado de https://www.iea.org/reports/the-future-of-hydrogen
6. International Energy Agency (IEA). (2021). *Global Hydrogen Review 2021*. OECD. Recuperado de https://doi.org/10.1787/39351842-en
7. IPCC (2022): *Reducción porcentual basada en emisiones del ciclo de vida*.
8. IRENA (2020), *Green Hydrogen Cost Reduction: Scaling up Electrolysers to Meet the 1.5°C Climate Goal*. International Renewable Energy Agency.
9. IRENA. (2023). *Renewable Capacity Statistics 2023*. International Renewable Energy Agency.
10. Magar, V., Gross, M. S., García Hernández, L. S., Hahmann, A. N., Pacheco Rojas, D. A., & Peña, A. (2024). Energía eólica. En Ferrari, L., Masera, O. & Straffon. (2024). *Transición energética justa y sustentable: Contexto y estrategias para México*. FCE.
11. Rincon, E. A., Islas Espinoza, M., & González Mora, E. (2024). Energía solar. En Ferrari, L., Masera, O. & Straffon. (2024). *Transición energética justa y sustentable: Contexto y estrategias para México*. FCE.
12. Zhang, H. L., *et al*. (2016). Concentrated solar power plants: Review and design methodology. *Renewable and Sustainable Energy Reviews*, 22, 466-481. https://doi.org/10.1016/j.rser.2015.08.068
13. *Richardson, K. et al*. Earth beyond six of the nine planetary boundaries. Science Advances; 2023. https://forest.ru/articles/zemlya-za-predelami-shesti-iz-devyati-planetarnykh-granits/

INDIA

Chakraborty Debjit
Executive Director

Chamber for Indo Russo Technology Collaboration (CIRTC)

Technology Investments Between India and Russia: A Strategic Shift in Global Alliances

Investment Vectors: Human Capital, Technology, and Strategic Resources

The economic relationship between India and Russia has been based on defense, energy, and space technology for a long time. Of late, however, the investment axis has turned towards newer technologies, including artificial intelligence (AI), cybersecurity, and renewable energy, ushering in a new era of technological collaboration. This is a direct reaction to geopolitical reconfigurations, economic sanctions against Russia, and India's quest to emerge as a global technology leader.

The two nations' investments are now aimed at human capital building, digitalization, and renewable energy, mirroring the larger trends among the BRICS+ economies. India and Russia's collaborative initiatives in technology research, financial innovation, and space exploration are indicators of a profound economic reconfiguration, providing the two nations with a route towards increased economic self-sufficiency and less dependence on Western economies.

Preamble: The Geopolitical and Economic Relevance of India-Russia Technology Investments

The Russia-India technology investment corridor is an important part of their overall bilateral trade relations, which stood at $49 billion in 2023, with Indian imports from Russia growing by 92% (Ministry of Commerce, India, 2024). Although this relationship has historically been dominated by defense and energy cooperation, it is now changing because of a number of urgent global challenges:

1. Western Sanctions against Russia: These have restricted Russia's access to Western technology, compelling it to look for alternative partners.
2. India's Green and Digital Transformation: India wants to be a leader in AI, cybersecurity, and renewables, and Russia's scientific research expertise is extremely valuable.
3. The BRICS+ Paradigm Shift: The growth of BRICS+ provides a special economic environment where India and Russia can collaborate without Western economic constraints.

While Russia is in need of new markets for its technology, India is in need of cutting-edge tech collaborations to speed up its "Make in India" and "Digital India" campaigns. This alliance has the potential to remake the international economic landscape, as long as both countries can successfully maneuver around political, economic, and technology issues.

Core Argument: Strategic Investment in Technology as a Catalyst for Growth

India and Russia's technology-driven economic cooperation is increasingly marked by strategic investments in digital transformation, renewable energy, space exploration, and cybersecurity. These are not merely bilateral initiatives; they follow larger economic trends in BRICS+, enabling both nations to hedge against economic volatility and geopolitical uncertainties.

1. Digital Economy and Cybersecurity Cooperation

India's digital economy is expected to become $1 trillion by 2030 (NASSCOM, 2024). Russia, with its robust cybersecurity industry and AI capabilities, is the best partner for India's digital journey.

- India's IT industry increased by 15% in 2023, totaling $245 billion, and Russia's cyber export grew 30% in the same timeframe (Statista, 2024).
- Indian IT behemoths Infosys and TCS are also looking at collaboration with Russian cybersecurity companies to create combined AI-based security products for BRICS+ markets (White Papers on Indo-Russia Tech Cooperation, 2024).
- Moscow and New Delhi are also working on secure digital payment systems, going around Western financial networks such as SWIFT (Chamber for Indo-Russo Technology Collaboration, 2024).

2. Energy and Green Technology Investments

Energy is the bedrock of the India-Russia relationship but renewable energy partnership is a fresh and emerging opportunity.

- India's target is 50% of its energy coming from renewables by 2030, while Russia has considerable nuclear and hydrogen energy expertise (Rosatom South Asia, 2024).
- Rosatom (Russia's state nuclear corporation) is making more investments in India's nuclear power initiatives, which will enhance India's clean energy production by 10% within the next 10 years (White Papers on Indo-Russia Tech Cooperation, 2024).
- India is making investments in Russian research on hydrogen energy with a goal to create affordable green hydrogen technologies (Chamber for Indo-Russo Technology Collaboration, 2024).

Russia is also a major provider of rare earth minerals, which are essential for India's renewable energy technologies and electric vehicle (EV) manufacturing. This makes India a future energy economy manufacturing hub.

3. Space Technology and Defense Innovations

The space cooperation between India and Russia has gone to new heights, especially with collaborative satellite ventures and defense technology collaboration.

- Roscosmos and ISRO are jointly developing global navigation satellite systems and deep space exploration satellite systems (ISRO Annual Report, 2024).
- Russia's space agencies have provided key technical assistance to India's Gaganyaan mission, bolstering India's aspirations in human spaceflight (White Papers on Indo-Russia Tech Cooperation, 2024).
- The joint project BrahMos-II hypersonic missile will further establish India-Russia defense relations, with a prospective market size of $7 billion in the decade ahead (Chamber for Indo-Russo Technology Collaboration, 2024).

4. Financial Technology and Trade Mechanisms

India has become an indispensable financial ally as Russia grapples with Western sanctions, specifically in alternative payment systems.

- Indian and Russian central banks are developing the integration of the RuPay and MIR payment systems to minimize the use of the dollar (Chamber for Indo-Russo Technology Collaboration, 2024).
- Future Digital Rupee-Ruble trade mechanisms are being considered for cross-border transactions using blockchain technology to increase efficiency in trade (White Papers on Indo-Russia Tech Cooperation, 2024).

5. Biotechnology and Pharmaceutical Cooperation: Enhancing Global Health Security

The pharmaceutical and biotechnology industries are an emerging area of India-Russia technology investment, with emphasis on collaborative vaccine production, biotechnology research, and pharmaceutical exports. With Russia's robust research infrastructure and India's low-cost pharmaceutical manufacturing capacity, the two nations are well-suited to become world leaders in biotech innovation.

Russia has been a leading country in innovative biotechnology studies, especially genetics, molecular biology, and virology, while India is a major world producer of generic drugs, supplying more than 20% of the world's generic drugs (Invest India, 2024). This merging of scientific ability and industrial strength is a firm ground for cooperation in life science, medical technology, and vaccine development.

5.1. Vaccine Development and Pandemic Preparedness

Perhaps the most prominent case of Indo-Russian biotech cooperation has been vaccine development. During the COVID-19 pandemic, India was the largest producer of the Russian Sputnik V vaccine, with production agreements between the Russian Direct Investment Fund (RDIF) and leading Indian pharmaceutical firms like Dr. Reddy's Laboratories, Hetero Biopharma, and Serum Institute of India (Chamber for Indo-Russo Technology Collaboration, 2024).

- Sputnik V and Sputnik Light vaccines were produced in mass quantities in India, reflecting India's pivotal position in international vaccine supply chains.
- Technology transfer arrangements between Russian and Indian biotech companies enabled collaborative research on next-generation vaccines, such as mRNA technology.
- Russian researchers are collaborating with Indian biotech companies to develop new vaccine candidates for infectious diseases like tuberculosis, hepatitis, and influenza.

In the future, Indo-Russian cooperation can be applied to other pandemics and forgotten diseases, specifically in the area of cost-efficient and scalable vaccine solutions for the Global South.

5.2. Biotechnology and Genetic Research

Russia's biotechnology research capabilities and India's large-scale production capacities offer tremendous opportunities for co-investment in genetic engineering, bioinformatics, and precision medicine.

- Russian institutions like the Gamaleya Research Institute of Epidemiology and Microbiology have led the way in molecular biology research, which can be paired with India's emerging bioinformatics and gene therapy sector (White Papers on Indo-Russia Tech Cooperation, 2024).
- Indian biotech startups like Strand Life Sciences and MedGenome are creating genomic solutions that could be augmented by Russian biomedical AI applications.
- Agricultural biotechnology collaborative projects may enhance the resistance of crops, disease, and food security, especially when climate change threatens farm yields in BRICS+ nations.

Economic and Social Impacts: Consolidating BRICS+ Economies

The increasing India-Russia technological alliance has significant economic and social impacts, affecting not only these two countries but the entire BRICS+ environment.

Economic Impact

1. Increased Foreign Direct Investment (FDI): Russia's FDI in the form of technology in India has increased by 45% in the last two years (RBI, 2024).
2. Job Generation and Human Capital Development: Joint AI and cybersecurity projects would generate more than 500,000 new employment opportunities in India by 2030 (NASSCOM, 2024).

Social Impact

1. Access to Technology and Digital Inclusion: Low-cost cybersecurity and AI-based solutions will enhance digital inclusion across India's rural landscape
2. Climate and Energy Security: Hydrogen energy initiatives can reduce India's fossil fuel dependence by 20% in 2040 (White Papers on Indo-Russia Tech Cooperation, 2024).

Conclusion: The Future of Indo-Russian Technology Investments

By 2030, technology-driven trade between Russia and India should reach $100 billion, fuelled by investments in digital infrastructure, green energy, and space technologies (World Economic Forum, 2024).

To unlock this potential, India and Russia need to:

1. Enlarge technology investment funds to fund collaborative AI and fin tech ventures.
2. Establish a BRICS+ Innovation Bank to fund cross-border digital and green energy initiatives.
3. Enhance trade mechanisms by completely integrating digital Rupee-Rubel transactions.

Through technology-driven investments, India and Russia are not only assuring their economic future but also shaping global trade and technological innovation for the new multipolar world.

RUSSIA

Chigintsev Matvei
Student

The Presidential Academy
of National Economy and Public
Administration

Innovative Technologies for an Accessible and Sustainable Energy Sector in BRICS+

Introduction

BRICS+ accounts for nearly half of the world's population, one third of the global GDP, and a major part of CO_2 emissions, which makes the alliance member states key actors in the global energy transition. In the late 2020s, power generating capacities working on fossil fuels will drop below 50% in BRICS since they are actively developing renewable energy sources (RES). Installed RES capacities in BRICS will reach 2.289 GW in 2025, which is greater than fossil fuel capacities (2.245 GW). RES projects in development, including wind and solar power, account for 1.550 GW, which is twice the fossil fuel capacities. BRICS states also seek to triple RES capacities by 2030, which will be an important step in combating climate change.[1]

1 Norman J., Clark G., Babajeva J., Sidorovskaya-Fretz N., Yu A., Han Y., Zhang M. Energy in the BRICS: Cleaner Energy to Eclipse Fossil Fuels for Half the World's Population // Global Energy Monitor, 2024. Report, October 2024. P. 5-7.

Current Situation: An Overview

China, as the largest manufacturer and energy consumer, demonstrates major successes in decarbonization. In the last five years, the share of fossil fuel capacities has been halved, and installed solar and wind capacities exceed 300 GW each. The country is setting itself ambitious goals: reaching peak CO_2 emissions by 2030 and carbon neutrality by 2060 through actively introducing carbon capture, utilization, and storage (CCUS) technologies at its coal power plants and developing its electric vehicle market.

India, one of the world's fastest-growing economies, is also actively developing renewable energy sources (RES) to reduce its coal dependency. Installed solar power capacities exceed 70 GW, wind power capacities exceed 40 GW. India is planning to bring its RES capacities up to 500 GW by 2030 and to reach carbon neutrality by 2070 by building massive solar parks, such as the one in Rajasthan with the capacity of 2.2 GW.[2]

Russia with its massive reserves of fossil fuels is slowly moving toward decarbonization, but is actively developing nuclear power. Over 20% of electric power in Russia is produced at nuclear power plants. Installed solar capacities total about 2 GW, wind capacities total about 1 GW. Russia is setting itself the goal of bringing the RES share in its power balance to 4-5% by 2030 and reaching carbon neutrality by 2060. In order to reduce emissions, Russia is actively exporting the small modular reactor (SMR) technologies, developing green hydrogen manufacture technologies based on nuclear power, and is using its massive forests to absorb CO_2.[3]

Decarbonization prospects are looking bright in BRICS. China will continue to lead in developing RES and CCUS technologies, India will increase its RES capacities and introduce green hydrogen into manufacturing, and Russia will focus on nuclear power and on forest projects to absorb CO_2.[4] The success of decarbonization in these countries will be of key importance for achieving global climate goals and conserving the planet for future generations.

Ethiopia should be supported, too: a review of its energy complex demonstrated very good results in the ratio of various types of power generation and its diversification. Ethiopia has Africa's largest hydropower capacities of over 5 GW that cover over 90% of Ethiopia's power demand. As of March 2024, the largest GERD (Grand Ethiopian Renaissance Dam) was 95% complete, while other hydropower projects with the total capacity of 10,078 MW are being

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2 BRICS Just Energy transition report. October 2024. P.127-137.

3 Savin V., Rozhenko S., Miroshnikova Yu., Karaseva M., Chigrin A., Artemenkova E. BRICS: An Analysis of Developing the Energy and Climate Potential. 2024. p. 9 (in Russian)

4 Kholkin D. V., Chausov I. S., Gubanov M. A., Mel'nikov P. A., Kolomyts L. V. New Business Models for Developing Local Energy Sectors // Energeticheskaya politika, 2025. No. 1. P. 32-43. (in Russian)

developed, including the second-largest Koysha Dam with the capacity of 2.170 MW.[5]

Potential Energy Transition Strategies in BRICS+

BRICS countries with their unique geographic, climatic, and economic conditions have a tremendous potential for developing “green” energy. Each member state can use its strong suits to reduce its dependence on fossil fuels and lead in renewable energy sources (RES).

China is banking on carbon capture, utilization, and storage (CCUS) technologies; it is introducing CCUS at its coal power plants thereby reducing CO_2 emissions and using carbon to manufacture synthetic fuel or construction materials. Hydropower plants such as the Three Gorges plant, are the backbone of the power grid. To increase sustainability, China combines hydropower plants with solar and wind power plants. Stirling engines are used in the Gobi desert to transform solar energy into electric power. China is also developing hydrogen power by manufacturing “green” hydrogen using hydropower and solar panels.

Since Brazil has huge water resources, it relies on hydropower. Its largest HPPs such as Itaipu cover most of Brazil’s own power demand. To increase sustainability, Brazil is developing solar power in its northern regions and wind power plants on its coast. Brazil is a leader in manufacturing biofuels, such as ethanol made from sugar cane, which can be combined with hydrogen power.

Russia uses a combined approach to developing “green” energy. In Siberia and in the Russian Far East, Russia is actively developing hydropower (for instance, HPPs on the Yenisei River). Russia is building solar power plants in its southern regions, such as Crimea and the Caucasus, and wind power plants in the Kaliningrad Region. Russia also has potential to develop hydrogen power, particularly, to become a “green” hydrogen exporter. Those northern regions that have excess heat emitted by industrial facilities can use Stirling engines.

Ethiopia is banking on hydropower by building large HPPs such as GERD. These power plants will form the backbone of the country’s power grid. To increase sustainability, Ethiopia could combine HPPs with solar power plants in the regions with high solar activity and with wind power in its mountainous areas. Stirling engines may serve as additional power sources in arid areas.

Egypt with its massive deserts is pinning its hopes on solar power. Large projects such as the Benban solar park already ensure a large share of its power consumption. Coastal areas, for instance, Red Sea shores, are perfect for wind power plants. Stirling engines can be used in deserts. Egypt also has potential to develop

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5 Norman J., Clark G., Babajeva J., Sidorovskaya-Fretz N., Yu A., Han Y., Zhang M. Energy in the BRICS: Cleaner Energy to Eclipse Fossil Fuels for Half the World’s Population // Global Energy Monitor, 2024. Report, October 2024. P. 27-28.

hydrogen energy. South Africa is actively developing solar power since it has many sunny days during the year. Coastal areas, for instance, Cape Town, are perfect for wind power plants. Stirling engines can be used in arid areas. South Africa also has potential to become "green" hydrogen exporter.

A smooth transition from "dirty" power to AES and greenhouse gas utilization requires that power generation be pegged to industrial capacities. The Oak Ridge Lab's studies showed that carbon dioxide can be processed into ethanol and can also be used as a source of utility-grade atomic hydrogen to be used in manufacturing polymers, including graphene.[6] Integrating such enterprises into complexes that take advantage of natural features (sun, water, wind) will make the transition more clean and efficient. For instance, solar power plants can provide power for CO_2 capture and utilization, while wind power plants and hydropower plants can be used to keep the power grid stable.

Introducing a comprehensive stage-by-stage approach will ensure a smooth and safe transition to sustainable development, resource conservation, and resolving the energy crisis. It will prevent environmental deterioration in industrial regions and make it possible to achieve the goals of the energy transition. To successfully develop "green" energy, BRICS countries need to bolster international cooperation, invest into infrastructure, train personnel, and introduce strict environmental requirements. Thus, each BRICS state will be able to use its unique advantages to make its contribution to creating a sustainable green power grid.

References

1. BRICS Just Energy transition report. October 2024. 238 p.
2. Norman J., Clark G., Babajeva J., Sidorovskaya-Fretz N., Yu A., Han Y., Zhang M. Energy in the BRICS: Cleaner Energy to Eclipse Fossil Fuels for Half the World's Population // Global Energy Monitor, 2024. Report, October 2024. 31 p.
3. Song Y., Peng R., Hensley D.-K., Bonnesen P.-V., Liang L., Wu Z., Meyer H.-M., Chi M., Ma C., Sumpter B.-G., Rondinone A.-J. High-Selectivity Electrochemical Conversion of CO2 to Ethanol using a Copper Nanoparticle/N-Doped Graphene Electrode // ChemistrySelect, 2016, Vol. 1. P. 6055-6061.
4. Savin V., Rozhenko S., Miroshnikova Yu., Karaseva M., Chigrin A., Artemenkova E. BRICS: An Analysis of Developing the Energy and Climate Potential. 2024. 27 p. (in Russian)
5. Kholkin D. V., Chausov I. S., Gubanov M. A., Mel'nikov P. A., Kolomyts L. V. New Business Models for Developing Local Energy Sectors // *Energeticheskaya politika*, 2025. No. 1. P. 32-43. (in Russian)

6 Song Y., Peng R., Hensley D.-K., Bonnesen P.-V., Liang L., Wu Z., Meyer H.-M., Chi M., Ma C., Sumpter B.-G., Rondinone A.-J. High-Selectivity Electrochemical Conversion of CO2 to Ethanol using a Copper Nanoparticle/N-Doped Graphene Electrode // ChemistrySelect, 2016, Vol. 1. P. 6055-6061.

JAPAN

Collins Patrick
Emeritus Professor

Azabu University

BRICS+ Lunar Sports Stadium Project

BRICS+ Lunar Sports Stadium Project — an exciting goal to revive young people's confidence in the future, and open the new era of economic growth in space.

1. Preamble – Relevance to Current Challenges

In response to the urgent need for new industries that will employ tens of millions of young people, even in the era of ubiquitous AI and robotics, this essay proposes the rapid growth of a major new industry, which has been delayed by more than half a century already. This is now becoming urgent due to the growing challenge of AI and robotics, which pessimists predict will cause massive unemployment due to lack of new industries. An example of this idea is described in the 1952 novel 'Player Piano' by Kurt Vonnegut, set in a dystopian future in which most Americans are unemployed because automation has eliminated their jobs amid a lack of new industries. However, Vonnegut's vision was mistaken, since he did not understand the unlimited potential for economic growth and new employment from developing passenger space travel services into a major new transportation system.

2. Distorted History of Rocket Propulsion

There is a unique opportunity to quickly create a space travel industry that will grow as large as air travel because the pattern of development of rocket propulsion technology has been very different from other transportation technologies. Each of the "Big 6" world-changing transportation technologies – horse-carriages, sailing- ships, trains, propeller-driven ships, automobiles and aeroplanes – grew to become a major new means of passenger travel throughout the world, eventually serving billions of customers and employing hundreds of millions of people. Their development also led to innumerable related technological and social innovations, and contributed greatly to economic growth and rising living standards worldwide.

The first space rocket was the A-4 prototype of the V2 missile, including the A-4b winged spaceplane and plans for a reusable piloted version. Many piloted Me163 rocket-planes were also flown during the early 1940s.However, piloted, reusable, passenger-carrying spaceplanes were not developed after the end of the war, as the pioneering engineers intended, because the 'Cold War' monopolised the use of rocket propulsion for missiles. Consequently rocket propulsion was not developed to supply travel services for the general public, as the previous "Big 6" major transportation technologies had been.

This was followed by the creation of national space agencies, which still use missile- based expendable launch vehicles which are not capable of reducing travel costs sufficiently for passenger space flights to become popular. In 80 years, only a few hundred people have traveled to space, mostly paid for by governments – but 10 million people pay to fly on aircraft every day, generating Trillions of dollars of revenue!If the 'Cold War' had been avoided, space travel services would surely have started long ago:the father of cosmonautics, Konstantin Tsiolkovsky, was not a warmonger but a visionary aerospace scientist.

3. The Coming Passenger Space Travel Revolution

It is surprising that even USA and Europe, despite their officially proclaimed support for democracy and capitalism, have both failed to apply this new transportation technology to its most popular consumer use – for more than 80 years! Instead they have focused almost solely on military uses and other government uses such as scientific research. The public can still only watch space activities passively on screens. Finally, in the 21st century reusable rockets have started to be developed for short, sub-orbital flights in the USA, and are now also being developed in Russia and China: so we are just on the brink of starting popular space travel services.

However, there is still a widespread misunderstanding that commercial space flights are merely a luxury for a small number of rich people. This is entirely mistaken!

Operating reusable spaceplane services will reduce space travel costs by 99%, exactly as the growth of airlines reduced air travel costs through the 20th century. Passenger space travel is the key to growing the space industry into a major commercial activity as large as the earlier "Big 6" passenger travel technologies. To achieve such major popular success, the space industry must collaborate deeply with the airline industry.

Accepting and implementing the idea that the space industry can and should be people-driven will be a major 'paradigm shift'. As it exists today, it has essentially no direct contact with the general public as customers. By changing this, aerospace engineers will change the world, just as aeroplane engineers have. Moreover, Russia and other BRICS+ members are world-leaders in all the many different capabilities needed to create this new industry, which will be a unique stimulus to young people's optimism, economic growth and social and cultural revival, for decades to come.

Passenger air travel is already a hugely popular service, which creates employment for 100 million people worldwide, and its turnover is still doubling every ten years. With active political support, an accelerated project to make space travel services available to the general public will ensure long-term growth of employment worldwide. This will also lead to the use of space resources to supply clean energy to Earth, reducing environmental damage and eliminating the risk of 'resource wars'. It will also thrill young people with a realistic vision of an optimistic future.

4. Phase 0 Parabolic Flights

It is particularly valuable that this project can start immediately at very low cost by using Russia's unique IL-76 MDK aeroplanes, which are specialised for parabolic flight services, to enable young people nationwide to experience weightlessness.

A fleet of these aircraft can ensure that all children have this deeply educational experience. School and student competitions will stimulate interest, and will grow to include students from friendly countries. As the project progresses, young people from many countries will travel to Russia's growing 'space city' of Tsiolkovsky in Amur Oblast. This popularity with young people will also lead to parabolic flight campaigns abroad, and to sales of IL-76 MDKs to friendly countries.

In parallel, introducing a 'Space Travel Syllabus', extending from age 10 through age 20, will prepare young people for their own parabolic flight experiences, and also stimulate them to learn more science, engineering and other space travel-related topics. It will thereby also develop the employees who will be needed in the innumerable businesses related to creating a global space travel industry.

5. Phase 1 Sub-orbital Space Flights

Sub-orbital space flight services have recently started in the USA with Virgin Galactic Inc and Blue Origin Inc – but still only on a tiny scale of about 10 customers per year! Reusable, sub-orbital rockets and spaceplanes are also being developed in Russia and China, but currently have low priority. By recognising their potentially major contribution to enriching 21st century education, and leading to large-scale employment in new space travel-related industries, policies to accelerate the start of sub-orbital passenger space flight services should be urgently implemented. Since only minimal infrastructure is required, many regional airports will be able to operate sub-orbital flights by the new vehicles, as they travel throughout the country to provide short space flights to local schools, universities and general public.

6. Phase 2 Passenger Flights to Orbital Hotels and Sports Centres

Developing reusable orbital passenger vehicles and orbital spaceports is a much larger project. Once these are developed, the cost of traveling to and from low Earth orbit will drop, just as air travel has continued to get cheaper for more than 100 years. For the ever-growing numbers of people who stay at an orbital hotel, a particularly popular activity will be sports in micro-gravity: every existing sport will be fascinatingly different, and new sports will also be developed. Over decades, ever larger and better orbiting Sports Centres will be developed, enabling ever more sports on ever larger scale – including a range of flying sports, and even rotating swimming pools and stadiums. Spaceports will become major new facilities like hub airports.

The technological knowhow needed for such developments already exists, including the components and systems developed for the space stations Mir, ISS, Tiangong and various companies' recently announced plans. The detailed design and construction of orbiting hotels and Sports Centres are waiting for a 'trigger' to be activated – the start of 'spaceline' services by fully reusable, orbital passenger launch vehicles. This will ensure ever more customers, like the virtuous circle of ever lower prices and ever higher demand which keeps the airline industry growing worldwide.

7. Phase 3 Lunar Surface Tourism and Sports

The third phase of passenger space travel will be travel to visit the lunar surface. In order to enable this, investment in a further range of new infrastructure is needed.

So it is very timely that work aimed at economic development on the Moon, such as searching for water ice, generating fuel, making bricks and concrete from lunar soil, power generation and geological surveys has increased recently. The International Lunar Research Station (ILRS) and 'Artemis' are major projects focusing on this work, which will facilitate the coming development of lunar tourism services.

Once the costs of travel to and from the Moon are reduced by reusable passenger vehicles, people from every country will visit the lunar surface, which will drive the construction of ever more and ever larger lunar hotels and sports centres. The Moon's low gravity of 1/6 of Earth's gravity is another unique environment which will be fascinating for all sports, including swimming. Most notably, humans will be able to fly like birds, enabling a range of flying sports and performing arts, which will further stimulate the construction of lunar sports stadiums, arenas and theatres.

8. Major, Long-term Stimulus for Worldwide Economic Growth

These developments will stimulate economic and industrial growth in space as well as on Earth, leading to recognition that humans now live in an 'Open World', in which the use of lunar and asteroidal materials and space-based energy supplies will definitively end the threat of 'resource wars' on Earth – which is an out-dated idea from the era of 'Closed World' thinking, still held by too many warmongering politicians. Hence, announcing the target of building a BRICS+ Lunar Sports Stadium will act as a sparkling goal for the next few decades of space travel industry growth. The following are some important aspects of this multi-decade project.

- The topic of space travel is of spontaneous interest to young people worldwide, so learning all the many parts of a new 'Space Travel Syllabus' will be fascinating and educational for them, while spreading an optimistic vision of the future.
- Everyone who has traveled in space says that it was one of the best experiences of their life: as many people as possible should be able to have this stimulating, new, forward-looking, 21st century experience, especially young people.
- Russia has world-leading aerospace capabilities: announcing that the development of space travel services for young people is now an official government priority will attract young people nationwide, and will encourage optimism and confidence in the future of the Russian Federation and BRICS+.
- The project can start immediately by providing 'Zero-Gravity' flight services using Russia's world-leading IL-76 MDK aeroplanes for young people to participate in weightlessness themselves – not just watch space activities on screens.
- The commitment by Russia and friendly countries to achieve this fascinating and optimistic future for humanity will excite young people world-wide, who will clearly see the benefits of peaceful, multipolar cooperation instead of enmity and wars.
- As a new field of commercial space activities, space travel will grow far larger than current space business which is still limited to information services. Only a few hundred people have traveled to space in 80 years: everyone else watches screens.
- The tourism industry employs huge numbers of people in many countries, and this will continue even as AI and robots take over many jobs in other industries.

- As an example of the potential for international collaboration, equatorial countries will operate launch services to Sports Centres in equatorial low Earth orbits (ELEO), due to the unique logistic advantages of return-flights to and from the same orbiting facilities every 90 minutes. Enabling countries of the 'Global South' to participate in such a world-leading space project will be a major success for BRICS+.
- Some people are working to start human travel to Mars, but this has far less economic and social value than developing a space tourism industry. For everyone except the few participants, it will be just another activity seen on a screen – like all space activities to date. By contrast, general public space travel services will involve direct participation, and will grow to include ever more people, like other forms of travel and tourism. They will also become commercially profitable, and so self- sustaining – but travel to Mars will not earn profits, and so will be a burden on taxpayers, instead of contributing to economic growth and new employment.

9. Conclusions and Expected Results

Rich countries' governments urgently need to develop sufficient new industries to provide fascinating careers for tens of millions of today's young people, and thereby revive their confidence and optimism about the future. The solution to this problem requires governments to recognise that supplying popular space travel services to young people and the general public is not "trivial". it can grow to have billions of customers, and drive employment and economic growth worldwide for many decades – just as passenger air travel has changed the world. Although building a BRICS+ Lunar Sports Stadium will involve multiple phases of development work over several decades, and will involve many related sub-projects, it is a clear, concrete goal which is easy for everyone to understand. Once governments accept this outside-the-box thinking about what are the most important activities for their civilian aerospace industries to develop, it is certainly achievable by Russia and BRICS+.

A key component is the introduction of a Space Travel Syllabus explaining this future in detail, and preparing young people to work in the many different parts of the overall project, from rocket engineering to space sports, from 'zero-G' interior design and fashion to working in the orbital coastguard service, from space diplomacy to managing a lunar flying sports stadium – and many, many more new activities.

The ever-growing popular demand for space tourism services will be a worldwide, people-driven stimulus for global economic growth and large-scale employment for younger generations, while reusable passenger space vehicles will become the 7th major world-changing transportation technology. As such, popular space travel is unique in offering a realistic path, using existing aerospace knowhow, to fulfill Tsiolkovsky's vision of humans becoming a true 'spacefaring' species.

Representative reference

1. Patrick Collins, 2006, "The Economic Benefits of Space Tourism", Journal of the British Interplanetary Society, Volume 59, pages 400-411, available at http://www.spacefuture.com/archive/the_economic_benefits_of_space_tourism.shtml

Deshukova Anastasia
Attache

Permanent Mission of the Russian Federation to the Food and Agriculture Organization of the United Nations (FAO) and other international organizations with similar functions in Rome, Italian Republic

Investments in Technology: New technology for ensuring food safety

The issue of food safety is as old as civilization itself. The specter of hunger has haunted humanity for centuries, despite numerous and multifaceted efforts to eradicate it.

Serious attempts to contain the food crisis were made during the post-war recovery period. In the midst of devastation and the collapse of food systems, the issue of food shortages became a major concern. It is no coincidence that the establishment of the Food and Agriculture Organization (FAO) of the United Nations had occurred just days before the UN Charter came into force. Over the following decades, in pursuit of the Zero Hunger goal, the international community has consistently sought to fight hunger. The 2000 Summit, the 2009 World Summit on Food Security, the 2015 UN Sustainable Development Summit, and finally, the 2021 Food Systems Summit have all regularly updated the targets in the fight against hunger. Each new decade brought another "innovation" aimed at overcoming the food crisis. Period after period, from different angles and with varying intensity, novel methods were proposed, yet the result remained the same.

So, what lies behind this veil of mystery? First and foremost, we must examine the technologies used to tackle global hunger. The initial response to a food shortage is often to increase production. The FAO statistics claim that global food production meets the needs of the world population. However, hunger continues to plague humanity, which implies that the problem lies not in food quantity but in certain factors that disrupt access to it. And each year, the issue is becoming more acute. The extensive approach to solving food safety is not working. Continuing to expand agricultural production is a dead end. Natural resources are not infinite, they are depleting, and humanity can no longer rely on a model based on the unlimited use of natural goods.

A paradoxical fact is that the majority of those suffering from hunger are engaged in agriculture and produce food themselves. Those who feed the world are the ones standing on the edge of starvation. But food safety is not just about the availability of food, it is about its accessibility.

Does this mean the current system of proposed solutions is not working? Are the bottlenecks elsewhere? And what, then, is plainly visible? Some of the weak links in the system were identified at the 2021 Food Systems Summit.

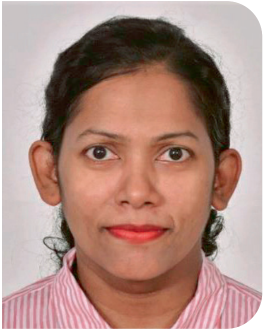
First and foremost, attention should be paid to the food supply chain, specifically the journey food takes from producer to consumer. Unfortunately, food products themselves can sometimes become a challenge in the supply chain. Products spoil depending on storage locations and conditions; high prices reduce demand, leading to product stagnation, waste, and spoilage, while expiration dates pass. There are, however, positive examples such as Uruguay's use of traceability systems in cheese production where blockchain technology is being implemented. Yet, such examples should not remain isolated, they should become the norm.

Another factor that underscores the futility of extensive agricultural development is the lack of adequate systems to respond to weather and climate conditions. Farming is a high-cost endeavor as long as uncontrollable environmental factors can lead to food losses. Hence, there is a need to implement technologies that develop weather and climate forecasting systems and early climate response mechanisms.

Another key issue that undermines the entire food safety system is the lack of support for smallholder farming. Urbanization is destabilizing the system. In pursuit of comfort and a better life, rural residents are migrating to cities, jeopardizing the achievement of SDG-2 (zero hunger). The growing divide between those not engaged in production and farmers who meet food needs continues to widen. Small farms need improvements in quality of life and sustainable livelihoods. A shift in perception toward food producers is necessary. Unfortunately, the current support system is skewed in favor of large agro-industrial companies. While they have become major players in the global agricultural market and bear immense responsibility, they also carry significant risks. To minimize production losses, holdings often turn to GMO technologies. Genetically modified crops may be convenient for business efficiency, but it raises a new dilemma: is the system's goal to feed the population or to provide access to healthy, nutritious food?

The system shaped by generations, unfortunately, fails to adequately respond to modern challenges and requires reform. Only by accepting the premise that systemic change is necessary can we hope to address global challenges and make new technologies for ensuring food safety truly effective, thereby making the world more resilient.

SRI LANKA



Divisekera Mudiyanselage Wasundara Devanmini Divisekera

Principal Research Scientist
PhD Microbiology and Food Biochemistry

Industrial Technology Institute

Ensuring Global Economic Growth

Food is essential for human life. Unsafe food, contaminated with pathogens or chemical hazards, is estimated to cost 110 billion US$ each year in productivity and medical expenses in low-and middle-income countries. According to the World Health Organization (WHO), 1 in 10 people get sick due to the consumption of contaminated food and about 420,000 deaths occur due to foodborne illnesses annually around the world (WHO, Food Safety, 2022). The impact of unsafe food extends far beyond individual health, creating a significant financial burden on individuals, healthcare systems, and national economies. The financial cost of unsafe food encompasses various direct and indirect expenses. These costs arise from both the immediate impacts of foodborne illnesses and the long-term consequences on public health, productivity, and economic well-being. Thereby effecting the global economic growth adversely. Food contamination due to microorganisms, mycotoxins, heavy metals, microplastics, persistent organic pollutants possess great food safety concern. In addition, climate change induced food safety risks, prolonged use of synthetic food additives, antibiotic resistance and water contamination also further contributing to soaring food safety concerns globally.

a. Microbial contaminants include bacteria, viruses, and parasites can contaminate food at any step of the food chain. Microbial contaminants are ubiquitous in nature, cross contamination encourage the spreading of infection, while unavailability of adequate refrigeration conditions further agitate the infection by providing optimum growth conditions, thus increasing the opportunities for food poisoning.
b. Mycotoxins are toxic secondary products of fungi that contaminate food commodities i.e., aflatoxins, ochratoxin, patulin, fumonisins, zearalenone and nivalenol/deoxynivalenol have become a serious health concern as these toxic materials can cause poisoning and serious health issues in animals and humans (Mukhtar et al., 2023). The Food and Agriculture Organization of the United Nations (FAO) has estimated that more than 25% of the global food crop is contaminated with mycotoxins, however the origin of this value is unclear, and research suggests that up to 60-80% of crops have detectable levels of mycotoxins (Eskola et al., 2019).
c. Heavy metals (HM), such as cadmium, chromium, mercury, lead, copper, zinc and nickel, are defined by their densities greater than $5\,g/cm^3$, which are non-biodegradable hazardous substances derived from natural mineral sources or industrial/agricultural discharges (Qin et al. 2020). The abundance of heavy metals in common foods, such as fresh vegetables and fruits, poses several human health risks including carcinogenesis, kidney dysfunction, immune system imbalance, and even death due to biomagnification and bioaccumulation (Sarker et al., 2021).
d. Microplastics (MPs) originated from single-use water bottles, to-go containers, food cans, and storage wraps etc. These small fragments of wastes being 1 μm - 5 mm contaminate the environment and threaten human health and ecosystem including crops, leading to economic losses. Based on reports from the United Nations Environment Assembly (UNEA) and the United Nations Environmental Program (UNEP), plastics in the environment annually burden the global economy by $19 billion, causing concerns for long-term ecological sustainability and the Global Goals. It is reported that about 8.3 billion tons of plastic waste have been created, leading to 4.9 billion tons discarded through landfilling globally, causing more than $13 billion financial loss annually. Microplastic waste management is more challenging compared to macroplastics due to their tiny size and less noticeable. The potential accumulation of microplastics in food chains, particularly in fish and crustaceans, appears to be the main source of human exposure to microplastics. Contamination of foodstuffs with MPs could have consequences for the health of human consumers by disrupting hormones, increasing risk of chronic diseases, impairing immune health etc. (Medicalnewstoday.com).
e. Persistent organic pollutants (POPs), are a group of carbon-based organic chemicals that are persistent, bio-accumulative with long-range transport

potential. POPs have been used and released to the environment through various human activities of industrial and agriculture sector. The released POPs can easily contaminate crops, livestock, seafood and drinking water and pose a high risk to human health.

f. Climate change significantly aggravating aforementioned food safety concerns. As extreme heat increases food safety risks, especially in areas without adequate cold-chain management facility, which makes it harder to prevent the growth of microbial contaminants. Warmer temperatures and droughts increase the production of aflatoxins in harvested crops. Warming seawater can induce the growth of toxin-producing algae that contaminate marine products and further incubate foodborne illnesses causing Vibrio species. Heavy rains and flooding encourage the spreading of infections. Moreover, extreme weather affects and reduces the quality and nutritional profile of agricultural commodities.

g. Permitted food additives, with or without nutritional value, is used in processed foods. Food additives deliver numerous functions in food industry as they intensify colour, thickness, shelf life and flavor of processed food. Regulatory authorities issue approvals as safe within acceptable quantitative limits. However, certain food additives such as artificial colorants, benzoate preservatives, non-caloric sweeteners, emulsifiers and their degradation derivatives reported to cause adverse health concerns by increasing risks of mental health disorders, attention deficit hyperactivity disorder, cardiovascular diseases, metabolic syndrome and possess potential carcinogenic effects. Further, ultra-processed foods (UPFs) contain combinations aforementioned additives possess a great risk on adult obesity, metabolic syndrome, cardiovascular diseases, mental health disorders and cancers (Warner, 2024).

h. Misuse of antimicrobial agents leading to the development of widespread antibiotic resistance (ABR) in organisms ranging from spoilage microorganisms to pathogens is another soaring issue. ABR is a threat to food industry, as it compromises the quality and safety of the food supply chain. ABR is one of the biggest threats to global health, food security, and development. Data from more than 200 countries forecasts the full toll of antimicrobial resistance on people, livestock and the economy and estimates a return of US$ 28 for every US$ 1 invested in drug innovation and health care improvements (World Organization for Animal Health).

i. Accessibility to safe water is a prerequisite in the food industry as water quality directly influences the product safety and quality. Water is one of the vital food ingredients which required from primary stage of crop production till its consumption. Water contamination by physical, chemical, or biological hazards poses health risks. Further, pesticide residues, heavy metals, persistent organic pollutants, and industrial chemicals contaminate food via water routes. Polluted water causes food contamination that leads to various foodborne diseases of bacterial (Travelers' diarrhea, cholera, shigellosis), viral (hepatitis, poliomyelitis), and protozoal (giardiasis and cryptosporidiosis) origin.

In parallel to the global scenario, numerous food safety challenges have been identified in recent times in Sri Lanka. Coconut oil imported to the country, was found contaminated with Aflatoxin, above permitted levels (Samarajeewa, U., 2021). Less data is available on the locally produced coconut oil, sold in the open market. Similarly, coconut refuse is added to animal feed and is known to contain aflatoxin, thus it becomes a potential contaminant in cow's milk as aflatoxin M (Lakshman, et al., 2022). Similarly, the presence of class 2A and 2B carcinogenic compounds, namely 3-MACP and GEs, are known to be formed in palm oil and other during refining and deodorizing (Gesteriro, et al., 2019.). The presence of such components has not been investigated adequately. Heavy metals are important environmental pollutants threatening the health of human population and natural ecosystems in Sri Lanka. Due to the application of imported low priced fertilizer may have also affected our food production and supply, increasing contamination with heavy metals. Heavy metals can affect the quality of agricultural soils, including phytotoxicity and transfer of heavy metals to human diet from crops. Excessive usage of poor-quality fertilizer, industrial and municipal waste are the potential contributory factors to toxic metals in soil and ground water. The heavy metals of most concern are Cd, As, Pb. (Mahendranathan and Priyashantha, 2019). Climate change has been challenging to the farmers, causing poor drying conditions and storage of food produce, thus reducing shelf life. The emergence and re-emergence of foodborne pathogens has been a serious concern. Major food borne infections recorded in Sri Lanka as per the Epidemiology Unit of Ministry of Health (2017), are *Campylobacter* (in raw milk, raw or undercooked poultry and drinking water), Entero-haemorrhagic *Escherichia coli* (in unpasteurized milk, undercooked meat and fresh fruits and vegetables), *Vibrio cholera* (in contaminated food and water), Hepatitis A (in raw/ undercooked sea-food) and *Listeria monocytogenes* (in unpasteurized dairy products, vegetables and fresh/frozen chicken). Adulteration of foods is common, to gain market advantage, without realizing the consequences. The adulteration of black tea with sugar, glucose, sodium bicarbonate and ferrous sulphate to improve colour of tea leaves (Gunathilaka and Warnasooriya,2021) is known. Microplastics that can be harmful to marine and freshwater organisms, may also enter our food chain (Dharmadasa et al., 2021). The risk of microplastics to be found in table salt is questionable. Two main salterns of Sri Lanka, out of three are located in areas, (Puttalam and Mannar) where the sea is mostly polluted. Therefore, there is a high possibility of salt produced in Sri Lanka to contaminate with microplastics. The main chemical contaminant problems for seafood export in Sri Lanka are histamine and non-essential trace metals, especially mercury (Hg) (Jinadasa and Fowler, 2019). Chronic kidney disease of unknown etiology (CKDu) has emerged as a significant contributor to the burden of chronic kidney disease (CKD) in rural Sri Lanka. The prevalence of CKDu is 15.1–22.9% in some Sri Lankan districts, and reports suggested an association with farming occupations, in terms of agricultural practices, geographical and contaminants identified in drinking water.

Investment in technology is the ideal way to ensure food safety as cutting-edge technological advancements can bring preventive and remedial actions to address critical food safety concerns thereby ensuring global economic growth.

a. Artificial intelligence (AI) is emerging as a transformative force in addressing the multifaceted challenges of food safety, food quality, and food security. AI enhances food safety through real-time contamination detection, predictive risk modeling, and compliance monitoring therby reducing public health risks. It improves food quality by automating defect detection, optimizing shelf-life predictions, and ensuring consistency in taste, texture, and appearance. Furthermore, AI addresses food security by enabling resource-efficient agriculture, yield forecasting, and supply chain optimization to ensure the availability and accessibility of nutritious food resources.
b. Application of Non-Thermal Processing methods such as cold plasma in food processing operations neutralize pathogenic micro-organisms, including bacteria, viruses, pathogenic fungi, and parasites. Pulsed electric field processing in food is a technology in which food is subjected to a short-term high-voltage electrical pulse. These impulses cause transient structural changes in the cells, which can lead to the inactivation of micro-organisms and enzymes, positively affecting the shelf life of the product. Application of Ultrasound in in optimizing food-freezing processes. High hydrostatic pressure (HHP) treatment enhances the food quality due to the lack of heat treatment, which preserves higher nutritional value and sensory quality.
c. Rapid food testing methods are cutting-edge techniques created to promptly identify allergies, infections, pollutants, and other dangerous materials in food. Rapid testing procedures yield results in a couple of hours or even minutes, in contrast to traditional methods that can take days to give results. Thus, facilitating quick decision-making and remedial measures in the event of contamination identification. These sophisticated techniques use state-of-the-art technology such as chromatography, biosensors, polymerase chain reaction (PCR), and immunoassays to detect pollutants with high sensitivity and precision.
d. Natural or natural-derived food additives such as microorganisms-derived preservatives (i.e. Lactic Acid Bacteria, Bacteriocins, Antimicrobial peptides) and plant-derived preservatives (corn syrup, plant chitosan, plant secondary metabolites, plant antimicrobial peptides, phytochemicals) can replace the harmful synthetic additives and improve the product safety
e. Designing sustainable, recyclable, reusable and/or biodegradable food packaging solutions, such as bio-plastics, edible films, anti-microbial films etc. can be novel technological interventions in food packaging. Further, environment friendly materials such as starch, poly hydroxy alkanoates, polylactic acid, and

polybutylene succinate, and their blends with active agents, rendering them suitable for innovative food packaging applications.

f. Engineered nanomaterials have emerged as a promising technology for water treatment, particularly for removing heavy metals. Their unique physicochemical properties enable them to adsorb large quantities of metals even at low concentrations.

g. Risk communication "an interactive process of exchange of information and opinion among individuals, groups, and institutions". As such, risk communication encompasses a range of activities, from consulting with the public or professional organizations, to meeting with governmental partners, to designing and delivering recalls or warnings. The future of food safety and risk assessment can be evolved rapidly with the emergence of New Approach Methodologies (NAMs). NAMs comprise in silico computational models, in vitro assays, omics technologies, and Adverse Outcome Pathways (AOPs). These technologies offer more accurate, human-relevant insights into exposure of chemical and biological hazards, while reducing reliance on animal testing.

h. Optimized pre-harvest practices and establishing Critical Control Points in post-harvest practices can prevent and reduce mycotoxin formation in grains, respectively. Further application of decontamination treatments with volatile bioactive compounds, cold plasma, ozonization or UV treatment can be adopted in case with grains contaminated with mycotoxins.

RUSSIA

Dudarev Murat

Expert of the Committee on SME

State Duma of the Russian Federation

International industrial clusters: from competition between countries to common goals

The global economy, evolving in its development, is becoming more complex, which means that economic ties between enterprises of different countries get inevitably intertwined. Countries are moving from conventional trade to the production of joint products. Russia can achieve its technological sovereignty by integrating into international cooperative ties, as the Russian Federation is part of the international community.

Foreign experience shows that businesses of different countries closely interact with one another. In this regard, such a thing as an international industrial cluster has become widespread. Russian enterprises also seek interaction, especially in complex production and high-tech, with foreign companies that have their own resources, so it is advisable to establish institutions of international industrial clusters in Russia.

An international industrial cluster is not a territorial but an extraterritorial economic phenomenon, the main feature of which is cooperative links between enterprises of different countries regardless of their location. That is, different parts of a common output product can be produced in different countries and throughout different continents.

The economic objective of the international industrial cluster is the establishment of stable long-term cooperative ties between specific business entities to achieve common production goals. Unlike joint ventures, which unite separate single business entities, international industrial clusters bring together a large number of differently oriented business entities into a single system. This will ensure a synergy of economic potentials of different countries, necessary for manufacturing high-tech and expensive products, as such a task would be too challenging and economically unsustainable for a single country. It will also facilitate the movement of finished products between the countries participating in international industrial clusters and for each of them to expand the market for its products. This will accelerate further technological progress of mankind in various fields of mechanical engineering, shipbuilding, space industry, medicine and other critical areas of development. The technological development paradigm may shift from competition between different countries to cooperation to achieve common goals. This will contribute to the common cooperation of countries and their peaceful coexistence.

It is advisable to start developing the institute of international industrial clusters in the SCO, BRICS and EAEU countries. This practice can later be extended to relations with other countries as well.

What the institution of international industrial clusters brings to Russia

1. Achievement of the national goal of the International Cooperation and Exports national project;
2. An additional factor of foreign states' connectivity with Russia through the creation of cooperative ties and joint ventures that would be economically unfeasible to break; a soft power tool to increase Russia's influence in foreign countries;
3. Expedited production of technically complex, knowledge-intensive and resource-intensive products at lower cost through the synergy of economic potentials of different countries;
4. Acquisition of foreign technologies by Russian enterprises though cooperation and joint ventures, through joint educational programmes with foreign enterprises to train and retrain personnel as well as via joint scientific cooperation;
5. The added value of finished products will be generated in Russia through establishing local production facilities, with taxes paid to the Russian budget and new jobs created for Russian citizens;
6. Enhancing overall cooperation with friendly countries and promoting their peaceful coexistence with Russia.

Tools to be developed and implemented as a result of international treaties of states in the process of creating international industrial clusters that are relevant to businesses:

1. Use of a single unique closed system of international financial settlements (including digital currency), available only to members of the international industrial cluster, simplifying financial relations, guaranteeing their enforceability and reducing transaction costs.
2. An alternative to lending. For Russian business entities, the format of creating joint ventures with foreign partners under international industrial clusters means investments in the existing production business, filling it with working capital, supplying equipment, introducing foreign technologies, modernising, expanding and scaling up the business, and providing export opportunities.
3. Use of a unified system of interstate support for all members of an international industrial cluster, regardless of their nationality, by creating a joint fund financed from budgetary or extra-budgetary resources of different states. The principle of 'more support for joint ventures' applies.
4. Tax, customs and other privileges and preferences typical for free economic zones, but applied extraterritorially and 'mirroring' in the territories of all states that are parties to international agreements on the establishment of international industrial clusters and in relation to their specific residents. The principle of 'more preferences for joint ventures' applies.
5. Duty-free customs movement of goods between member countries of an international industrial cluster for member business entities.
6. A favourable system of barter exchange based on the principle of 'shipping a component in exchange for duty- and tax-free finished products worth the value of the said component', including the use of a guarantee system established by each state to ensure the performance of deliveries.
7. Expansion of the market for manufactured products.
8. Formation of a globally competitive cost of manufactured goods.

The institution of international industrial clusters in Russia can be arranged as follows:

- monitoring of Russian industrial enterprises, their condition and output products in order to identify technologies, equipment, raw materials, components and parts lacking for successful and profitable operations, as well as unique and/or innovative technologies, equipment, raw materials, components and parts, and to analyse their ability for international cooperation;
- interaction between government authorities and business entities to ensure systemic measures for the development of international cooperation;
- development of draft laws and regulations aimed at introducing the necessary legal framework to establish the institution of international cooperation in Russia;
- scientific cooperation with scientists, inventors and innovators in order to study foreign technologies, develop their own technologies, build a scientific base for introducing developments and technologies into industrial

production in order to create new technologies, equipment, raw materials, components and parts using cooperative models of interaction;
- educational activities and training events for business entities in order to teach them basics of international cooperation;
- preparation of agreements on the protection and promotion of capital investments with joint ventures and foreign enterprises.

A register of residents of international industrial clusters will be maintained, with residents being Russian, foreign, joint ventures and international companies.

Criterion for inclusion in the register:
- compliance of the planned finished manufactured products with the sectoral import substitution plans of the Ministry of Industry and Trade of Russia;
- provision by a resident candidate of a production programme that meets the established requirements.

Criterion for removal from the registry: significant deviations from the production programme.

Being in the register gives the right to receive all support measures and preferences. Exclusion from the register deprives of such rights.

Specialised organisations will be created for managing international industrial clusters; they will provide methodological, organisational, expert-analytical, information and communication support to Russian and foreign business entities.

International activities will be carried out through the following activities:
- building up an extensive communication network with business entities, as well as with Russian diplomatic missions and Russian consulates abroad and in Russian regions;
- building international cooperative chains;
- monitoring of foreign countries to find partners, holding negotiations, participation in international events to disseminate registers of supply and demand for cooperation and to find participants in the international cooperation mechanism.

Potential conflicts that may arise in the course of cooperative activities between cluster residents will be resolved by an internal mediation service, which will act as a mediator in order to avoid litigation and quickly settle disputes between residents on an amicable basis.

A tribunal will also be established as an intra-system body following the rules of international arbitration and will handle disputes between residents.

Maintaining demand registers: these registers will contain **deficit** technologies, technological equipment, raw materials and components by sectors to form a cooperative demand.

Maintaining supply registers: these registers will contain **unique** technologies, technological equipment, raw materials and components by sector to form a cooperative supply.

In order to develop international industrial clusters, Russia needs the respective regulatory framework to provide a legislative definition of this phenomenon and to develop state support mechanisms and other necessary rules. The regulatory work will look as follows.

1. Amending the federal law 'On industrial policy in the Russian Federation' to introduce legal groundwork for international industrial clusters;
2. Developing and adopting a number of regulations to create systems for all elements of the IIC institution, in particular, identifying priority international cooperation areas for Russia, defining rules for inclusion and exclusion from the registers of IIC residents, registers of cooperative supply and demand, approving rules for state support, customs and tax preferences, approving the rules for international settlements within IICs, creating guarantee mechanisms for the functioning of the financial and barter systems of interaction within IICs, and other functions necessary for the existence of this institution;
3. Signing international agreements with foreign states on the creation of international industrial clusters, establishing common rules and standards, creating systems of interstate support for IIC members, other systems necessary for the functioning of the IIC institution on the international level;
4. Drafting amendments to Russian legislation in accordance with international agreements reached.

In conclusion, I propose that the topic 'International industrial clusters: from competition between countries to common goals' be taken for presentation at the National Centre RUSSIA open dialogue 'The Future of the World: A New Platform for Global Growth', which will be held on 28–30 April 2025, given its global creative significance.

Ebo Kouassi Frunze

Director, faithful and aspirant to the Russian Orthodox Church in Benin

Trium unit Sarl

A strategic lever for global growth and improved living standards

Introduction

Technological investments no longer depend merely on strategic direction, but they depend on the economic imperative aimed at accelerated development of the Southern and Eastern countries. In the face of significant economic inequality, persistent health challenges, food insecurity, and rapid urbanization emerging technologies constitute the decisive factor in inclusive growth promotion and strengthening of sustainable social and economic ecosystems. Within the framework of this dynamics targeted allocation of funds to the most promising technology sectors is required to optimize the impact of investments and ensure sustainable transformation with significant added value.

Based on the studied areas, three strategic sectors will be defined, in which technologies may play the key role: optimization of the public healthcare system, food security, and smart city development.

If implemented correctly, these initiatives can catalyze sustainable and inclusive growth.

Plan of the presentation

Introduction

1. Optimization of the public healthcare system through cutting-edge technologies
- Tasks of the public healthcare sector in developing countries
- Technological innovations in the service of public healthcare
- Economic and social impact
- Certain cases and examples of success
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2. New technologies to ensure food security
- Issues of food security
- Technological solutions
- Economic and social consequences
- Practical example
-

3. Use of technologies for smart city development
- Tasks of the fast-growing urban areas
- Key technologies of smart cities
- Economic and social results
- Successful project example (smart city of Kigali, Rwanda)

Conclusion

In the world where innovations constantly redefine the economic and social dynamics, Southern and Eastern countries find themselves at a strategic turning point. Target implementation of cutting-edge technologies provides unique opportunity to fill in the main structural gaps in terms of access to medical services, food security, and urban management. By accumulating such achievements, these countries may not only accelerate their own development, but also become stable members of the global competition. It was decided to discuss three key areas deserving special attention in this presentation: optimization of the public healthcare system, food security, and transformation of cities into smart and interconnected spaces.

1. Optimization of the public healthcare system through cutting-edge technologies

Among multiple challenges faced by Southern and Eastern countries, public healthcare sector takes the center stage in view of the persistent inequality and significant lack of adapted infrastructures. Thus, the contribution of cutting-edge technologies is important to improve availability and efficiency of medical services.

Tasks of the public healthcare sector

Southern and Eastern countries are facing significant gaps in terms of access to medical services: insufficient medical infrastructure, lack of qualified personnel, high cost of medical services, and geographic inequality. These challenges significantly slow down development of human potential and economic performance.

Technological innovations in the service of public healthcare

Rapid development of telemedicine, artificial intelligence (AI) used in diagnostics, digitalization of medical records, and biotechnology are revolutionizing the access to medical services. For example, AI based applications enable increasingly accurate remote diagnosis of diseases, which reduces the need for physical consultations. Such devices with Internet access to control patients as smart watches and biometric sensors enable real time control of health parameters (heart rate, glucose level, blood pressure), which facilitates early detection of diseases and preventive control of the patients. Such AI aided surgical robots as Da Vinci enable surgical interventions with increased precision, which reduces post-operational risks and facilitates access to high quality medical services even in the regions, where experts are lacking.

Economic and social impact

Integration of cutting-edge technologies in the medical sector reduces expenses on public healthcare, as well as increases life expectancy and productiveness. According to report of the World Bank, switch of medical services to the digital format could decrease expenses on public healthcare in some African countries by 20%. At the same time, development of technological solutions for public healthcare creates new commercial opportunities, promotes investments in digital infrastructure, and supports emergence of specialized startups.

Practical example: Rwanda and its medical drones

Rwanda uses drones for fast delivery of blood bags and medicines to remote regions. This initiative introduced by Zipline significantly decreased the level of mortality associated with complications in case of bleeding.

2. New technologies to ensure food security

Provision of sufficient and stable nutrition for the world's population, the number of which is continuously increasing, is the main strategic task, especially in the most vulnerable regions.

Issues of food security

Demographic growth, impacts of climate change, and post-harvest crop losses are the main challenges for food security. In many regions performance of agriculture remains low because of obsolete traditional methods and lack of access to innovations.

Technological solutions

Precision farming, blockchain based product tracking, vertical farms, and artificial intelligence used for agricultural forecasting are the necessary solutions. For example, smart sensors allow optimization of irrigation and fertilization, which improves performance and ensures protection of natural resources.

Economic and social consequences

Implementation of new technologies in agriculture promotes better resource management, reduces losses, and increases farmers' incomes. Blockchain increases transparency of supply channels, which reduces the possibility of fraud and ensures higher remuneration for the manufacturers. Access to technologies expands the coverage area of clusters and makes trade more profitable.

Practical example: Agricultural drones in West Africa

Such enterprises as Aerobotics use drones to control crops and detect diseases prior to their dissemination, which significantly improves yield.

3. Use of technologies for smart city development

Tasks of accelerated urbanization

Infrastructure of Southern and Eastern cities is hardly coping with rapid pace of urbanization. Challenges include overload of the roads, contamination, poor waste management, and insufficient utilities.

Key technologies of smart cities

Internet of things (IoT), smart resource management, smart transport systems, and digital management are the main solutions for the challenges. For example, IoT enables optimization of lighting in public areas and energy consumption, thus reducing expenses and promoting adaptation of the new cities.

Economic and social results

Smart cities improve the quality of life, reduce pollution, and facilitate access to the main services. Besides, they attract foreign investments and promote growth of innovative entrepreneurial ecosystem.

Successful project example: Kigali, a pioneer city

Kigali (Rwanda) has implemented several smart city projects, including smart surveillance systems and electric buses, and became an example for other African cities.

Conclusion

Technological investments are an important issue in solving of the structural challenges of the Southern and Eastern countries. Modernization of public healthcare sector, agricultural innovations, and smart urbanization are the three strategic areas that shall be prioritized in order to ensure inclusive and sustainable growth.

Expected accompanying effects include improved living conditions, stimulation of the economy, and improved resilience in the face of future crises. However, these achievements require strong political commitment, continuous investments, and dynamic partnership between the public and private sectors to ensure the maximum effect. Strategic integration of such technologies will help these countries to start profound long-term transformation and make technologies the driver of world prosperity.

MEXICO

Flandes Montalban Andrea

Student

National Autonomous University of Mexico

Russia and artificial intelligence: innovations for global competitiveness

"The nation that leads in AI will be the ruler of the world"
Vladimir Putin

In recent years, the development and implementation of artificial intelligence (AI) has become a key factor in economic and geopolitical rivalry in the international arena, and Russia, aware of this reality, has managed to take a leading position in this area. In this paper, I analyse the various strategies that Russia has implemented in the field of AI development, how it has achieved its dominant position in the global competition, and what it can offer other countries hoping to develop and realize their own technological potential.

AI has become a disruptive technology that drives innovative changes in markets and industries, creating new business models. At the same time, AI leaders have obtained both economic advantages and significant geopolitical influence. Russia is among the countries implementing new policies and strategies for the development of AI.

Russia's AI Strategy

- Investments

In September 2017, CNN gave extensive coverage to President Vladimir Putin's statements about who might dominate global politics in the future. According to the Russian leader, artificial intelligence would be the deciding factor.

To quote Putin, "Artificial intelligence is the future, not only for Russia, but for all humankind. It comes with colossal opportunities, but also threats that are difficult to predict. Whoever becomes the leader in this sphere will become the ruler of the world." In this sense, Russia has joined the club of countries that believe that those who are able to monopolize this technology will not keep it for themselves, but will share it with the rest of the world.

In 2019, Russia adopted its National Strategy for the Development of Artificial Intelligence for 2020–2030, which aims to make the country a global leader in AI technologies. The Strategy served as a complement to the "Digital Economy of the Russian Federation" National Program, which prioritizes the development of AI and quantum technologies.

- Use in Defence and National Security

AI technologies have radically altered the defence and security sectors. President Putin stresses the importance of AI for national security and warned of the dangers of technological monopolies in this area. AI is utilized in areas such as cybersecurity, digital intelligence, and the development of hybrid warfare strategies, which strengthens Russia's position on the world stage.

- AI for the Economy

Global experience shows that key economic sectors such as energy and mining have optimized their processes using AI for the purposes of increasing efficiency. Leading companies such as Sberbank[1] have adopted AI to improve their services and operations, demonstrating the private sector's commitment to technological innovation.

Impact on Global Competitiveness

Russia's large-scale investments in AI allow it to compete with the United States and China in this field and even challenge their dominance in advanced technologies. The creation of alliances such as the AI Alliance Network[2] with BRICS countries and other partners aims to counteract the technological limitations imposed by international sanctions.

Russia has repeatedly stressed the need to develop its own artificial intelligence so it does not have to rely on Western platforms, which, critically speaking,

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1 Sberbank is an internationally recognized banking and financial company.

2 Европейская A European initiative to establish an open dialogue on artificial intelligence.

could impose values and norms that are alien to Russian culture. This position highlights the differences in approaches to AI regulation and ethics between Russia and other regions, most notably North America.

Through technological cooperation, Russia has expanded its influence in developing countries by offering alternative AI technologies. Not only does this approach expand the Russian market in this area, but it also strengthens future geopolitical alliances, which will in turn influence global economic processes.

A Lesson in How to Grow the Tech Sphere

As a student and future international relations expert, I see a genuine interest on Mexico's part in integrating technology into its economic, social, and technological development. But the country faces serious challenges in terms of its social dynamics, namely, the lack of a coherent national strategy and the growing dependence on foreign technologies. Bilateral cooperation between Mexico and Russia has been subject to scrutiny to identify promising areas for joint work in technology and education.

These are major powers that can potentially accelerate AI development and close the technological gap. What is more, from the economic point of view, adopting these technologies in such sectors as heavy industry, agriculture, and the financial services market could improve Mexico's productivity and competitiveness on the global market.

Among the challenges and risks, as we have already mentioned, are technological dependence and the lack of adequate regulation. Over time, these issues should focus on developing public policies that encourage innovation while protecting and safeguarding the rights of citizens and national security.

Russia's current AI strategy demonstrates how technology has become a battleground for global competitiveness. While this approach has brought advances in defence, economics, and national security, it has also raised concerns about the use of AI for geopolitical purposes. Russia has opted for a development model based on technological independence and state control, which differs from the more open and regulated approach of the West.

For Mexico and other emerging economies, the key question is not simply whether they should adopt AI technologies, but which model they should implement. Should Mexico follow in Russia's footsteps and develop AI with strong government support and strategic implementations, including for defence? Or is the regulated implementation of AI with a human rights focus like the one promoted by the European Union and the United States more appropriate?

Relying exclusively on Western models carries the risk of becoming subject to their technological dominance and regulation, while cooperation with countries like Russia could be an alternative for technological diversification. But is Mexico prepared to balance innovation with the ethical and cybersecurity challenges that a more aggressive AI strategy entails?

This contradiction raises the important question of the extent to which AI should be used as a tool for economic growth, and the extent to which it may become a geopolitical weapon. In its quest for technological advancement, Mexico must not only embrace artificial intelligence, but it must also decide what type of AI it wants in its future. Andrea Cadenas de Llano Sosa

Bibliography

1. Freire, D. (2025, February 25). Vladimir Putin, presidente de Rusia, lo tiene claro desde hace años: "El país que domine la IA, dominará el mundo" Andro4all. https://www.lavanguardia.com/andro4all/tecnologia/vladimir-putin- presidente-de-rusia-lo-tiene-claro-desde-hace-anos-el-pais-que-domine-la-ia-dominara-el-mundo
1. Cadenas de Llano, A. (2024, December 11). Putin abre un nuevo frente contra Estados Unidos y China. Huffington Post. Available at: https://www.huffingtonpost.es/global/putin-abre-nuevo-frente-estados-unidos-china.html
1. Price Lab Solutions. (2024). Inteligencia artificial en México: Estrategias y oportunidades. Available at: https://pricelabsolutions.com/inteligencia- artificial-en-mexico-estrategias-y-oportunidades/
1. Reuters. (2024, December 11). Russia teams up with BRICS to create AI alliance, Putin says. Available at: https://www.reuters.com/technology/artificial-intelligence/russia-teams-up-with-brics-create-ai-alliance-putin-says-2024-12-11/
1. UNESCO. (2021). Russian Federation. En UNESCO Science Report: The Race against Time for Smarter Development. Available at: https://www.unesco.org/reports/science/2021/es/russian-federation
1. Universidad de Colima. (2024). Relaciones bilaterales entre México y Rusia: Oportunidades en tecnología y educación. Available at: https://www.ucol.mx/noticias/nota_8835.htm
1. Voz de América. (2024, December 10). Putin impulsa la IA en Rusia para competir con Occidente. Available at: https://www.vozdeamerica.com/a/putin-impulsa-ia-rusia-/7369328.html

AZERBAIJAN

Gafarov Ruslan
VC Analyst

Digital Space Ventures (DSV)

Investments in Technology as a Driver of Sustainable Global Growth

Thematic Vector

The thematic vector of this essay aims to investigate the role of investments in technology as a key mechanism for addressing the global challenges faced by countries in the Global South and East, with a particular emphasis on the BRICS nations. The essay will delve into the practical applications and implications of technological advancements across various sectors, including food security; healthcare; energy; water management; smart city development; cybersecurity; platform economy, as well as new areas such as artificial intelligence (AI), quantum computing, and fusion reactors.

As the world grapples with the pressing issues of climate change, demographic shifts, and widening disparities between developed and developing nations, technology is evolving from a mere tool to a foundational solution for addressing these challenges. Investments in technology have the potential to drive not only economic growth but also to foster social equity, environmental sustainability, and enhanced quality of life.

Contemporary challenges

Since the dawn of the 21st century, the world has been confronted with a multitude of global challenges that require urgent and ambitious solutions. These include climate change, rapid demographic expansion, resource depletion, inequitable distribution of benefits, and the technological gap faced by developing countries. The United Nations expects that by 2050, the global population will surge to 9.7 billion, placing unprecedented strain on vital resources such as food, energy, and water.

Moreover, climate change is already exerting significant pressure on the global economy. According to World Bank estimates, by 2030, its effects could result in the loss of over 100 million jobs, predominantly impacting nations in the Global South. Concurrently, there has been a notable economic shift towards the Global South and East, particularly among BRICS countries. While their combined economic output represented just one-fifth of the global economy at the start of the century, it now exceeds half. To fully harness this growing potential, innovative development strategies centred on technological advancements are imperative.

Data analysis

According to McKinsey (2023), the BRICS nations have the potential to expand their share of global GDP to 60% by 2040 if they prioritise the development of high-tech industries. Supporting this, BloombergNEF data highlights that China and India are already leading in renewable energy, collectively investing over $300 billion annually in solar and wind technologies.

Opportunities in technology

Technology presents a unique chance not only to address current challenges but also to establish a sustainable development framework that benefits future generations. Investing in technology is no longer just a trend; it has become essential for ensuring food security, accessible healthcare, environmental sustainability, and social equity.

The significance of this topic is underscored by the critical development stage of countries in the Global South and East. Strategic investments in technology can accelerate their economic growth and enhance the quality of life for their populations. For instance, advancements in precision farming, artificial intelligence, and renewable energy are already yielding substantial outcomes in nations like China, Russia, India, and Brazil.

Hypothesis

Investments in technology hold the potential to form the cornerstone of a new global growth paradigm, grounded in the principles of sustainability, equity, and openness. This could empower countries in the Global South and East to not only address their internal challenges but also to assume a leadership role in the global economy.

Analytics and Data

1. Food security

- According to the Food and Agriculture Organization of the United Nations (FAO), global food consumption is expected to rise by 70% by 2050, driven by population growth and urbanisation. These factors will place additional strain on agricultural systems.
- Precision farming can boost crop yields by 20-30% by leveraging technologies such as drones, satellites, and the Internet of Things (IoT). For instance, precision farming initiatives in India have demonstrated a notable 25% increase in wheat yields. This achievement was facilitated by the deployment of soil sensors to monitor moisture and nutrient levels, combined with automated irrigation systems.
- Alternative food sources, such as lab-grown meat, are already attracting annual investments of $1.5 billion (Good Food Institute, 2022). Companies like Beyond Meat and Impossible Foods have demonstrated that producing artificial meat can reduce carbon emissions by up to 90% compared to traditional livestock farming. This innovation is particularly significant for nations with limited arable land, such as Bangladesh and Nigeria.
- Vertical farms, which enable food production in confined spaces, are gaining popularity. For instance, in Japan, these farms can produce up to 10,000 heads of lettuce daily while using only 1% of the water required by traditional farming methods. This solution is especially pertinent for urban environments where land is scarce.

2. Healthcare

- The World Health Organization (WHO) forecasts that by 2030, over 1 billion people will require healthcare services due to chronic diseases. This issue is particularly acute in the Global South, where access to quality healthcare remains limited.
- Telemedicine has the potential to decrease healthcare costs by as much as 30% by offering access to medical professionals in remote areas. For instance, in Brazil, the adoption of telemedicine has reduced waiting times for consultations from one week to just a few hours. This is particularly crucial for rural regions where medical facilities are often far from populated areas.
- Artificial intelligence (AI) is already being utilised to diagnose lung cancer

with accuracy rates as high as 94% (Nature Medicine, 2021). In China, AI systems are assisting in the analysis of X-rays, enabling early disease detection and reducing mortality rates by 20%. This technology is particularly vital for countries such as India and Brazil, where healthcare systems face significant strain.

- Bioprinting of organs and tissues is rapidly transitioning from concept to reality. For example, Organovo has developed technology to bioprint human liver tissue suitable for transplantation. This innovation holds the potential to significantly reduce organ transplant waiting lists and save millions of lives.

3. Energy

- The International Energy Agency (IEA) forecasts that renewable energy will contribute to 90% of electricity growth by 2050, driven by increasing awareness of climate change effects and declining technology costs.
- Investments in solar and wind energy grew by 20% in 2022, reaching $500 billion (BloombergNEF). For instance, Morocco launched Noor, the world's largest solar facility, which now supplies energy to over 1 million households. This initiative not only reduces reliance on fossil fuel imports but also creates new jobs.
- Energy storage technologies, such as advanced batteries, offer solutions to address the instability of renewable energy sources. Tesla has developed energy storage systems capable of powering entire cities for several days. This innovation is particularly vital for countries like Nigeria and India, which experience frequent power outages.
- Hydrogen energy is emerging as a highly promising sector. For instance, Japan has initiated projects utilising hydrogen to generate electricity and heat homes. This technology has the potential to serve as an alternative to fossil fuels and reduce carbon dioxide emissions.

Empasis on Economic and Social Effects

Economic effects

1. GDP growth

- Investing in technology can boost the annual GDP growth of countries in the Global South and East by 2-3%. For example, in India, the expansion of the IT sector has contributed an additional 8% to the nation's GDP over the past decade, driven primarily by the growth of software and services exports.
- The growth of high-tech industries is driving the creation of new markets and employment opportunities. According to the World Bank, the digital economy is expected to generate over 100 million jobs in Asia and Africa by 2030. This development can play a crucial role in reducing unemployment and enhancing the quality of life for populations in these regions.

2. Cost reduction

- Automation and robotisation in production can lower operating costs by 15-25%. For instance, in China, the integration of robots in factories has resulted in a 40% reduction in labour costs. This approach can be adopted by other countries to enhance the competitiveness of their economies.
- Precision farming technologies can reduce resource usage, such as water and fertilisers, by up to 40%. This is particularly crucial for countries with limited resources, such as Bangladesh and Nigeria.

Social effects

1. Improving the quality of life

- Access to quality healthcare and education through digital platforms. For instance, in Nigeria, online learning platforms for children have increased literacy rates by 15%. This approach can be expanded to other nations to help reduce illiteracy rates.
- Improving living conditions in smart cities by reducing pollution and noise levels, which is particularly critical for megacities like Delhi and São Paulo, where air pollution poses a severe challenge.

2. Social justice

- Technology is playing a crucial role in addressing inequality by providing equal opportunities to all population segments. For instance, in Bangladesh, blockchain-based microcredit platforms have empowered small farmers to secure financing without relying on traditional banking systems. This solution can be replicated in other countries to help combat poverty.
- The platform economy fosters the growth of small and medium-sized businesses by creating favourable conditions for their development. For example, Alibaba enables small entrepreneurs in China to access international markets. This approach can be expanded to other countries to accelerate their economic progress.

General Conclusions and Expected Results

1. Investing in technology is not merely a current trend, but a vital necessity for addressing global challenges.
2. Nations in the Global South and East have a unique opportunity to leverage technology to accelerate economic growth and enhance the quality of life for their populations.
3. A new platform for global growth should be founded on the principles of sustainability, equity, and openness.

Expected results

1. Economic:

- The GDP of countries in the Global South and East is projected to increase by 2-3% annually.

- Over 100 million new jobs are expected to be created in high-tech industries.
- Automation and robotisation are expected to reduce operating costs by 15-25%.

2. Social:

- Literacy rates and access to education are expected to rise by 15-20%.
- Mortality from chronic diseases is projected to decrease by 20-30% through the application of AI in healthcare.
- Living conditions in smart cities will improve thanks to reduced pollution and noise levels.

3. Environmental:

- The carbon footprint is expected to decrease by 30-40% as a result of transitioning to renewable energy sources.
- The sustainable utilisation of water resources is anticipated to reduce their shortage by 20-25%.
- Environmental protection will be enhanced through the implementation of sustainable technologies in agriculture and industry.

Proposals for Innovative Approaches and Solutions

1. ***Creation of a shared technology platform for BRICS nations***

- Establish a shared platform to facilitate the exchange of technology, research, and innovation among BRICS member states, ensuring optimal resource utilisation and avoiding redundant efforts.
- For instance, collaborative projects such as developing fusion reactors or quantum computing systems could position BRICS countries as global leaders in advanced technology markets.

2. Launching regional centres of competence

- Set up specialised centres in each BRICS nation, each focusing on a distinct area of expertise: artificial intelligence in India, renewable energy in China, water management in Brazil, and space technologies and advanced materials in Russia, among others.
- These centres will drive research, train professionals, and implement innovative solutions tailored to local needs.

3. Establishment of a BRICS joint venture capital fund

- Launch a $10 billion venture capital fund dedicated to supporting technology start-ups across BRICS nations.
- The fund will focus on financing initiatives that tackle critical global issues, including climate change, food security, and public health.

4. Collaborative development of green infrastructure

- BRICS nations can collaborate on developing green infrastructure, encompassing renewable energy systems, water purification facilities, and smart city initiatives.
- For instance, they could jointly construct solar power plants in arid regions or initiate desalination projects along coastlines.

Assessment of Economic and Social Effects

1. Economic effects

- Implementing the proposed solutions could boost the combined GDP of BRICS nations by 5-7% by 2035.
- The generation of new employment opportunities in high-tech sectors will contribute to reduced unemployment rates and increased household incomes.

2. Social effects

- Enhanced access to high-quality healthcare and education services will elevate the overall standard of living for the population.
- The use of technologies such as blockchain and platform economies will help reduce inequality, fostering equal opportunities for all societal groups.

Expected Results Relevant to the BRICS Regions

1. Technological Independence

- By fostering their own innovative sectors, BRICS nations will decrease their reliance on imported technology and equipment.

2. Global Technological Leadership

- BRICS countries will enhance their standing in the global technology market by advancing in promising fields such as AI, quantum computing, and thermonuclear energy.

3. Sustainable Growth

- The adoption of green technologies and sustainable practices will enable BRICS countries to meet the United Nations' Sustainable Development Goals (SDGs) by 2050.

Conclusion

Investing in technology is a forward-thinking strategy that ensures future generations enjoy a better quality of life than we do today!

Technological investments not only address current challenges but also pave the way for a sustainable development model that benefits humanity as a whole. I urge all participants in this dialogue to collaborate in building a global technological ecosystem, which will serve as the foundation for a new platform driving worldwide growth.

References

1. FAO: Report on Global Food Security. URL: https://www.fao.org/state-of-food-security-nutrition/en/
2. Good Food Institute: Investments in Alternative Proteins. URL: https://www.gfi.org/marketresearch
3. 3. Nature Medicine: AI in Lung Cancer Diagnosis. URL: https://www.nature.com/articles/s41591-021-01450-6
4. BloombergNEF: Clean Energy Investment Trends. URL: https://about.bnef.com/clean-

energy-investment-trends/
5. McKinsey Global Institute: Smart Cities Report. URL: https://www.mckinsey.com/featured-insights/smart-cities
6. PwC Reports: AI Impact on Global GDP. URL: https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf
7. ITER Project: International Thermonuclear Experimental Reactor. URL: https://www.iter.org/
8. World Bank Reports: Climate Change and Economic Impact. URL: https://www.worldbank.org/en/topic/climatechange

RUSSIA

Gladkikh Egor
Student

Kurgan State University

Cybersecurity in the era of the big data economy

Our era is the era of digital boom. Every day, the world generates trillions of bytes of data. They shape the economy, create value, and become the new oil. Companies analyze these data sets to predict customer behaviour, optimize deliveries, and automate processes. However, big data is accompanied by big risks. Cyber threats are multiplying. Hackers, leaks, fraud – these are no longer mere movie scenarios but the reality. How to protect information? What are the mechanisms used by Russian companies and government agencies? It will be the subject of our discussion.

Online shopping, doctor's appointments, utility bill payment. Digital footprints are everywhere. Who collects them? How are they used? Law No. 152-FZ On Personal Data in Russia clearly regulates this process. However, even it does not protect against leaks. Let us recall loud cases, i. e. hacking of bank databases, leaks of passwords of large Internet platforms. And what are the results? Millions of users are losing money and facing identity theft. It is true that companies must encrypt and anonymize data, but do they always do it and do they do it well?

Hackers are no longer loners in hoods, they are an industry. Their methods get more complicated. Phishing, DDoS, exploits. In Russia, there is Law No. 187-FZ On the Security of the Critical Information Infrastructure. This federal law protects government systems, but what about businesses? Private companies remain the target. System got hacked? Loss of millions. Electronic signature got forged? Assets are stolen. Cybercrime adapts. In such situation, business can only follow the standards, implement protective measures, and train employees.

Besides, there are fake news, manipulation, and disinformation. How to distinguish truth from fake? In Russia there is a law On Counteracting Fake News. However, deep-fake technologies make data diddling more and more plausible. Should one trust videos, if faces are replaced by algorithms? Manipulation of financial markets, spread of panic – digital reality is dictating new threats.

AI makes work easier. It analyses data sets, identifies patterns, and predicts behaviour. But what if it was trained on false data? Manipulation of artificial intelligence is already real. AI regulation standards are being developed in Russia. But who is going to control the algorithms? Who will check whether they lead to discrimination, errors or biased decisions?

Encryption is more than just passwords. These are powerful algorithms, such as GOST 28147-89. These are new developments in post-quantum cryptography. In a world where computing capacities are growing, information security should be one step ahead. Companies must implement advanced encryption methods. Otherwise they risk losing everything.

Federal law No. 149-FZ sets the basics of information security. However, it does not solve all the challenges. Requirements shall be stricter. Mandatory software certification. Control of foreign technologies. National software development. This is not an easy task, but it is a must.

Is anonymity a myth? It is partially true, but anonymization technologies are developing. Blockchain, zero-knowledge proofs, and distributed databases – all of this helps to hide unnecessary information and maintaining privacy. The more data remains in shadow, the harder it is to steal it.

Thousands of security systems can be installed, but if a person clicks on a "suspicious link," entire security collapses. This is why training is the key aspect. Cybersecurity courses, government programs on digital literacy, corporate trainings. Without it, technology is of no use.

Cybersecurity is not mere technology. It's a strategy. It's awareness. It's protection at all levels – from private users to major corporations. Russia is actively developing legislation in this area. However, the threat is still there. It is evolving. Only comprehensive measures will help to survive this digital confrontation. Are we ready for this? The question is still open.

Gonzalez Figueroa Emmanuel Pablo
Student

National Autonomous University of Mexico

Dissemination of the Russian Language Using Generative Artificial Intelligence

Area of interest

This essay addresses the issues of “investments in technology” and “investments in humans,” as well as the ways these areas mesh with and complement each other.

Hypothesis

The use of generative artificial intelligence in the study of the Russian language could facilitate both the dissemination of the language itself and the promotion and popularization of Russian culture, provided that the use of such technologies will not contradict the spiritual and moral values of the Russian Federation.

Introduction

Technological progress has led us to the development of “generative artificial intelligence,” a technology that is capable of automatically synthesizing learning materials based on user requests. These materials can be represented as text, images, graphs, tables and even videos.

According to data published on the statistics portal *Statista*,[1] in 2023 the Russian language was the eighth most widely used language in the world. Russian has official status in the Russian Federation, Belarus, Kazakhstan and Kyrgyzstan, and is a secondary language in countries such as Armenia, Azerbaijan, Estonia, Georgia, Latvia, Lithuania, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. There are a total of 154 million native Russian speakers, and approximately 104 million people speak Russian as a second language, which amounts to approximately 258 million Russian speakers.

The most widely spoken languages in the world as of 2023

Position	Language	Native language	Total No. of speakers
1	English	380 million	1.456 B
2	Chinese (Mandarin)	939 million	1.138 B
3	Hindi	345 million	610 million
4	Spanish	485 million	559 million
5	French	81 million	310 million
6	Arab	274 million	274 million
7	Bengali	234 million	273 million
8	**Russian**	**154 million**	**258 million**
9	Portuguese	232 million	257 million
10	Urdu	70 million	231 million
Source: compiled by the author based on data published on the statistics portal *Statista* by Rosa Fernández on February 14, 2024.			

The United Nations (UN), World Health Organization (WHO), National Aeronautics and Space Administration (NASA), Organization for Democracy and Economic Development (GUAM), Shanghai Cooperation Organisation (SCO), and Commonwealth of Independent States (CIS) recognize the significance of the Russian language at the global level, as it is an official language in each of these organizations.

So how is AI relevant to the Russian language? As mentioned above, technological progress has brought about the creation of "generative artificial intelligence." Despite the controversy surrounding the subject, the use of generative artificial intelligence evidently facilitates learning for people anywhere in the world, as long as they have stable internet access. Consequently, artificial intelligence may potentially be a tool for studying the Russian language.

1 (Rosa Fernández, 2024, 14 de febrero).

According to a 2023 article by Sandra Hernández at SAS (Sociedad por Acciones Simplificada), the large-scale roll-out of generative artificial intelligence is observed across various regions of the world: in North America (20%), the Asia–Pacific (10%), Latin America (8%), Northern Europe (7%) and Southwestern and Eastern Europe (7%).

Economic and social effects

This technology can be used to not only popularize the language, as the language itself can become a vehicle for promoting Russian customs, traditions and values – that is to say, "Russian culture."

But why is generative artificial intelligence viewed as a "potential" tool? Currently available artificial intelligence generally violates Russian ethical principles (which are based on traditional values[2]), as it acquires information on the basis of statistics collected by algorithms on the basis of data from various social media.[3] For this reason, it would be more reasonable to develop artificial intelligence "from the ground up," leaving its development completely in the hands of the Russian government, supported by teachers, scientists and experts in Russian linguistics, phonetics and information technologies. This would be a social programme that must be in line with the spiritual and moral values of the Russian Federation.

Nevertheless, internet access may represent a hurdle to the implementation of this socially significant project. According to the International Telecommunication Union (ITU), almost one-third of the world's population (2.6 billion people) does not have internet access. According to the World Bank, the Earth's population in 2023 was 8.6 billion.

Finally, the implementation of this technology would not only contribute to cultural development, but boost the economy. Companies responsible for developing this artificial intelligence technology could receive funding from the government to finance the project and earn the larger share of the profits.

Conclusions

Technological progress has led to the development of generative artificial intelligence, which changes methods of the synthesis and transmission of knowl-

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2 According to Paragraph 5 of Decree No. 809 of the President of the Russian Federation dated November 9, 2022, traditional values include life, dignity, human rights and freedoms, patriotism, citizenship, service to the Fatherland and responsibility for its destiny, high moral ideals, a stable family, productive labour, priority of the spiritual over the material, humanism, compassion, justice, collectivism, mutual assistance and mutual respect, historical memory and continuity of generations, and unity of the peoples of Russia.

3 "GenAI is trained using data collected from webpages, social media conversations and other online media. It generates its content by [statistical analysis]..." (UNESCO, 2023, p. 8).

edge, in this case the Russian language. Russian is among the top ten languages in the world by popularity (it is spoken by approximately 258 million people), and technological progress in this area can help to spread Russian culture. Nevertheless, in order to maximize the educational potential of these new technologies, it is important to develop a version of artificial intelligence that corresponds to Russian spiritual and moral values. Such a socially important project would benefit Russian culture as well as the country's economy.

Expected results

The goal of this project is to disseminate the Russian language using a generative AI that would respect Russian moral and ethical principles. At the same time, the Russian language is expected to act as a vehicle for popularizing the Russian culture among the global community.

Sources

UNESO. (2023). Guidance for generative AI in education and research. pp. 7, 8, 28–30, 36, 37. https://unesdoc.unesco.org/ark:/48223/pf0000386693/PDF/386693eng.pdf.multi

Fernández, R. (2024). Los idiomas más hablados en el mundo en 2023. Statista. Accessed March 6, 2025. https://es.statista.com/estadisticas/635631/los-idiomas-mas-hablados-en-el-mundo/

Putin, V. (2022, November 9). Указ Президента Российской Федерации от 09.11.2022 г. № 809 (Decree No. 809 of the President of the Russian Federation dated November 9, 2022). Paragraph 5. http://kremlin.ru/acts/bank/48502.

Ginebra. (2023, September 12). La población mundial sin conexión sigue disminuyendo hasta los 2 600 millones de personas en 2023. Accessed March 6, 2025. https://www.itu.int/en/mediacentre/Pages/PR-2023-09-12-universal-and-meaningful-connectivity-by-2030.aspx

World Bank Group. (2024). Population, total. Accessed March 6, 2025. https://data.worldbank.org/indicator/SP.POP.TOTL

SAS Colombia. (2024). Estudio Global de IA Generativa: China lidera a nivel mundial. Accessed March 7, 2025. https://www.sas.com/es_co/news/press-releases/locales/2024/estudio-global-ia generativa.html

VENEZUELA

Gonzalez Franklin
Professor

Institute of Higher Studies Pedro Gual (IAEDPG)

New technology world

"The human mind is not a statistical machine like ChatGPT and its ilk, greedy for hundreds of terabytes of data in order to arrive at the most plausible answer to a conversation or the most likely answer to a scientific question." On the contrary... it "is a surprisingly efficient and elegant system that works with a finite amount of information. It does not try to corrupt correlations from the data, but rather tries to create explanations"

Noam Chomsky

The science fiction film *The Matrix*, written and directed by the Wachowski sisters (Lilly and Lana) (1999), reflects on humanity and the reasons that may lead to its demise. The film shows a hopeless future for humans who have depleted the planet's resources, destroyed the sun, and are eventually enslaved by machines of their own creation.

The film also looks at attitudes towards technology and the increasing separation of body and mind due to the development of robotics and virtual reality. It was believed that freedom was really nothing more than a predictable algorithm inside a computer programme, far from becoming a reality, at least in the near future. We are talking about the year 2199.

The film follows the adventures of Neo, a young hacker who was recruited by a resistance movement led by Morpheus, fighting against the domination of machines over humans. Morpheus offers him two pills of different colours: a blue one that will allow him to continue living in illusion, and a red one with which he will learn the truth.

Faced with this dilemma, the protagonist chooses the red pill and wakes up in a capsule. This is how he discovers that the human race is under the control of an artificial intelligence and imprisoned in a computer programme that serves only as a power source. Neo realises that the Resistance sees him as the Chosen One: a kind of messiah who will free humanity from the slavery of the Matrix.

Although he doubts his destiny, throughout the film he learns to overcome the rules of simulation. He manages to rescue Morpheus, who has been kidnapped, and defeat Agent Smith after a duel in which he proves his worth as a warrior and confirms that he is indeed the Chosen One.

Today, the world is witnessing events that make us question the established timeframes. The COVID-19 pandemic has accelerated automation in many industries such as services, construction, medicine, food, defence and aerospace. Robotisation is developing rapidly. It affects not only work (remote working), but also decisively changes the way people live. It seems that machines have gained independence and now dominate people by invading their personal space. Indeed, there is no human space left without gadgets, for example.

Hence the claim that in a few years we will have "robot friends" who will live in our homes, communicate with residents and become a kind of confidant who will listen to all our problems, sufferings, pains, anxieties and emotions.

Our observations below address the most striking features of a world where technology has an almost existential impact on humans and where machines are actively competing with them.

Loss of social ties

We can agree with Zygmunt Bauman that we live in a 'liquid modernity', which leads to a loss of social ties (people increasingly communicate more with a mobile phone or tablet than with relatives or friends), while "personal space, intimacy, anonymity and the right to secrecy fall outside the principles of consumer society."

Some argue that we are facing new forms of communication and social relationships in a society of social networks, which raises the following questions: What happens to identity? Does it blur, disappear or hide behind emoticons/emoji? Where do words, language, ethics, lies/truths remain, and what types of social relations develop in this society?

According to American linguist and political analyst Noam Chomsky, the use of mobile phones and social media represents a step backwards as live communication disappears, creating superficial relationships. He believes that new technologies isolate people from each other.

Emoji language

People talk about different "deaths." For example, the death of history according to Hegel's philosophy or, in a more modern version, the end of history according to Francis Fukuyama. Also the death of God, according to Friedrich Nietzsche.

But now they're talking about something more important: the death of the word with the advent of a worldwide language of emojis.

With their help, a world language was created, the so-called emoji or emoticons, which are small images without any borders, expressing and conveying any emotion or thought. These are sequences of keyboard characters used to convey emotions (smile, wink, surprise, sarcasm, sadness, or to send hugs and kisses).

These icons convey what words no longer express or cannot or will not say. So, any person (rich, poor, dark-skinned, blond, white, educated or not, male, female, homosexual, immigrant or native) becomes a decentred subject, that is, a subject in process, immersed in an unreal reality, influenced by the effects of reality.

These emoticons/emoji have become the perfect medium to communicate with people from any part of the world as they break language barriers, or even with our own friends/enemies when there is simply no need to write a lot of words to express what can be shown through pictures.

Social media

Today, it is not radio, television, print media or cinema, but the Internet and, in particular, social media that are the world's main means of communication, changing the way information is disseminated, as they have cultural, economic, social and political implications for the global community, creating new forms of communication.

Today, for example, both the Internet and social media have become a major medium precisely because of the speed and ease of access and exchange of information, data of all kinds, and because of their ubiquitous and global nature. They erase boundaries. It is also a chaotic, multi-dimensional environment with a blurred hierarchy, where - unlike television or newspapers - anyone can freely publish their thoughts. The user, more than in any other environment, acts as both consumer and content creator. The "I" that constantly manifests itself online is simultaneously author, narrator and character.

Let's look at what some thinkers are saying:

Polish philosopher Zygmunt Bauman says:

"Social media don't teach us to dialogue because it is so easy to avoid controversy... But most people use social media not to unite, not to open their horizons wider, but on the contrary, to cut themselves a comfort zone where the only sounds they hear are the echoes of their own voice, where the only things they see are. *Social media are very useful, they provide pleasure, but they are a trap*."

Portuguese writer Boaventura de Sousa states:

"This is one of the contradictions of our time. We welcome social media and the internet as platforms, as a form of democratisation of knowledge and information. But recently, in the post-truth era, social media and the internet have been used to manipulate public opinion based on what is difficult for the average person to understand."

The era of social networks is developing within what the French philosopher Gilles Deleuze called the "Societies of Control" – that is, societies dominated by biopolitics (regulation of the species), flexible and changeable networks; where power relations are rooted in scientific and technological innovation and seek to encompass the entire social body, leaving virtually nothing outside of control.

South Korean philosopher Byung-Chul Han argues that in a performance society, social media is a space in which people need to constantly stand out by displaying an idealised image of themselves. The search for recognition and validation becomes an obsession, creating a constant pressure to get likes, followers and positive comments.

This dynamic of performance on social media leads to the alienation of people. In an attempt to conform to the standards of success and happiness imposed by society, people become disconnected from their true selves and become mere consumer goods. Authenticity is lost, replaced by a carefully constructed image that seeks external approval.

Social networks generate a typical confrontation between those who defend them at all costs ("pro-technology hysteria", as German professor Peter Sloterdijk puts it) and those who consider them diabolical and the cause of all ills ("anti-technology hysteria").

Social media as an international player

However, today social media have become an extremely important international player, as many political changes and coups d'état have taken place through them. For example, the "colour revolutions" in some post-Soviet countries (the Rose Revolution in Georgia in 2003, the Orange Revolution in Ukraine in 2004 and the Lemon or Tulip Revolution in Kyrgyzstan in 2005), the Arab Spring in 2010 and the so-called "outraged." Latin America and the Caribbean have also been hit by such coups.

The schemes are almost identical. Gene Sharp, a theorist of nonviolent action, lays them out in his works *From Dictatorship to Democracy* and *The Methods of Nonviolent Action*.

Hence, social media is one of the major international players with tremendous effectiveness, shaping subjective opinions and penetrating daily life, family, internet, wi-fi, mobile phone, violating privacy, invading personal space, becoming part of everyday life every second of the day.

And Venezuela is experiencing this, being turned into and has becme a breeding ground for such technologies, which this is nothing new.

What is said on these platforms about Venezuela and spread around the world is that our country is a dictatorship state, that there is a civil war, that we are killing each other, and many erudites, progressives and even leftists, including those from Latin America and the Caribbean, believe these allegations.

But this is nothing new. For example, a document entitled "Plan to Overthrow the Venezuelan Dictatorship: Masterstroke, released in February 2018 and attributed to Admiral Kurt Walter Tidd, commander of US Naval Force Southern Command, explicitly points to the importance of social media in achieving the goals set. In this sense, the author suggests the following approach: "Increasing, inside the country and through the mass media established abroad, the dissemination of designed messages based on testimonies and publications originated in the country, making use of all the possible capacities, including the social networks. Claiming, through that mass media, the need to put an end to this situation because of its unsustainable essence."

In this situation, according to President Nicolas Maduro, "Venezuela continues to be the jewel in the crown for the imperial elites of the United States and its allies. The country is also a target for cyberattacks."

Ilon Musk, owner of Platform X, and Mark Zuckerberg, co-creator and founder of Facebook (from 2021 Meta Platforms), both of whom profited from the COVID-19 pandemic and wield enormous power – not only in the economic but also in the media sphere – are aiming to undermine the Bolivarian revolution and the President in an attempt to reverse history.

It is important to mention that against the backdrop of the information war that is being waged in Venezuela, disinformation is becoming a powerful weapon. It is therefore essential to strengthen the country's digital defence capabilities to counter manipulative campaigns and protect the credibility of information.

Are we living through a time of "brain strike"?

From a lexicographical point of view, a strike means a collective cessation of labour activity by workers in order to demand certain conditions or to express protest. Let us add that in the world of capital strikes can also be staged by peasants, teachers, professors and even entrepreneurs.

However, in this Liquid Modernity, as Zygmunt Bauman calls it, where the only certainty is the constant presence of uncertainties and voids to be filled, we are living through what is called a "brain strike," which means nothing less than a refusal to use the brain and its neurons. And this happens at times when we are faced with an overabundance of information (infodemia) in our global world, which, paradoxically, brings about misinformation. This is not a fiction, not a fairy tale, not a fable, but a reality.

We live, without fear of making a mistake, in the era of cut and paste, which means that it is possible to find on the Internet any monograph or other work written by another author and pass it off as one's own. This is happening not only at the undergraduate level, but also at the master's level, and even at the highest level, in doctoral studies. Sad but true, in the age of Artificial Intelligence (AI), one of the professions that could be replaced is said to be teaching.

Today, new technologies and neoliberalism do not call for reflection, rather quite the opposite. The reality is that people no longer read books, novels or even essays. Everything is now simplified by social media, which is also dominated by the "I like" philosophy according to Byung-Chul Han, meaning that we post or forward what we like, without bothering to verify its content. This trend has accelerated with the emergence of post-truth and fake news.

We believe that the best way to resist the "brain strike" is to return to reading, using the word and reflection, constantly and continuously, so as "not to die in the attempt," because, in the end, "The dangerous thing about living without reading is that it makes you believe everything you are told" (Mafalda).

The Age of Infocracy

In 2022, South Korean philosopher Byung-Chul Han wrote the work entitled *Infocracy*. There he argues that Infocracy can be compared to an information regime and says: "With the term 'information regime' I refer to a form of domination in which information and its processing by algorithms and artificial intelligence have a decisive influence on social, economic and political processes."

In the current era, the supremacy of information and digital algorithms is taking root in the political sphere, which has its consequences, especially in the selection of new rulers, i.e. information is destructive to the democratic process. Therefore, for Han, "Democracy is degenerating into Infocracy."

Infocracy is becoming a phenomenon of digital media, where the abundance of information makes it possible to create algorithms that work with users' data to manage their behaviour and preferences. Digital algorithms are developing the psychometrics of social media users. According to Han, "psychometrics, also known as psychography, is a data-driven procedure for obtaining a personality profile." This profile is developed based on the pattern of information consumption in digital networks. Algorithms, together with psychometrics, form a user who is subject to a regime of information. This regime, in turn, is an expression of psychopolitics, that is, it has the power to control and manipulate the human psyche. Consequently, the abilities inherent in the democratic process, such as autonomy or free will, are destroyed in the name of Infocratic domination. Democracy as the power of the people yields to Infocracy as the power of information. The digital algorithm acts arbitrarily and favours certain politicians or parties.

For Byung-Chul Han, “In Infocracy, election campaigns degenerate into information warfare,” with political parties taking more interest in controlling this information than in developing their proposals and development plans. “Voters are not told about a party’s political programme but are manipulated by election advertising tailored to their psychoprogramme. And often with the help of fake news” (Han). Therefore, the speeches, actions and plans of political parties no longer matter. Information warfare is conducted with algorithmic weapons.

In Infocracy, information warfare is expressed as political warfare, and social media users resemble an overly docile and compliant herd.

“In electoral campaigns understood as information warfare, it is no longer the best arguments that win, but the smartest algorithms,” Han says. Hence, democracy becomes subject to digital algorithms that can guide human behaviour. Commanding this information and these algorithms is the most effective form of sovereignty nowadays. “Sovereign is he who has control over the information on the web” (Han), that is, sovereign is the one who determines what is true based on information. What is valuable and necessary for the people.

We would say: we live in an era where the technological divide is undermining the democratic process.

Artificial Intelligence (AI) and employment

Artificial Intelligence (AI) is a combination of algorithms designed to create machines with the same abilities as humans. It is a technology that still seems distant and mysterious to us, but which has been present in our daily lives for several years now, constantly, and continues to gain ground in many areas of the modern world.

With artificial intelligence comes a scenario where, over time, some jobs can be done without any human involvement at all.

AI is replacing professional workers. For this reason, about 85 million jobs in medium and large companies are expected to be cut this year. 80 million of them will be replaced by artificial intelligence.

There is increasing talk that 5 professions are under threat and could disappear, giving way to artificial intelligence. Here they are:

1. Education. Business experts say that artificial intelligence can provide effective learning materials to students without contact with a teacher, and many AI companies are interested in investing in educational tools. ChatGPT, developed by OpenAI in 2022, is said to be able to deliver lessons.
   They also say that machine learning, a branch of artificial intelligence, will help revolutionise the education system, and it will no longer exist as we know it. Since AI can recommend content to students.
   The advantage for teachers or education professionals, experts warn, is that with the use of artificial intelligence, a teacher may not have to worry about administrative tasks and can focus on the quality of learning.

2. Journalism. Artificial intelligence has proven to be highly effective in collecting data, analysing it and finding patterns. For this reason, some companies are abandoning journalists and replacing them with artificial intelligence. Reportedly, about 50 journalists have been fired from Microsoft in 2020. However, not all is lost for journalists, as even tools such as ChatGPT require verification of their information.
3. Graphic design. The ChatGPT artificial intelligence has also shown that graphic design as a profession may disappear in the future. Currently, ChatGPT can create personalised images based on user needs.
4. Finance. The financial sector and jobs in it will be displaced by artificial intelligence, which already spots fraud. It can also provide financial counselling services 24 hours a day and search for potential clients without the need for human intervention.

AI can write code, design websites, and create high-performance user interfaces, jeopardising professions in the field.

Machines dominate humans

It is worth noting that technology itself is neither good nor bad - it all depends on the ethics of those who use it. We are not against technology, but we wonder: who controls whom? Are the machines controlling us or are we controlling them? What will happen when machines become smarter than us? Will we be able to live without them?

The example of the World Cup in Qatar, which has caused much controversy and criticism of FIFA for choosing a country with human rights issues, especially against women, shows the role machines play today.

Robotisation is developing rapidly. It affects not only work (remote working), but also decisively changes the way of life. It seems that machines have gained independence and now dominate people, invading their personal space.

Therefore, some argue that in a few years we will have robotic friends who will live in our homes, communicate with the occupants and become a kind of confidant, listening to our problems, opinions, pains, anxieties and emotions.

In football, which is called the king of sports, we see the dominance of machines. VAR (Video Assistant Referee) is a system introduced by the Federation Internationale de Football Association (FIFA) to eliminate refereeing errors. Today, hardly any football match can do without this technology. VAR consists of a set of cameras whose images are analysed by FIFA referees in a special room with monitors. They make decisions, which are then relayed to the head referee and line judges.

Here we can say that technology has been put at the service of the king of sports, and all the controversies are ultimately decided by the machine.

VAR is still used in the following cases:

- When a goal is scored. Potential rule infringements such as offsides, fouls, hand play or other offences are checked.
- In the case of a penalty kick. It is checked whether the decision to award or cancel a penalty has been correctly made. Situations both inside and near the penalty area are analysed.
- Penalties. VAR checks whether the removal of a player was justified.
- Player identification. Sometimes the referee may mistakenly show a card to the wrong player. In such cases, VAR intervenes and informs the referee of the error.

As we can see, we didn't have to wait until 2199, as in the *The Matrix*, for the machine to finally subjugate man; at least in football this is already a reality.

Conclusion

In light of the above, the following questions arise:

Who will ultimately dominate our complex world: machines or we humans?

Is it possible that machines will become smarter than humans? And if that happens, what will happen to us? Will we be able to live without them?

If there are huge risks with today's technology and talk of something frightening, what will happen to the technology of the future?

Should we allow machines to flood our information channels with propaganda and lies?

Should we create non-human species of intelligence that may eventually surpass us in numbers, intelligence and replace us?

What will happen to love, feelings, experiences, joys and sorrows - all the things that make us human? Will these qualities be transferred to machines? Some argue that he who works like a machine thinks and feels like a machine. Will he then be able to operate like a human being?

We conclude with three thoughts.

"The human brain is unique in that it is the only container of which it can be said that the more you put into it, the more it will hold" (Glenn Doman).

RUSSIA

Gudkova Anna
Assistant to the Deputy

State Duma of the
Russian Federation

Investments in artificial intelligence

The modern Russian economy can certainly be described as a post-industrial one. A large portion of it is taken by the service sector. The growth of added manufactured products is largely due to the increasing use of advanced technologies. In particular, artificial intelligence plays increasingly bigger role in the domestic economy. The competitiveness of Russian products on world markets, national security, technical equipment of enterprises, and the amount of vacancies for highly qualified specialists hinge on investments in AI. This is all the more evident given the increased interest in AI investments on the part of the state, society, and the private sector.

Investments in artificial intelligence are made both by the state (represented by its public law entities) and by individuals and legal entities. According to Kirill Dmitriev, CEO of the Russian Direct Investment Fund, the fund has invested more than RUB 150 billion in the development of domestic AI technologies. The state invests in artificial intelligence to improve the quality, efficiency, and transparency of its functions. Government authorities are actively introducing it into their activities, which allows them to process a greater volume of information, reducing the human error rate. This helps improve the accuracy of inspections and reduce employee costs. Managerial decision-making and analysis of programme results are beginning to prevail in the structure of civil servant activity. State investments in AI technology quickly pay off through streamlining the workforce and reducing violations that could be challenged in court, leading to damages.

Investors' interest in artificial intelligence is confirmed by the creation of the Alliance for Artificial Intelligence. This alliance includes major players in the Russian market in various industries: Yandex, Vkontakte, Gazprom, Aircraft, Uralkhim, Rusagro, Sibur, Severstal, T-Bank, Rostelecom, Kaspersky, and MTS. One of the Alliance's top priorities is assistance in attracting investment. In addition to investments by the alliance members themselves, they also seek to create a favourable investment climate in this area and actively promote the idea of investing in artificial intelligence.

Investments in artificial intelligence are made by venture capital funds, private equity funds, business angels, and private investors. The state invests in artificial intelligence through grants. As part of the Artificial Intelligence federal project, grants are awarded on a competitive basis to the winners of the Start II programmes of the Foundation for Assistance to Innovations. Grants of RUB 4 million and RUB 8 million make it possible to realise the most promising business ideas for the introduction and development of AI, while also stimulating high-tech enterprises.

One of the most commonly cited risks related to investing in artificial intelligence is possible bubble blowing. Big money is currently being invested in AI projects, which may lead to asset depreciation in the long term. If artificial intelligence technologies are not applicable, investments will not pay off. In my view, this risk is greatly exaggerated. AI is applicable in a whole range of economic sectors including education, culture, medicine, manufacturing, media, and law enforcement. When investing in artificial intelligence, one should follow the same rules and procedures as with other investment targets such as diversifying assets, examining the organisation's accounts, performing fundamental and technical analysis, and monitoring changes in legislation. AI is not implemented everywhere, the state and the private sector are ready to continue investing in it, which makes it possible to assess this area as a promising one for investments.

Investments in artificial intelligence, on the one hand, help corporations keep their technological equipment at the high level and, on the other hand, are a manifestation of their corporate social responsibility. Organisations adhering to ESG principles should invest in projects that contribute to human, technological and environmental development without harming future generations. AI technologies can be recognised as one of the most socially responsible areas for investment. The competent application of AI technologies will help reduce environmental damage from production and enhance the productivity of enterprises without doing damage to the environment, society or the state.

The state, as well as the private sector, invests more actively in applied projects related to AI development. Fundamental research is no less important, but in the long term it has a longer payback period. For example, Skolkovo give grants for AI development projects, helping organisations that develop AI decision support applications, carry out automatic inventory and conduct real-time reporting research. These projects allow organisations to quickly introduce technologies into production processes, cut labour costs and minimise the number of technical errors and defects.

Given the high rate of Russia's economic development, not only large corporations but also small and medium-sized businesses can afford to invest in artificial intelligence. There are a large number of promising startups on the market, which are supported by business angels. Investments in artificial intelligence are developing most rapidly in the technology and telecoms sector, commercial and professional services, financial sector, and service sector. These are high-tech areas that are rapidly embracing AI technologies. For example, in Moscow hospitals, AI technologies help mammologists make diagnoses. AI is also widely used in telemedicine and preliminary counselling of patients.

According to a research by Rostec, the global artificial intelligence market will be worth USD 59.75 billion by the end of 2025. So, the massive investments made by the Russian Federation and its private sector in artificial intelligence support global economic trends. Russia's economy is digitalising, which facilitates trade in digital products and export of artificial intelligence technologies abroad.

Investing in artificial intelligence has a positive impact on the development of human potential, too. This is especially relevant in Russia, which has serious demographic problems. Amid shrinking labour force, artificial intelligence will temporarily replace workers whose shortage is caused by low birth rates. AI can help improve the quality of education and medical care for children who have already been born. The competent integration of AI solutions into the educational process will improve the quality of self-education and stimulate the creative activity of students. The introduction of artificial intelligence into medical care can reduce mortality rates and enable earlier detection of dangerous diseases.

AI technologies are a broad concept. They include machine and deep learning, autonomous systems, quantum computing, self-learning, expert and knowledge systems, and much more. I think the most successful solution for investing in these technologies is the creation of special economic zones. Within this legal regime, organisations receive tax benefits, preferential loans, access to infrastructure, subsidies and grants. Support is provided in a comprehensive and multifaceted manner. Therefore, organisations have more opportunities to implement both fundamental and applied research in the field of artificial intelligence.

Summing up the results of this study, we would like to emphasise the high role and importance of investments in artificial intelligence. This is one of the most promising areas of technology, which has a great impact on political, economic, social and cultural spheres. Investments in artificial intelligence can help solve the problems associated with the commodity focus of the Russian economy and preserve its social and demographic potential. Joint efforts of the state, society, and private sector to invest in this area can significantly improve the living standards and quality of life for Russians. Artificial intelligence is so effective that it is already giving researchers reason to consider the real possibility of introducing an unconditional basic income in Russia. I believe that investment in artificial intelligence should remain a priority area of development in order to achieve the 'common good' for all Russians.

RUSSIA

Gurev Sergey
Chief Pricing Specialist

Federal autonomous Institution
"Main Department of State Expertise"

Investments in technology. Platform economy. Problems of establishing a reliable construction cost based on the resource-index method

Preamble

Under the “Investments in technology” theme the authors were invited to elaborate on the following topic: “Technology is not just a fashion trend. Technology has the potential to address critical challenges facing countries in the Global South and East. Which technology areas and initiatives should be supported under the new platform for global growth so that they contribute to economic development and improve the quality of life?”

I suggest considering this issue using the example of index formation when applying the resource-index method to determine the estimated cost of construction in the northern regions of Russia.

Currently, much attention is being paid to the transition of the constituent entities of the Russian Federation to the resource-index method of determining the estimated cost of construction. This becomes especially relevant in the conditions of limited resources and specific climatic conditions of the northern areas. The paper explores the sources of cost estimates and the importance of accurately accounting for all factors affecting costs, such as resource availability, transport costs and seasonal variations.

This essay also analyses the problems of practical application of the existing regulatory documents governing this process. In particular, this includes identifying gaps in legislation and standard approaches to index formation, as well as the issues that may arise due to the peculiarities of the natural environment and economic structure of northern regions.

The issues addressed are important for sustainable development and improved management of construction projects in these unique and remote areas.

Text of the essay

Northern regions of Russia are unique territories with special natural and climatic conditions and limited resources. Efficient establishment of cost estimation indices in these regions is of particular importance for ensuring sustainable development and improving the quality of life of local people. The purpose of this paper is to consider the problems arising when one attempts to establish indices using the resource-index method and to propose possible ways of solving them.

In this study, I have analyzed the existing literature on the resource-index approach, as well as data on the situation in Russia's northern regions. I reviewed various indices created for these regions in order to assess their effectiveness and identify problems associated with their application.

The resource-index method in determining the estimated cost of construction allows to address such key factors as the availability of natural resources, infrastructure and social services in these regions as well as the local environmental situation.

When calculating indices for the northern regions of Russia, it is necessary to consider their specific geographical location, harsh climatic conditions and the resulting limited availability of resources. Therefore, establishing the indices proves to be a more challenging task.

Another problem we encounter here is the seasonality and variability of resource supply, especially in winter. This affects the level of resource availability and needs to be taken into account when calculating the indices.

Another important factor affecting the formation of indices for the northern regions is the high cost of resources. The supply difficulties and limited reserves in the north drive local prices much higher, which creates additional problems for the population and economy of the region.

Therefore, establishing indices for the northern regions of Russia is a complex and challenging work.

What is particularly troublesome is the mismatch between the intrinsic needs of the regions and resource capacities. If you establish indices based on the resources only, you risk depriving the region of necessary funding for development, despite the active attraction of investments. This can lead to imbalances in economic development and negatively affect the social sector.

Another problem is the difficulty of determining the resource potential of northern regions. Specific climatic conditions, availability of minerals and other factors mean that this potential is diverse and heterogeneous, which complicate the task of establishing indices and requires additional analysis and research.

Northern regions of Russia are also highly vulnerable to climate change and environmental problems. As a result, establishing indices using the resource-index method may require consideration of climate factors, adaptation to climate change and the creation of environmentally sustainable development strategies.

While establishing indices, we have to take into account innovations and modern technologies that can make the regions more successful and competitive. In the northern regions of Russia, it is necessary to determine which innovations and technologies are most effective for development and how to introduce them, bearing in mind the peculiarities of these regions.

What affects the establishment of indices for the northern regions of Russia

The first factor is the climatic nature of the northern regions. These territories are characterised by low temperatures, long winters and short summer periods. Such weather conditions significantly affect the economic and social development of these regions and, consequently, the establishment of indices. For example, a long heating season leads to high energy costs and higher heating fuel prices, which will be reflected in the consumer price index.

The second factor is the remoteness of the northern regions from the central economic areas. This leads to high transport costs and expensive supply of goods, which will affect the wholesale price index and the production cost index. The remoteness from central markets may also cause shortages of various goods and services in the northern regions, which will be reflected in the consumer price index.

The third factor affecting the formation of indices is the specific economic structure of the northern regions. In most cases, they are dominated by industries related to the extraction and processing of natural resources. This can lead to fluctuations in the production cost index and commodity prices. For example, changes in global oil prices can greatly affect the production cost index in the oil and gas regions.

The fourth factor is the socioeconomic situation in the northern regions. They often have low income levels, high unemployment rates and limited opportunities for business development. This affects the consumer price index, wage index and other socioeconomic indices.

Therefore, we can conclude that the establishment of indices in the northern regions of Russia requires a special approach and bearing in mind their specific conditions. Addressing the challenges related to climatic conditions, remoteness from centres, specific economic structure and low living standards will help offset the negative effects on index establishment and provide more accurate data for analysis and decision-making in these regions.

Recommendations for better index establishment in the northern regions

To make the process of index establishment in the northern regions of Russia more efficient, it is recommended to focus on a number of important aspects.

First, it is worth noting the specific climate of the northern regions. The indices used in the resource-index method should be aligned against the severe climatic conditions. We have to develop special adjustments and coefficients that factor in the impact of climate on the indices, which will enable a more accurate assessment of the impact the resource factor has on the economic activities in the northern regions.

Second, it is recommended to consider geographical conditions when working on the indices. The northern regions cover a large area and have a wide variety of terrains, including tundra, taiga and mountainous areas. These aspects should be taken into account when determining the resource-index indicator, as adding specific indicators reflecting the availability of natural resources and the specifics of the northern nature to the calculations can help better present the real economic situation on these territories.

The third important factor has to do with the demographics of the northern regions. These areas are sparsely populated, which has a significant impact on economic indicators. Therefore, when establishing indices, we need to factor in the share of the population employed in resource-related sectors, along with the local level of unemployment and wages. This will allow a more accurate assessment of the impact the resource factor has on economic activity.

Finally, it is recommended to regularly monitor and analyse the economic activity in these areas. This will make it possible to track the changes in indicators and adjust the index calculation formulas, if necessary.

So, taking into account local climate, geography and demographics combined with regular monitoring will make the process of index establishment in the northern regions more accurate and ensure efficient assessment of the impact the resource factor has on the economic activities in these territories.

Prospects for the development of the resource-index method in the northern regions of Russia

In parallel with the growing interest in the use of the resource-index method in the northern regions of Russia, we encounter a number of problems that complicate its establishment and application. However, despite these difficulties, there are prospects for the development of this method and its successful adaptation to the specifics of the northern regions.

One of the main problems here is the lack of up-to-date data on resources and their availability in the northern regions. This has to do with limited data collection and processing capabilities, as well as with challenging access to deposits and other natural resources in the harsh northern environment. To address this problem, specialised data collection methods need to be developed and innovative technologies, such as geolocation and remote sensing, need to be applied to provide up-to-date and reliable data on resources.

The second big challenge involves accounting for climatic conditions and their impact on resource use in northern regions, which is by no means easy. Climatic factors can severely limit the availability and utilisation of resources. The resource-index method should take into account these climatic characteristics and develop appropriate indices that will factor in the impact of climate on resource availability and utilisation.

Another difficulty is the need to consider socioeconomic factors when establishing the indices. Northern regions, especially remote and sparsely populated areas, are often characterised by uneven distribution of resources and lack of infrastructure, which creates additional difficulties in assessing the availability and use of resources. The resource-index method should take into account the socioeconomic situation in the region and develop indices that will consider these factors.

However, there are still prospects for the development of the resource-index method in the northern regions of Russia. With the development of infrastructure and improvement of data collection and processing methods, we can expect better quality of indices and more accurate assessment of resource availability. Also, the development of modern technology, such as the use of remote sensing and artificial intelligence, allows for more efficient data collection and assessment of data availability.

A step in this direction is the creation of the platform “Federal State Information System of Pricing in Construction” (FSIS PC).

FSIS PC is information support for the process and procedure of determining the estimated cost of construction of capital construction projects financed using funds from the budgets of the budgetary system of the Russian Federation, funds of legal entities created by the Russian Federation, constituent entities of the Russian Federation, municipalities, where the Russian Federation, constituent entities and municipalities have more than 50% in the charter capital.

One of the main tools for transition to the resource-index method of determining the estimated cost of construction is the information placed in the FSIS PC.

The creation of a self-developing system of pricing and cost estimating in construction, which will be improved on a regular basis, with a constant increase in the reliability of construction cost estimates.

Despite the problems associated with the establishment of indices using the resource-index method for the northern regions of Russia, there are still prospects for their solution. The development of modern data collection and processing methods, taking into account climatic conditions and socioeconomic factors, as well as the use of innovative technologies can help develop the resource-index method and ensure its successful adaptation not only to the northern regions of Russia, but also to other BRICS+ countries.

EGYPT

Hatem Mohamed Mohamed Hassan Abouelnaga

Editor & International Relations Researcher

RIA Novosti

Bridging the Digital Divide in Egypt: Lessons from India

Introduction

In the modern digital era, access to the internet is no longer a luxury but a fundamental necessity for economic growth, education, and governance. The International Task Force on Global Public Goods identified knowledge generation as one of six essential global public goods in 2006, emphasizing the role of the internet as the primary medium for knowledge dissemination. However, despite its critical importance, the digital divide remains a major challenge, particularly in developing economies. Addressing this divide is crucial for ensuring equitable access to opportunities, fostering innovation, and promoting inclusive economic development.

This paper employs the Most Similar Systems Design (MSSD) methodology, comparing Egypt and India, two nations that share common demographic and economic challenges, including high population growth, widespread poverty, and efforts to enhance e-governance. Both countries recognize the transformative power of digital technology in governance and economic progress. However, while Egypt has focused on localizing smartphone manufacturing to reduce costs and drive economic development, India has prioritized making internet access more affordable through regulatory reforms and net neutrality enforcement.

India's approach has resulted in some of the world's lowest internet costs, significantly increasing data consumption and digital participation. In contrast, Egypt faces rising internet costs and regulatory gaps, which hinder accessibility and widen socioeconomic disparities. By examining these contrasting strategies, this study explores how different policy approaches can either widen or narrow the digital divide, ultimately shaping economic and technological progress.

As a member of BRICS, Egypt stands to benefit from learning from India's policies, particularly regarding internet affordability and digital accessibility. The experiences of both countries provide valuable insights into how governments can effectively balance industry localization with digital inclusion, ensuring that all citizens can benefit from the opportunities offered by the digital age.

Egypt's Efforts in Localizing the Smartphone and Mobile Phone Industry

Egypt is actively working to localize smartphone and mobile phone manufacturing to reduce reliance on imports and establish itself as a regional technology hub. These efforts align with Egypt's Vision 2030, which emphasizes digital transformation, industrial growth, and job creation. By attracting international and local investments, Egypt aims to build a sustainable mobile phone manufacturing sector that supports economic development and technological innovation.

Government Policies and Incentives

The Egyptian government has introduced policies to attract investment in the local smartphone industry. The Ministry of Communications and Information Technology (MCIT) has partnered with global and domestic firms to establish production facilities. In 2022, the government implemented tax incentives and reduced customs duties on key components to enhance competitiveness. The "Egypt Makes Electronics" (EME) program further supports the sector by promoting assembly and production in industrial zones such as the Suez Canal Economic Zone (SCZone) and the New Administrative Capital.

International Investments and Local Manufacturing Efforts

Leading smartphone manufacturers such as Oppo, Samsung, Vivo, Xiaomi, and Infinix have established production facilities in Egypt, benefiting from its strategic location, skilled labor force, and government incentives. Egyptian companies, particularly Silicon Industries Corporation (SICO), have also contributed to domestic smartphone production. By mid-2024, mobile manufacturing companies in Egypt had reached a total production capacity of 11.5 million units, with cumulative investments of $87.5 million. However, challenges remain, including reliance on imported components and competition from international brands.

The Impact of Rising Internet Costs and the Need for Net Neutrality in Egypt

Egypt's increasing reliance on digital services has been undermined by rising internet costs and limited accessibility. Internet service providers (ISPs) engage in practices such as paid prioritization, zero-rating favored platforms, and imposing additional charges on high-bandwidth applications. This undermines competition and raises costs for users reliant on other services. Countries that recognize the internet as a public good enforce net neutrality regulations to prevent such distortions.

Disproportionate Price Hikes and Accessibility Barriers

Recent internet price hikes have disproportionately affected lower-income households. The most affordable broadband package—140 GB per month—saw a 108% price increase between December 2023 and December 2024. While higher-tier plans experienced smaller price increases, the rising costs have deepened socioeconomic inequalities. Internet accessibility remains highly uneven, with urban areas having significantly more fixed-line subscribers than rural regions.

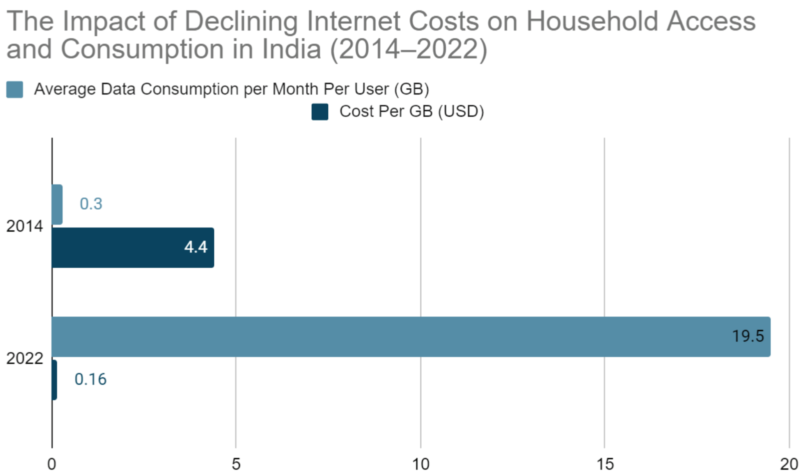
Despite higher costs, mobile broadband subscriptions grew at an annual rate of 6.53%, reflecting its increasing adoption. However, fixed-line internet remains crucial due to its affordability and superior capacity for downloading and streaming, making it indispensable for students, healthcare, and government services.

The Need for Regulatory Reforms

Egypt's internet services are regulated under the Telecommunication Regulation Law No. 10 of 2003, which lacks specific provisions on internet pricing. While it emphasizes free competition and fair pricing, it does not mandate ISPs to disclose detailed pricing structures, allowing companies to increase prices without regulatory scrutiny. Improvements in infrastructure have not kept pace with price hikes, leading to frequent outages and reduced speeds.

India's Approach and Its Lessons for Egypt

India's telecom sector has prioritized affordable internet access. The Telecom Regulatory Authority of India (TRAI) introduced regulations in 2016 prohibiting discriminatory data tariffs and ensuring a free and open internet. In 2019, India's Supreme Court recognized internet access as a constitutional right. These measures have contributed to India's exceptional internet affordability, driving significant data consumption. By 2028, India's per capita data usage is expected to surpass that of Western Europe and the United States.



Egypt, as an aspiring regional digital hub and a BRICS member, can learn from India's approach to internet accessibility. India has demonstrated that regulatory measures ensuring fair competition and price control can significantly enhance digital inclusivity. While Egypt focuses on localizing industry, ensuring affordable internet access is equally vital for fostering digital transformation.

The High Cost of Mobile Phones in Egypt: A Barrier to Digital Inclusion

One of the key challenges to enhancing e-government services in Egypt is the high cost of mobile phones, which, combined with rising internet prices, makes digital access unaffordable for large segments of the population. While Egypt has made significant efforts to localize smartphone manufacturing, this has not yet translated into lower prices for consumers. Instead, mobile phones remain luxury items, disproportionately affecting low- and middle-income households who struggle to afford both a device and the increasingly expensive internet services necessary to access government platforms.

Mobile Phone Pricing and Its Impact on Digital Accessibility

Despite Egypt's push for local smartphone production, prices of mobile devices have continued to rise sharply due to high import duties on essential components, currency devaluation, and inflation. Many of the locally assembled smartphones still rely heavily on imported parts, leading to higher production costs that are passed on to consumers. As a result, an entry-level smartphone in Egypt can cost between EGP 5,000 and EGP 8,000, while mid-range and premium models can exceed EGP 20,000, making them unaffordable for much of the population.

This high pricing structure excludes a significant portion of Egyptians from digital participation. For many families, purchasing a smartphone is a major financial burden, especially when coupled with the excessive costs of internet services. The average household in Egypt, particularly in lower-income brackets, often prioritizes essential expenses such as food, housing, and education over purchasing costly mobile devices. As a result, large numbers of people lack access to e-government services, limiting the success of digital transformation initiatives.

The Double Burden: Expensive Internet and Costly Smartphones

In addition to high smartphone prices, rising internet costs further widen the digital divide. Egyptian internet service providers (ISPs) have implemented price hikes that make broadband and mobile data increasingly expensive. For example, the most affordable broadband package (140 GB per month) saw a 108% price increase, jumping from EGP 120 in December 2023 to EGP 249.4 in December 2024. This disproportionately impacts those who are already struggling to afford internet access, particularly in rural areas where connectivity is limited.

With both smartphones and internet access becoming luxury items, the Egyptian government's efforts to digitize services risk being ineffective. If citizens cannot afford the tools necessary to access these services, digital transformation will remain an elitist concept, benefiting only those who can pay the high price of connectivity. This is in contrast to countries like India, where affordable smartphones and low-cost, high-speed internet have made digital services accessible to a much broader population.

Policy Recommendations for Affordable Digital Access

For Egypt to fully realize the potential of e-government services, it must address the cost barriers associated with mobile technology. This includes:

- Encouraging price controls on locally produced smartphones to ensure affordability.
- Reducing taxes and import duties on key smartphone components to lower production costs.
- Implementing stronger regulations to prevent excessive internet price hikes and ensure fair pricing.
- Exploring subsidies or financing options to make smartphones accessible to lower-income citizens.

Without targeted interventions to reduce both smartphone and internet costs, Egypt's digital transformation will remain incomplete, leaving millions excluded from essential government services and digital opportunities.

Mobile Phone Pricing and Its Impact on Digital Accessibility

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Bridging the Digital Divide in Egypt

The digital divide in Egypt is exacerbated by economic inequalities, high internet costs, and inadequate infrastructure, particularly in rural areas. While Egypt has made strides in digital transformation, these barriers hinder full digital inclusivity. Lessons from India suggest that addressing affordability and regulatory oversight can significantly enhance internet penetration.

A multi-pronged approach is necessary to bridge the digital divide in Egypt. First, enforcing net neutrality regulations would ensure fair access to online services. Second, revising telecommunications laws to regulate pricing and enhance transparency would prevent arbitrary price hikes. Third, investing in broadband infrastructure, particularly in underserved regions, would ensure wider coverage. Lastly, adopting policies that promote competition among ISPs would drive down costs and improve service quality.

India's experience illustrates that affordable internet access directly contributes to economic growth, educational opportunities, and enhanced e-governance. Egypt can replicate this model by prioritizing accessibility alongside its industrial localization strategy.

Conclusion

Egypt's localization of smartphone and mobile phone manufacturing is a strategic move toward economic self-sufficiency and technological advancement. Through supportive policies, international collaborations, and increased investments, the country is positioning itself as a regional production hub. However, digital accessibility remains a significant challenge, exacerbated by rising internet costs and inadequate regulatory frameworks.

India's example highlights the importance of enforcing net neutrality, regulating internet pricing, and expanding infrastructure to promote digital inclusivity. As a BRICS partner, Egypt can benefit from adopting similar measures to bridge the digital divide, ensuring that all citizens have equal opportunities in education, healthcare, economic participation, and civic engagement. By balancing industry localization with internet affordability, Egypt can accelerate its digital transformation and enhance its global competitiveness.

IRAQ

Haval Ashna

University Lecturer

Salahaddin University-Erbil

Machine learning approach to predicting systemic risk in Russian banks

Abstract

This study contributes to the literature on systemic risk in the Russian banking sector. Economic downturns, interest rate fluctuations, geopolitical events, and regulatory changes can impact the entire financial system, creating systemic risks for banks. Individual banks are often unable to cope with these risks, which can threaten their stability and profitability. Thus, good risk management is required to predict and mitigate the impact of such systemic hazards. Banks using machine learning techniques can improve their ability to identify trends, anticipate impending crises, and implement decisions to maintain financial resilience in the face of systemic risks.

Purpose — The goal of this study is to create a strong machine learning framework for predicting systemic risk in Russia's banking sector. The study's goal is to provide insights into the determinants of systemic risk, as well as a data-driven approach to risk management and decision-making for banks and regulators in emerging markets.

Problems — Selecting and implementing the best machine learning models for detecting systemic risk is difficult. Furthermore, evaluating and improving the

performance of machine learning models when dealing with imbalanced datasets in systemic risk prediction situations is another significant challenge.

Methodology — The study uses a comprehensive machine learning framework to detect systemic risk in Russian banks. A variety of machine learning methods, Selecting and implementing the best machine learning models for detecting systemic risk is difficult. Furthermore, evaluating and improving the performance of machine learning models when dealing with imbalanced datasets in systemic risk prediction situations is another significant challenge. such as gradient boosting machines (GBM), and deep learning models, are used to detect complicated patterns in financial data. To solve the issue of data imbalance, the study uses advanced resampling techniques including Adaptive Synthetic Sampling (ADASYN). Furthermore, feature engineering and dimensionality reduction methods, such as Principal Component Analysis (PCA), are utilized to improve model performance and interpretability. The DCoVaR approach is used to assess individual banks' systemic risk contributions, and cross-validation techniques ensure that the predictive models are resilient and reliable.

Keywords: Systemic risk, Risk Prediction, Banks, Machine learning, Classification problem, Emerging economy.

2 — Methodology

2.1 Data and sample

The study will focus on Russian banks and will use data from a variety of sources, including individual bank share prices on the Moscow Exchange, government variables from the Central Bank of Russia, and banking statistics from the Center for Monitoring the Russian Economy. The dataset contains both categorical and continuous variables, organized into two categories: aspects of the bank's balance sheet (e.g., ownership, size, profitability) and characteristics of the bank's shares (e.g., valuations, market risk). These characteristics influence systemic risk, which is estimated biweekly for each bank and averaged quarterly.

The analysis is divided into two sections, one focusing on high systemic risk and the other on moderate systemic risk as a robustness check. The study uses machine learning (ML) models to categorize banks according to their systemic risk categories (high or moderate). Discretized quartiles of systemic risk (DCoVaR) are used to generate classes, simplifying model training and making predictions more useful. The goal is to create a classifier that can predict cases of high and moderate systemic risk, allowing regulators and institutions to anticipate future problems without relying on human experts. The main goal is to create a model that accurately generalizes to previously unexplored data.

2.2 Estimation of systemic risk

The DCoVaR metrics of Tobias and Brunnermeier (2016) are used to estimate systemic risk in the Russian banking sector. Quantile regression is used to estimate systemic risk by defining the stress state as the 1% quantile. DCoVaR is the spillover of bank risk into the system, which accumulates as systemic risk. The estimation methodology includes state variables such as call money rate, 91-day treasury bill and 10-year GSec rate. VaR of bank asset growth is regressed on the lagged state variables.

2.3 Machine learning models

Model characteristics are the key parameters that determine the model's complexity. Prediction models have poor accuracy due to irrelevant features. Feature selection is an important component in machine learning models since it removes redundant features that may have an impact on the model's performance. The factors stated above are the input features for this investigation. The ML models eliminate duplicate features and train a durable model. This approach enhances model accuracy while decreasing overfitting. This subsection provides an overview of the ML models utilized in the research.

2.3.1 Logistic regression

LR is a technique for modelling dichotomous categorical outcome variables using one or more explanatory variables. LR calculates the probability that a given bank may emit high or moderate systemic risk.

When the input variables have complex associations, LR performs less effectively.

2.3.2 Deep Learning Models in Systemic Risk Prediction

Deep learning algorithms are used in this study to predict systemic risk in Russian banks because they can capture complicated, nonlinear correlations in financial data. Deep learning, a form of machine learning, employs artificial neural networks with several hidden layers to detect complex patterns in banks' financial statements, balance sheets, and market data. These models, such as feedforward neural networks, may learn from vast amounts of data, allowing them to identify tiny indicators of systemic risk that traditional models may miss. The application of deep learning models enables a more accurate and complete assessment of which institutions may be contributing to Russia 's financial instability.

2.3.3 Gradient boosting machine

GBM models are gaining popularity due to their efficacy in identifying difficult data sets (Bissacco et al., 2007; Hutchinson et al., 2011; Pittman and Brown, 2011; Johnson and Zhang, 2012). The goal of boosting was to improve a poor learning algorithm in order to generate a strong predictive model. The GBM classifier is built on ensemble techniques that merge multiple weak learning models in a progressive, cumulative, and sequential manner. Gradient boosting algorithms are typically implemented using decision trees. For all ML models, the study filters out critical data-set factors known as feature selection. Feature selection distinguishes valuable factors from noise and other irrelevant variables.

2.4 Addressing Data Imbalance

Addressing data imbalance is critical in systemic risk prediction to avoid model bias towards the dominant class. Techniques such as Adaptive Synthetic Sampling (ADASYN) generate synthetic samples for the minority class, improving the model's capacity to identify high-risk banks. This method increases the sensitivity and forecast accuracy of the models in detecting systemic risk.

2.4.1 Adaptive Synthetic Sampling (ADASYN) for Data Imbalance

Given the rarity of systemic risk events in comparison to non-risk events, the dataset used in this analysis is significantly skewed. To solve this issue, adaptive synthetic sampling (ADASYN) is used as a data preprocessing technique. ADASYN creates synthetic examples of the minority class based on the difficulty of categorization in the feature space. By adaptively providing more synthetic samples in places where the model struggles to distinguish between high-risk and low-risk banks, ADASYN assures that machine learning models can learn well from imbalanced data. This method improves the model's capacity to reliably anticipate systemic risk among Russian banks, especially when faced with an uneven distribution of risk occurrences.

2.5 Feature Engineering and Dimensionality Reduction

Feature engineering involves creating and transforming input variables to improve model performance, whereas dimensionality reduction seeks to reduce the number of features while retaining critical information. Principal Component Analysis (PCA) simplifies high-dimensional datasets, increasing model efficiency and interpretability by focusing on the most important factors for systemic risk prediction.

2.5.1 Principal Component Analysis (PCA)

The dataset used to predict systemic risk in Russian banks has a large number of financial and macroeconomic factors, which can result in high dimensionality and potential difficulties like multicollinearity. To address this, Principal Component Analysis (PCA) is used as a dimensionality reduction technique. PCA reduces the original high-dimensional data to a smaller set of uncorrelated principle components that retain the most significant variation from the source data. The study uses PCA to efficiently reduce the dataset's complexity, enhancing the efficiency and interpretability of machine learning models. This technique helps to narrow the study to the most important aspects contributing to systemic risk, making the predictive framework more robust and manageable.

3 — Limitations of the study

The study may have several limitations, including reliance on historical data that may not reflect future systemic risk scenarios, a lack of generalizability to banks in other areas, issues with imbalanced datasets impacting model accuracy, and potential bias in feature selection. Despite these limitations, the study makes a substantial contribution to knowledge by improving our understanding of systemic risk factors, offering machine learning approaches for categorization and prediction, and generating insights that might help regulators and policymakers. It indicates essential features that influence systemic risk, enhances risk management techniques in banking, and lays the groundwork for future research in the area.

4 — Conclusions

1. This study confirms the effectiveness of machine learning, in particular GBM and deep learning, in predicting systemic risk in Russian banks, allowing for a more proactive approach to risk management.
2. The study highlights the importance of addressing data imbalances using strategies such as ADASYN to improve model accuracy and minimize bias in predicting systemic risk.
3. Machine learning models help Russian banks detect systemic threats at an early stage, leading to greater financial stability and resilience in the face of economic and geopolitical challenges.
4. Russian policymakers can use machine learning models to improve systemic risk management practices, especially in response to economic sanctions, geopolitical events, and oil market fluctuations
5. Future research should focus on integrating real-time data sources, expanding the use of advanced machine learning techniques, and examining how external economic and geopolitical variables affect systemic risk in the Russian financial system.

References

1. Bissacco, A., Yang, M.-H. and Soatto, S. (2007), "Fast human pose estimation using appearance and motion via multi-dimensional boosting regression", *IEEE Conference on Computer Vision and Pattern Recognition*, *CVPR'07, Minneapolis*, MN,doi:10.1109/CVPR.2007.383129.
2. Hutchinson, R.A., Liu, L.-P. and Dietterich, T.G. (2011), "Incorporating boosted regression trees into ecological latent variable models", *AAAI'11, San Francisco*, CA, pp. 343-1348, available at:www.aaai.org/ocs/index.php/AAAI/AAAI11/paper/view/3711.
3. Johnson, R. and Zhang, T. (2012), "Learning nonlinear functions using regularized greedy Forest", *Technical Report*. arXiv:1109.0887. doi: 10.2172/1052139.
4. Pittman, S.J. and Brown, K.A. (2011), "Multi-scale approach for predicting fish species distributions across coral reef seascapes", *PLoS ONE*, Vol. 6 No. 5, p. e20583, doi: 10.1371/journal. pone.0020583.
5. Tobias, A. and Brunnermeier, M.K. (2016), "CoVaR", *American Economic Review*, Vol. 106 No. 7, p. 1705.

MEXICO

Hernandez-Mendoza Abdiel

Full Professor

National Autonomous University of Mexico, National School of Higher Studies, Juriquilla, Queretaro

Role of technology in creating the modern world

The 21st century commenced with events that marked a crucial moment in the destiny of mankind: September 11, 2001 (New York and Washington, D.C.), and September 1, 2004 (Beslan), were landmark dates for the United States and Russia, making them aware of the need to innovate alternative ways of perceiving the world that go beyond life-threatening actions.

The breakdown in international relations worsened during the global financial crisis of 2007-2009. The crisis has highlighted the need for a return to active labor to improve well-being and, as a consequence, to generate a value product that will contribute to the renewal of social relations aimed at creating a world less susceptible to crises (including in the areas of security, food, energy and finance) and oriented towards a chain of actions that will address the causes of crises.

In this context, the global community witnessed the expansion of the Internet as a space that reflected the daily activities of the population. It has gradually become commonplace to watch videos or communicate online in real time, increasing the need for technologies that enable communication. However, it also revealed some resource and change needs in human life, starting from the use of new terms (e.g., cyberattack, *doxing*) and ending with processes (e.g., remote work, data processing).

During this period, people began to recognize the implications of the technological revolution, which was then just beginning to gain momentum and which led to an awareness of changes in the growth of infrastructure designed for innovation, changes in models of innovation, the role of imitation as a strategy and as a trap, as well as doubts about the innovation development model (Golishenko, 2010, pp. 13-15 and 25).

Undoubtedly, the coronavirus pandemic triggered a revolutionary breakthrough in processes that had previously been cautiously shaped by technological paradigm shifts, but as Slovak author Slavoj Žižek (2018) points out, an event is “something traumatic, suddenly arising and disrupting the normal course of things”. That is, the pandemic as a traumatic event accelerated worldwide processes such as dependence on technologies. However, the changes did not only affect health concerns, but also changed the direction of humanity in different aspects; for example, people started to talk about the right to privacy related to video calls and the use of cameras when working remotely (Mikov and Alexandrova, 2021).

With the unprecedented acceleration of technological development, the objective of this essay is to reflect on the role of technology in the construction of the modern world from alternative perspectives, different from the Western worldview, where tools can be found concerning collective sovereignty, geopolitical stability, and an ethical reassessment of human relations, which have been based on ethics of individualism until present day.

To do this, it is important to focus on the thought of Alexandra Mikhailovna Kollontai, the world’s first female diplomat, who became famous for her diplomatic mission to Mexico, where she represented the Union of Soviet Socialist Republics. She provided an important legacy for this essay. Her phrase, quoted in the introduction, articulates the vision of the 21st century ideal – to promote a human coexistence that puts co-operation above conflict in the face of global crises and accelerated technological progress.

Thus, the essay will consider whether it is possible for technologies to become a bridge to mutual development beyond the tool of domination. The essay is divided into four sections: 1) Technology and sovereignty in a multipolar world, 2) Pandemic as a catalyst for contradictions, 3) Alternative models of technological development, and 4) Conclusion: reliance on collective sovereignty and an ethic of co-operation.

Technology and sovereignty in a multipolar world

At the beginning of the century, it became necessary to ask whether modern technological development would promote human co-operation or, on the contrary, deepen historical splits. In this regard, the second assumption seems to prevail: the different events that still keep the world on the verge of collapse in a multidimensional crisis (Ornelas et al., 2013) and the open proliferation of more than fifty conflicts and wars simultaneously (according to *the Institute for Economics & Peace* (IEP), 2024) confirm it.

Within this conflict, one can come to understand that an idealistic approach to technology as a tool for the liberation and enrichment of humanity collides with a realistic position of an ideological nature surrounding this technology and leading to political projects aimed at ensuring the production cycle of this technology. This cycle proceeds from conceptualization to market introduction, accompanied by the capture of the areas necessary for its execution, i. e. territories containing critical resources for the production of devices, machines, tools, etc.

Deepening the realist conception of technology, Pablo González Casanova, former rector of the National Autonomous University of Mexico, warned of the dangers of the US scientific-military-industrial complex that emerged after World War II (González Casanova, 2005, p. 24). According to him, this complex has since prioritized a dynamic of capital accumulation aimed at "winning the war", thus creating a technological pole of power that imposes on the rest of the world the use of certain devices, the languages to use them, and a technological pedagogy based on technologies developed in Silicon Valley. The French philosopher Eric Sadin (2020) calls this process the "siliconization of the world".

However, in parallel to this technological imposition that emerged in the age of unipolarity other regions of the world developed its own ways of perceiving the world and maintained alternatives, which were most evident during the Cold War period. It is worth to remember such milestones as the first artificial satellite (*Sputnik1*), the first living being in space (*Yuri Gagarin*), the first woman in space (*Valentina Tereshkova*), and other technological achievements that supported alternative ways of technologization in the world.

Keeping the above in mind, we can start to identify differences in the formation of the technosphere (a generalized name for science, engineering, and technology), on the basis of which some countries continued to develop innovations "without obstacles to their national interests", i. e. within their technological sovereignty, which allowed these countries to respond more easily to current and future threats (Afanasiev, 2022, p. 2389).

Pandemic as a catalyst for contradictions

The coronavirus pandemic made the world understand that the technological race that humanity was experiencing was not limited to the realm of information technology, artificial intelligence or the Internet of Things. An example of this was Russia's record-breaking production of the *Sputnik V* vaccine, which made it possible to counteract the effects of COVID-19 and contain its spread around the world. However, as with the vaccines developed in China, as well as the Cuban projects, these developments were minimized, prohibited or discredited by the West, despite the fact that at that moment the world needed certainty and effective solutions (De Santos, 2021).

In parallel, other controversies developed around the pandemic situation. The spread of remote working and digital technologies, the mass deployment of platforms that enabled everyday tasks to be performed even in self-isolation – shopping, leisure, education, work, community interaction, and even medical consultations (Platonova et al., 2021) – became an integral part of our life. However, a number of activities remained indispensable: rubbish collection, sanitation, urban food security agriculture, etc.

In order to emphasize the contradictory nature of this period, Bylyaeva and Lobatyuk (2021) describe the pandemic as a "natural experiment". At first, it facilitated the widespread dissemination of information, then the digitalization of everyday processes, and eventually the establishment of control mechanisms. In their view, this has led humanity to face biological threats not only in medical, but also in psychological and social aspects, which has had a significant impact on the perception of information and communication technologies. As a result, there has been an increase in the use of the Internet, technological awareness, information sharing, and new forms of social interaction, making sense of the formation of the modern world on a technological basis, which remains a matter of debate.

Alternative models of technological development

Despite the pervasiveness of the "siliconization" model of the world, it is also possible to identify key technological developments that help to understand the current age of accelerated technological change based on digitalization. For example, Shenzhen, China, is leading developments in 5G networks, genomic sciences, and other areas that have made the country the world's leading patent holder. The European Union is actively developing *fintech*, automotive and nuclear technologies. India, which exports IT and biotechnology services from Bangalore, is also worth mentioning. Russia should also be mentioned, where *Yandex* and *Kaspersky* are notable (Aganbegyan, 2023), as well as developments in military technology, aerospace, medicine, and materials science.

In this context, it is important to emphasize that development models based on the still dominant technological paradigm face a challenge that goes beyond competition for resources, providing communication or energy storage to power digital devices and so on. It is about the need to manage technology in an equitable manner, in dialogue with the environment, and in engagement with the communities living in the territories where resources are extracted.

Moreover, in order to democratize digital technologies, it is important to develop systems of collective knowledge and technological exchange, taking into account the historical development of humanity. In this sense, it is necessary to rely on approaches that combine traditional knowledge and allow for the integration of existing technologies that maintain harmony with nature. This requires resisting hegemonic impositions of technology, adapting it and betting on sovereign, autonomous, and decentralized technologies.

Conclusion: reliance on collective sovereignty and the ethics of co-operation

Following the thoughts of Alexandra Kollontai, we can state that technological development should become not a war, but a source of joy and overcoming social contradictions in the world. Technologies are not neutral and independent (or based on the interests of those who develop them), they do not determine whether the world becomes a better and safer place to live in. Their role in creating a modern society will depend on whether they can be prioritized in terms of collective sovereignty, the ethics of cooperation (the relationship between man and nature), and searching for ways to address the causes of global inequality.

References

1. Afanasiev, A. A. (2022). Technological Sovereignty as a Scientific Category in the System of Modern Knowledge. First Economic Publishing House, 12 (9), 2377. [In Russian].
2. Aganbegyan, A. G. (2023). “Silicon Valleys” – Innovation Areas in the US, China, EU, Russia, and Other Countries. Economics of Science, 9(2), 8–19.
3. https://doi.org/10.22394/2410-132X-2023-9-2-8-19. [In Russian].
4. Bylyeva, D. S., Lobatyuk, V. V. (2021). Image of the Digital Future of Society Through the Lens of the Pandemic. Philosophical Thought, (2). https://doi.org/10.25136/2409-8728.2021.2.35169
5. De Santos, J. C. (March 2021). Sputnik V Developers Reject Allegation that Approval of Vaccine is a Russian Roulette Game. Euro News. https://es.euronews.com/2021/03/09/los-desarrolladores-de-la-sputnik-v-rechazan- que-aprobar-la-vacuna-sea-un-juego-de-ruleta-
6. Golichenko, O. G. (2010). Modern Technological Revolution and New Opportunities for Innovative Development of “Catching Up” Countries. “Innovations”, (3), 1222. [In Russian].
7. González Casanova, P. (2005). New Sciences and Humanities. From the Academy to Politics. Barcelona, Spain: Anthropos. Institute of Social Studies of the National Autonomous University of Mexico.
8. IEP. (2024). Global Peace Index 2024.
9. https://www.economicsandpeace.org/wp-content/uploads/2024/06/GPI-2024-web.pdf
10. Mikov, P. V., and Alexandrova, S. O. (2021). Human Rights and Coronavirus Pandemic: On the Constitutionality of Restrictive Measures in Russia and Civic Responsibility. Social Security and Human Protection in the Conditions of a New Social Reality During COVID-19 (p. 7-13). [In Russian].
11. Ornelas, R., Bartra, A., Ceceña, A., Esteva, G, y Holloway, J. (2013). Civilisational Crisis and the Overcoming of Capitalism. Mexico City, Mexico: Institute of Social Studies of the National Autonomous University of Mexico, Aviso de Incendio.
12. Platonova, N. I., Shakhabov, I. V., Smyshlyaev, A. V., and Kuznetsov, D. V. (2021). Telemedicine Technologies in COVID-19 Pandemic, Health Law, (1), 21-28. [In Russian].
13. Sadin E. (2020). Siliconization of the World. Irresistible Expansion of Digital Liberalism. Argentina: Caja Negra.
14. Žižek, S. (2018). Event. Madrid, Spain: Sexto Piso.

REPUBLIC OF BELARUS

Hrytsevich Sviatlana

Senior lecturer

Belarusian National Technical University

Transformation of inter-organizational collaboration in the context of platform economy development

The increasing application of information and communication technologies (ICT) in the social and economic space have given rise to a host new concepts, such as digitalization, digital transformation, platform, business ecosystem, knowledge economy, sharing economy, etc. However diverse, all the current definitions reflect a clear trend related to the emergence of a new type of the economy where stakeholders have to adopt and effectively apply digital tools to strengthen their positions in a rapidly changing business environment to deliver sustainable growth.

In terms of today's standards of a well-performing business, top competitive positions are secured by platform companies that employ technology innovation for continuous improvement and development.

Over the recent decade, digital technologies have transformed our understanding of how business is supposed to work, as ICT deployment has delivered faster business processes, higher flexibility and profits. While platform companies are consolidating their leadership, conventional businesses need to do more to adopt transformational processes and new practices that can generate higher added value for their finished products and support these companies' integration into the digital environment [1].

Some countries and regions still depend on lower-technology sectors. Today, conventional industrial sectors in developing countries are dominated by medium- and low-technology manufacturing that, in most of them, account for the biggest share of their economies. Appendix 1 illustrates the changes in the share of low-, medium- and high-technology manufacturing in the manufacturing value added (MVA) of BRICS countries over the period from 2000 to 2020.

But the key global economic trend, despite all the crises, is still the expanding role of the high-technology sectors and stronger performance of developing economies in the long term.

The current boost in industrial activity is driven by a large number of various cooperation networks created between stakeholders that in conventional sectors include alliances, trade houses established to promote a common brand, subcontracting, retail chains, etc. The top priority now for conventional businesses should be transition to digital partnerships that would allow them to share expertise, technologies, information and knowledge. This would directly enhance their ability to expand presence in existing and new markets, and identify and strengthen their competitive positions enough to confront the challenges of the modern world. Studies [2] show that in 2021, only 11% of the processing sector companies in the Russian Federation used digital platforms for their business operations and these were mostly (80%) used to communicate with suppliers, partners and other companies.

Successful integration of traditional sectors into the platform economy, with participation of some high-tech companies, could be implemented through a new form of inter-organizational engagement based on an integrated ecosystem approach, i.e. by creating business ecosystems that would not only facilitate adaptation of conventional sectors to the new market realities, but would also open new opportunities for their development in the modern landscape.

Based on a review of multiple authors and scholars around the globe, the concept of business ecosystems incorporates the following principles: self-organization, complementarity, adaptation to externalities, common goals, modularity, coordination, innovation complexity, co-evolution, co-competition, and joint creation and fair distribution of the value proposition. Implementation of these principles will help to transform traditional business models into more viable systems [3].

The development of business ecosystems is driven by improved collaboration and cooperation processes and the shift from competition to partnership in order to increase final value. Transition to the network model for managing relations between high-tech and low-tech stakeholders would broaden the field for finding new players through expanding the digital framework and creating combinations of products and services as a result of joint value propositions. Note that a digital platform is the central component of any business ecosystem which integrates supplementary assets and serves as the linchpin for the value proposition.

Network effects in ecosystems increase the value and cost-efficiency of platform business models as a key driver of their commercial success. Once they kick in and become stronger, network effects produced by digital platforms attract a growing number of economic agents to this business model. By redesigning their interactions to align with the network structure and platform rules, such agents can cut their transaction costs and boost the efficiency of inter-organizational collaboration [4].

Furthermore, digital platforms enable faster deployment of innovations as the ecosystem makes it easy to share information, knowledge and resources between all the stakeholders. A digital platform can be used as a tool for both developing and managing business ecosystems. Integration into the joint value proposition process supported by digital platforms would help to accelerate digitalization of existing assets of member entities, establish feedback channels between the members, and build and expand the network links and relations that provide access to other types of the members' assets. In an ecosystem model, the use of digital platforms as central elements for creating joint value produces a sustainable competitive advantage because such platforms are the ones that actually define and build the network infrastructure which is responsible for initiating and propagating network effects [5].

Readiness for transforming business models along the lines of the ecosystem approach can be achieved by increasing resilience of inter-organizational engagement through joint creation of innovative solutions, including products and services that satisfy the needs of end-users in a comprehensive fashion. This process transforms value chains and this leads to changes in the management strategies of conventional companies that help to adapt their operations to the new market environment.

In the context of enhancing viability of complex network structures, such as business ecosystems, and managing interactions within them, the resources of the members from conventional sectors along with digital tools are essential for creating joint value. Note that the co-creation of value, which combines both tangible and intangible assets, increases the benefits for the parties involved in the inter-organizational network collaboration. The value of contributed ICT services grows with more use, including their contribution to transformation of existing business processes in medium-tech and low-tech companies. This is an important argument in favor of maintaining the efficiency of business ecosystem development by increasing its joint value proposition.

Besides the economic effects, it is important to consider that an ecosystem's inter-organizational collaboration framework includes multiple member entities, their resources, expertise, and links for sharing them in order to create a joint value proposition. The classification of their roles in an ecosystem includes leaders (organizers) and complementors (suppliers of supplementary resources and services). Using the architecture of the business ecosystem to establish inter-organizational links, leaders should, as key players in their business community, efficiently manage the system and use their complementors' resources to co-create a final product with a higher added value.

Given that any stakeholders can join business ecosystems as long as they are ready to share various resources and combine them through digitalization, the ultimate product of such cooperation would be jointly created value, i.e. a package of tangible and intangible assets, products and services. Further on, the value of intangible assets (e.g. information and knowledge) would increase with more frequent use. The support of the collaboration between the leader and its complementors within a shared ecosystem architecture would be reflected in incremental value delivered through network effects, including digital ones. It would be fair to say, therefore, that today entities involved in inter-organizational collaboration are not interested in participating in models built around the process of creating value which is unilaterally produced and realized under hierarchical control, but seek to become co-authors of a value proposition in a dynamic network structure powered by digital solutions.

Thus, based on the study [6] of the global light industry that can be regarded as a traditional sector in today's economic environment, a hypothesis was presented on how to assess readiness for application of the ecosystem approach to achieve sustainable growth of the industry. Such assessment involves definition of the most universal indicators of readiness for deploying business ecosystems on the basis of estimated efficiency of current network-based forms of inter-organizational collaboration. The results of the study [6] can provide the foundation for subsequent statistical observations and evidence-based economic studies to assess the readiness of companies and organizations in traditional sectors of most BRICS countries for developing or participating in modern cooperation networks based on digital platforms.

List of References

1. Grintsevich, S.A. Methodology for a Comprehensive Assessment of Stakeholder Readiness for Inter-Organizational Engagement / S.A. Grintsevich // Science and Technology News, 2024, No. 4 (71), pp. 25–33.
2. Platform Economy in Russia: Potential for Development. Analytical Paper / G.I. Abdrakhmanova, L.M. Gokhberg, A.V. Demyanova et al.; edited by L.M. Gokhberg, B.M. Glazkov, P.B. Rudnik, G.I. Abdrakhmanova; Higher School of Economics (HSE) National Research University. Moscow, HSE ISSEK, 2023, 72 p.
3. Grintsevich, S.A. Methodological Basis for Defining an Ecosystem Approach: A Theoretical Analysis / S.A. Grintsevich // Economic and Socio-Humanitarian Studies, 2022, No. 1 (33). p. 39–49.
4. Grintsevich, S.A. The Impact of Social Space Networkization on the Development of Business Ecosystems / S.A. Grintsevich // Social Space of Professional Activities: Collected Papers, Issue 1 / compiled by D.L. Gulyakovich, edited by D.L. Gulyakovich (lead) et al. Minsk: Kolorgrad, 2025, pp. 111–124.

5. Grintsevich, S.A. Digital Platforms in Current Business Ecosystems / S.A. Grintsevich // Proceedings of the IV International Research and Practice Conference "Economic Development Trends in the 21st Century", Minsk, 1 March 2022 / Belarusian State University; edited by A.A. Korolyeva (senior ed.) et al. Minsk: BSU, 2022, pp. 499–501.
6. Grintsevich, S.A. Potential for Sustainable Development of the Global Textile and Clothing Industry Based on the Ecosystem Approach / S.A. Grintsevich // Journal of International Law and International Relations, 2023, No. 3, pp. 62-74.

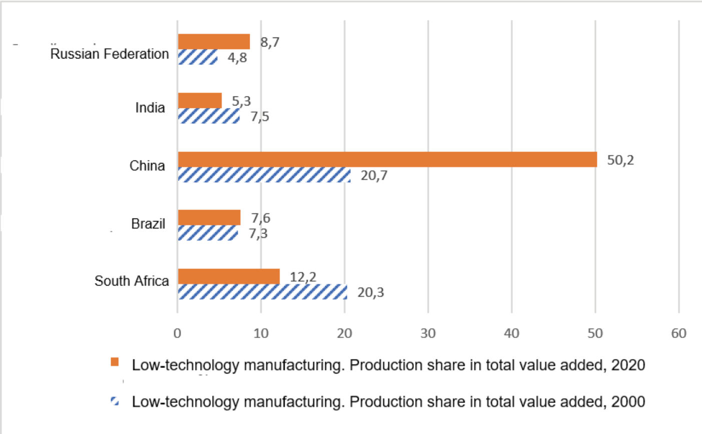


Fig. 1. Share of low-technology manufacturing in BRICS MVA in 2000 vs 2020 (%)
Source: The international yearbook of industrial statistics [Electronic resource] // UNIDO. Mode of access: https://www.unido.org/publications/international-yearbook-industrial-statistics

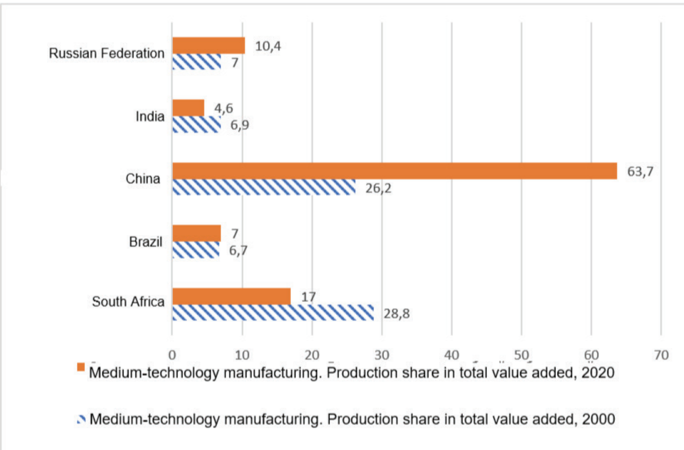


Fig. 2. Share of medium-technology manufacturing in BRICS MVA in 2000 vs 2020 (%)
Source: The international yearbook of industrial statistics [Electronic resource] // UNIDO. Mode of access: https://www.unido.org/publications/international-yearbook-industrial-statistics

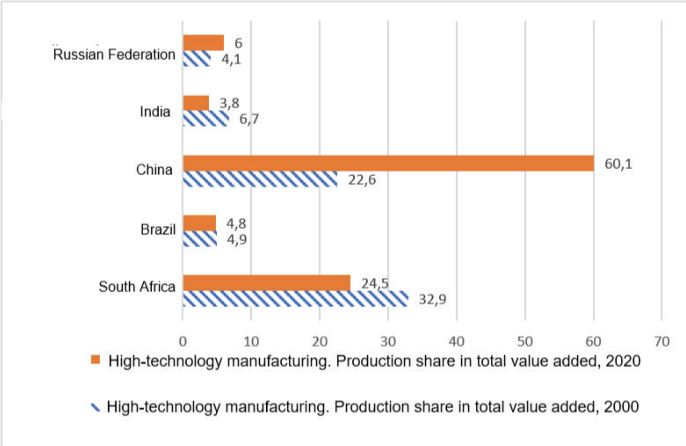


Fig. 3. Share of high-technology manufacturing in BRICS MVA in 2000 vs 2020 (%)
Source: The international yearbook of industrial statistics [Electronic resource] // UNIDO. Mode of access: https://www.unido.org/publications/international-yearbook-industrial-statistics

PERU

Javier Oswaldo De La Torre Palomino

Project Engineer

Luz del Sur

Energy Innovation in BRICS: Artificial Intelligence and Blockchain for a Sustainable Grid

Preamble

The energy transition is a key challenge in the 21st century, with BRICS countries standing out for their innovative strategies in renewable energy and advanced technologies. This essay explores how Artificial Intelligence (AI) and Blockchain are revolutionizing energy generation, distribution, and storage in these countries, promoting efficiency, cost reduction, and equitable access to sustainable energy.

As electricity demand and concerns about climate change grow, the adoption of advanced technological solutions becomes essential. Currently, BRICS countries are responsible for approximately 40% of the world's energy consumption, highlighting their critical role in the transition to cleaner and more sustainable energy sources. However, challenges persist, as 685 million people worldwide still lack access to electricity, with over 570 million in Sub-Saharan Africa alone. These numbers emphasize the urgent need for investment in decentralized, efficient, and affordable energy solutions.

Brazil, Russia, India, China, and South Africa have implemented strategic policies to address these challenges, positioning themselves as leaders in energy innovation.

Expansion of Renewable Energy in BRICS

India: Solar Energy and Storage

India has emerged as a leader in solar energy production with projects like the Bhadla Solar Park (2,245 MW). Additionally, the development of large-scale storage solutions is enhancing grid stability and maximizing the use of clean energy. With approximately 1 million jobs in the renewable energy sector, India continues to invest in workforce development to support its clean energy transition.

Brazil: Synergy Between Hydroelectric and Solar Energy

Brazil has successfully integrated hydroelectric and solar energy, enabling a more stable and reliable energy supply. Projects like university microgrids, backed by the China Electric

Power Research Institute, are fostering energy autonomy in remote communities. Brazil currently employs over 1.56 million people in the renewable energy sector, further reinforcing its commitment to clean energy expansion.

China: Artificial Intelligence in Grid Management

China is optimizing its electrical grids using AI, reducing waste, and improving energy distribution. Companies like State Grid Corporation have adopted predictive algorithms to balance real-time electricity supply and demand, ensuring an efficient and resilient network. As the world's largest employer in the renewable energy sector, China leads with approximately 7.4 million jobs, representing nearly 46% of the global total.

Russia and South Africa: Green Hydrogen and Blockchain Exploration

Russia is investing in technology for green hydrogen production and export, while South Africa has implemented blockchain for solar energy trading, enabling direct and decentralized transactions between producers and consumers. South Africa is also planning to generate 500,000 tons of green hydrogen by 2030, with projections reaching 7 million tons by 2050, marking a significant step toward sustainable energy.

AI and Blockchain: Transforming the Energy Sector

Smart Grids with AI

The use of IoT sensors and predictive models in smart grids in China and India has optimized energy consumption and storage, allowing real-time adjustments to improve system efficiency.

Blockchain for Decentralized Energy Trading

In India and South Africa, blockchain is facilitating decentralized energy trading, eliminating intermediaries and improving transparency in the electricity market. This enables communities and small producers to sell their energy surplus directly to end consumers.

Economic and Social Impact

Job Creation

The renewable energy sector is expected to generate over 25 million jobs by 2030, driven by training programs in energy technology. This employment growth will play a crucial role in shaping the future energy landscape and ensuring equitable access to new opportunities.

Inclusion of Rural Communities

Microgrids and decentralized systems are enabling remote communities to access electricity without the need for costly traditional infrastructure.

Cost Reduction and Greater Accessibility

The implementation of AI and blockchain has optimized operational costs, making renewable energy more affordable for consumers. Furthermore, the capacity of fossil fuel-based energy in BRICS countries is projected to fall below 50% of total installed power capacity by the end of this year, reinforcing the ongoing transition toward renewables.

Conclusions and Projections

- The combination of AI and blockchain is positioning BRICS as leaders in the global energy transition.
- Successful models in these countries can be replicated in other emerging

economies, including Peru.
- Investment in innovative energy technologies is recommended to consolidate a more sustainable and accessible future.

This essay highlights the relevance of emerging technologies in the energy sector, emphasizing their impact on efficiency, sustainability, and equitable access to energy.

MEXICO

Jose Carlos Lozano Lizardi
Student

Autonomous University
of Puebla State

The Importance of Aerospace Development in a Multipolar World

The year 2025 marks a radical shift in the balance of regional powers around the world. While the socioeconomic causes of this transformation are fundamental and should not be ignored, the development of aerospace technologies represents a critical moment in this transitional stage. Innovations in satellite communication systems and their ground components have come to play a vital role in everyday life. Technologies such as real-time global positioning systems (GLONASS, GPS, GALILEO and BeiDou) have become strategic tools that drive global connectivity.

On the other hand, in the aerospace industry, the development of advanced military technologies continues to be the exclusive domain of the most economically and technologically advanced powers. A glaring example of this is the Middle East, where air defence systems play a critical role in both national protection and deterrence. Similarly, the monitoring and control exercised by a country over its territory is an integral part of ensuring its sovereignty, and aerospace technologies are a means to achieving this goal.

Development

The United Mexican States maintains close international ties with the Russian Federation. Examples include the participation of Dr. Nikolai Korneev in highly specialized technologies research and the work of Dr. Svetlana Mansurova. Together, these researchers have explored such topics as the Wentzel–Kramers–Brillouin (WKB) approximation in the field of optical waves. In 2021, Mexico and Russia signed a cooperation agreement on cooperation in the exploration and use of outer space for peaceful purposes, under which the Agencia Espacial Meфxicana (the Mexican Space Agency, AEM, now part of the Agencia de Transformación Digital, or Digital Transformation Agency) would establish cooperation with the Russian State Corporation for Space Activities Roscosmos. The agreement involves cooperation in the development, production, testing, and launch of spacecraft and their components, as well as the retraining of personnel in the space industry. The development of the aerospace sector is a key area of focus for Mexico, and many students interested in aerospace technologies are starting to see new opportunities in collaborative projects that can help grow this industry in their country. Various events are held for these students to this end, including the ENMICE competition, where the most prestigious public and private universities participate in the development and operation of experimental rockets designed to solve various practical problems.

It is important to note that several international companies already operate in Mexico, including Safran (France), Bombardier (Canada), GE Aerospace (United States), and the Brazilian branch of Bombardier, as well as other subsidiaries and smaller companies. The arrival of these organizations has opened up opportunities for Mexican manufacturers to participate in the international aerospace industry, causing other countries to pay attention to experienced Mexican specialists in this sector. Other emerging countries in this field include China, which has made tremendous progress in space exploration in a relatively short time, launching its own satellite navigation system consisting of 55 medium-orbit satellites. India has also made great strides with its Chandrayaan-3 project, sending a rover to the Moon's surface to explore its southern pole. As these examples show, we are witnessing an explosive growth in the development and use of aerospace technologies around the world.

In terms of international cooperation, until recently, the International Space Station (ISS) has played the key role in the collaboration between countries with active space programmes. But its planned decommissioning in 2031 has prompted several countries to develop their own space stations. New forms of cooperation are also emerging. For example, the China National Space Administration (CNSA) and Russia's Roscosmos are working on a project to build an international lunar station. This space complex, which will be built on the surface of the Moon, will have all the necessary facilities and equipment to carry out experiments, research and development, including remote operations without the need for human presence. In addition, potential projects for broader cooperation have also been put forward, such as the BRICS+ initiative on joint activities in outer space to improve people's quality of life. Specifically, we are talking about the launch of a constellation of satellites designed to monitor weather patterns, natural disasters, and other hydrological phenomena that may affect the civilian population. The constellation, made up of the Gaofen-6, Ziyuan III 02, CBERS-4, Kanopus-V, Resourcesat-2 and Resourcesat-2A satellites, would provide crucial information to the relevant authorities, helping them prevent and mitigate such threats. This example of cooperation shows why all countries need to establish relationships with each other that would allow them to satisfy their interests in the fields of aerospace technologies and the exploration of outer space. These efforts are a major step forward in the exploration of interplanetary space, demonstrating that international cooperation is the most effective catalyst for humans to master space exploration. BRICS+ represents a new world order, not only in terms of the socioeconomic development of its member countries, but also in terms of technological cooperation and relationships.

We are currently entering a new stage, one where many countries are developing in various directions, primarily the economic and demographic. Countries are becoming more open and are seeking new markets, yet at the same time they are faced with the need to expand their production potential and diversify their industries. In the 21st century, cooperation between nations and mutual respect for each other's interests, which are key tenets of this new world order, will help bring about significant progress in the field of space technology. For many nations, a promising area of growth within this continuous development is space mining. Indeed, the ability to extract valuable resources in the form of raw materials from the Moon, Mars, and other celestial bodies will have enormous geopolitical significance and put those countries that manage to master such technologies in a highly advantageous position.

Lunar resources, which consist mainly of materials such as regolith – a layer of lunar dust and rocks that can protect against radiation – can be used to build various structures and synthesize oxygen. The most abundant metals on the Moon include iron, aluminium, magnesium, and titanium. However, the Moon is not the only celestial body that contains important raw materials. The presence of ice, effectively water – a resource that is of vital importance for our existence as a species – has been observed and analytically confirmed on the surface of some asteroids and planets. A turning point in this respect is the Chang'e 6 mission, the purpose of which was to deliver a space probe to the surface of the far side of the Moon to collect information and extract a 2-kilogram sample of lunar rocks and regolith. The expedition reflects a trend that is emerging in some countries as they steadily approach new frontiers. Unfortunately, we have not witnessed rapid progress as of yet, due to a number of limiting factors. Achieving a return on investment in interplanetary missions will require huge financial outlays. The equipment required for such missions needs to be designed specifically for the environmental conditions of each space object, which adds a level of technical complexity and makes the project even more expensive. Finally, the transportation of large volumes of cargo on return spacecraft would be impossible without supply facilities on the celestial bodies in question.

In the context of the new world order, where different powers are major players in the space field, the notion of a military presence in space will continue to play an extremely important role. The militarization of space has encountered obstacles, mainly due to the proposal to place nuclear weapons in space; however, the strategic need to develop space capabilities for national defence cannot be ignored. The main use of space in this capacity is to monitor and protect space assets, as well as to guarantee the security of critical telecommunications satellite systems and constellations for both civilian and military purposes. A military presence in space also serves as a deterrent.

The three most important global players in this new technological field are the United States, China, and Russia. For example, the United States Space Force (USSF) was set up in 2019 to protect U.S. interests in outer space. However, the main drawback of this new branch of the military is that it is completely independent from the armed forces. This has given rise to several bureaucratic problems, from the lack of clearly defined tasks to difficulties in obtaining sufficient budgetary funds, which has a knock-on effect on the results of its activities. China, for its part, has leveraged its huge economic advantage to fund expensive space defence programmes, including the development of anti-satellite weapons, spy satellites, and space-based electronic warfare systems. Finally, Russia's Special Military Operation has given it valuable experience in this area, demonstrating the importance of space superiority. The development of hypersonic systems such as the System A-235 PL-19 *Nudol* (a carrier that can destroy intercontinental ballistic missiles and satellites) is an example of how this technology can protect the sovereignty of countries and stimulate the development of aerospace technologies.

Unfortunately, military advances in space could spark an open competition between countries, which could lead to tensions at the global level. What is more, since space exploration is still an emerging niche, efforts to regulate it are still insufficient. Many existing agreements do not provide effective control over military activities, creating a legal vacuum regarding the actions of countries in outer space. A solid foundation at the intergovernmental level is thus needed for the effective and equitable regulation of space technologies, with access to such technologies being provided on a similarly equitable basis. All existing space-related treaties need updating. The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (the Outer Space Treaty) prohibits the use of weapons of mass destruction in or from space, as well as the appropriation by any country of celestial bodies. The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (the Moon Treaty), which stated that lunar resources are the common heritage of humankind, was signed in 1979, although the agreement is not recognized by all countries. Later, in 2008, the United Nations published a set of principles for governing the activities of states in the exploration and use of outer space, encouraging cooperation among nations to safeguard the lives of astronauts and cosmonauts.

One of the most important factors in aerospace development is the availability of financing, which determines the industrial, scientific, and engineering potential of each country. The growth of this industry creates a significant number of jobs around the world, producing experts in the fields of mathematics, natural sciences, and engineering. The aerospace industry, from the production and maintenance of commercial aircraft to the development of orbital systems, is shaped by two key factors: the weight of aerospace vehicles and their cost. Weight is one of the most important factors in the implementation of any aerospace technology, since reducing weight while maintaining the same design features and performance characteristics makes it possible to optimize logistics and operating costs. Reducing the weight of aircraft improves their aerodynamic efficiency and increases their carrying capacity. In astronautics, a weight reduction of even one kilogram means significant savings when it comes to launching and operating satellites and spacecraft.

In turn, the cost depends on compliance with established standards and the proper application of production technologies, as well on the reliability of the product from the market's point of view. The situation at Boeing is a prime example of the challenges facing the industry. The company has seen a series of aircraft maintenance incidents, raising concerns among industry participants and damaging confidence in some models. These challenges are not unique to any one company or region, however. Rather, they reflect the complexity of the global aerospace industry.

In this regard, international cooperation is key to ensuring quality, safety, and efficiency standards in aerospace manufacturing. Russian aerospace manufacturing is a good example of this, with companies such as VSMPO-AVISMA Corporation earning a reputation for producing high-quality precision components for both Boeing and Airbus. There are similar cases in the space sector: large space agencies such as NASA and Roscosmos prefer to use their own launch vehicles (SLS and Soyuz, respectively) which are safer than those produced by certain private companies thanks to the fact that the technologies they use have been tried and tested over the course of decades. Cooperation in access to strategic materials, the development of advanced technologies, and the implementation of common standards can help improve the competitiveness of the industry and the reliability of its products globally. In a multipolar world, the aerospace industry benefits from synergies between countries and companies, demonstrating that innovation and security can be strengthened by working together rather than competing in isolation.

The development of the aerospace industry in the multipolar world of the 21st century is more than just a technological breakthrough – it is a paradigm shift in international relations. International cooperation, as seen in initiatives such as the one put forward by BRICS+ and the agreement between Russia and Mexico, demonstrates that space exploration and development transcend borders and geopolitical rivalries. However, the progress that has been made brings its own challenges. The militarization of space, the loopholes in existing international treaties, and the cost of interplanetary expeditions are all obstacles that require innovative, and joint, solutions. Not to mention that these problems are made worse by the dynamic geopolitical landscape, which is placing increasing pressure on underdeveloped countries.

On the other hand, the exploration and extraction of resources on the Moon and asteroids are becoming key factors for the future of humanity. Not only can they boost national economies, but they can also help ensure the long-term survival of our species. However, it is extremely important that work in this area be done in strict accordance with ethical and legal standards that promote equity and prevent undue exploitation and which ensure the fair distribution of resources and benefits among countries on the basis of existing international agreements.

Ultimately, aerospace development should not be viewed solely as a competition between powers, but also as an opportunity to develop the education system, conduct research, and train specialists in the field. The experience of countries such as Mexico, India, and China shows that with investment and a long-term strategy, a country can become an active participant in the new era of space exploration. In this sense, the future of the aerospace industry will depend not only on technological progress, but also on the ability of leading aerospace countries and those playing catch-up to work together for the benefit of all humankind.

UZBEKISTAN

Karimov Umid
Student

Moscow State University
(Tashkent branch)

Application of neural networks for meteorological time series analysis and forecasting: from RNN to LSTM

Area of interest: Investigation of capabilities of recurrent neural networks, in particular RNN and LSTM models, for solving the problem of meteorological time series forecasting. The potential benefits of the introduction of such technologies are analysed in the context of global challenges: climate change, food safety and effective resource management.

Relevance of the topic

The modern world is experiencing an unprecedented growth in data volume, including meteorological data, which is extremely important for decision-making in agriculture, energy, city planning, and disaster prevention. Technological advances enable the use of complex machine learning algorithms for analysing and forecasting weather conditions. One of the key trends has been the integration of neural networks capable of processing time series and creating detailed scenario forecasts.

Improvements in the accuracy of meteorological forecasts directly affect socioeconomic stability, particularly in countries of the Global South and East, where agriculture and water resources require careful management [1]. In this context, neural networks pave the way to increased planning efficiency and reduction of climate change risks. Based on this, the problem of time series forecasting using RNN and LSTM is important not simply from the technical standpoint, but also from a global perspective, as it favours a transition to more sustainable forms of economic activity and contributes to the development of a new platform for global growth.

Research hypothesis and goals

Hypothesis. More advanced neural network architectures (LSTM), relative to classical RNN, provide greater accuracy of meteorological time series forecasting, especially under conditions of complex seasonality and temperature extremes.

Goal. To compare several recurrent network variants (RNN, Keras-based and PyTorch-based LSTM) in terms of prediction accuracy and stability.

Analysis and statistical data. The experiment used weather data at three-hour time intervals (city of Tashkent, OpenWeatherMap [2]). After collection and preprocessing (normalization to the range [0;1]), the models were trained on 80% of the dataset, and the remaining 20% were used for testing. The key accuracy parameter was RMSE (root-mean-square error).

1. **RNN:** RMSE ≈ 4.13. The least satisfactory results were obtained when forecasting complex seasonal variations, especially during extreme heat events (Fig. 1).

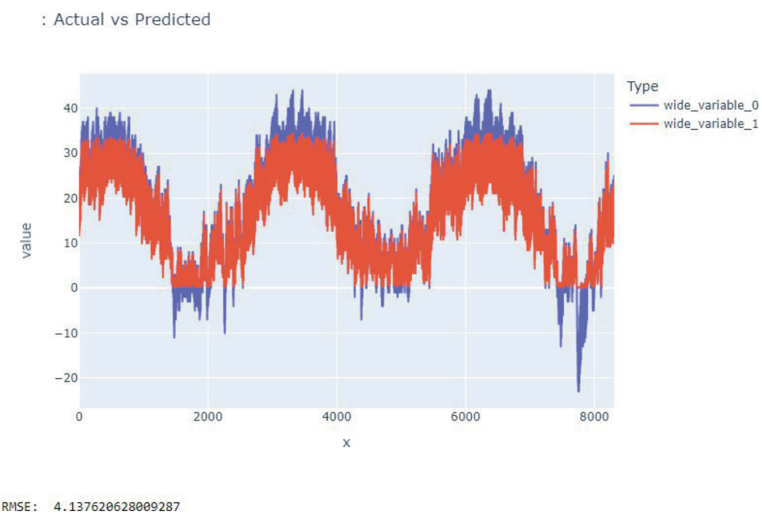


Fig. 1. Demonstration of RNN-based weather forecasting

2. **LSTM (Keras):** RMSE ≈ 3.53. The model confidently forecasts weather conditions, but accuracy is degraded at extreme temperatures.
3. **LSTM (PyTorch):** RMSE ≈ 3.56. Comparable to Keras results, which speaks to the stability of the LSTM-based approach for time series (Fig. 2 and Fig. 3).

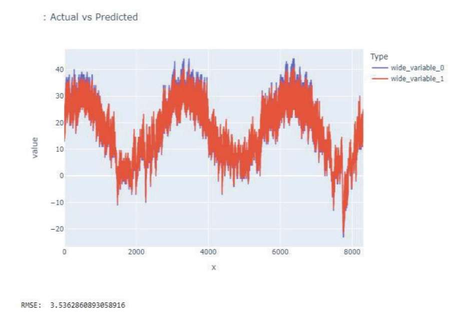


Fig. 2. Demonstration of LSTM-based weather forecasting
(Ceras)

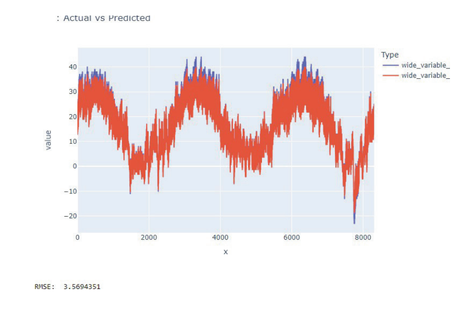


Fig. 3. Demonstration of LSTM-based weather forecasting
(PyTorch)

Forecasts. The results warrant the following expectations:

- **An increasingly prominent role of LSTM models** (and their modifications like GRU) in meteorology and related fields;
- **Reduction of economic losses** due to weather forecasting errors (losses in agriculture, in the power industry, etc.);
- **Growth of investment attractiveness** and emergence of new technological solutions in countries of the Global South and East, where it is especially important to take climate change into account and implement prudent resource management.

Methodology of data collection and analysis

- **Data source:** OpenWeatherMap [2] with an open API was used for building the dataset. Weather data for the city of Tashkent were loaded in JSON format with a 3-hour time step.
- **Structuring:** Field extraction (temperature, humidity, precipitation, wind speed, etc) to table weather_history_test.

Table 1. Data storage in a database

weather_history_test	
column	**description**
country	country
city	city
day	date in the format “yyyy.mm.dd”
time	hour in the format “hh24”
tempC	temperature in degrees Celsius
windspeedKmph	wind speed in km/h
winddirDegree	wind direction in degrees
winddir16Point	wind direction on the 16-point compass
weatherDesc	weather description
precipMM	precipitation in millimetres
humidity	humidity in percent
visibility	visibility in kilometres
pressure	pressure in millibars
pressureInches	pressure in millimetres of mercury
cloudcover	cloud cover in percent
HeatIndexC	thermal comfort index in degrees Celsius
DewPointC	dew point in degrees Celsius
WindChillC	wind chill in degrees Celsius
WindGustKmph	wind gusts in kilometres per hour
FeelsLikeC	apparent temperature in degrees Celsius

Where country, city and day were taken from date and request nodes, and the other fields were taken from the hourly list of measured weather parameters. Each of eight measurements throughout the 24-hour period was associated with a name of a city.

- **Preprocessing:** data cleanup and normalization using the pandas library (and if necessary, SQLite3), which converted the data to the [0;1] range.

Description of the investigated architectures

1. **RNN (SimpleRNN)**
   → Three layers: input, hidden (SimpleRNN) and output (Dense).
   → Optimizer: SGD with a 0.7 learning rate.
   → Loss function: mean squared error (MSE).

→ Result check every 10 epochs.

2. **LSTM (Keras)**
   → Includes the input layer, the LSTM layer with 50 cells and the output layer.
   → Optimizer: Adam, loss function: MSE.
   → Training on 80% of the dataset, the remaining 20% are allocated for testing.
3. **LSTM (PyTorch)**
   → A similar LSTM architecture but based on PyTorch.
   → DataLoader objects are used for serial loading of data batches.
   → RMSE (root-mean-square error) is the key accuracy indicator.

Test results

- **RNN:** RMSE ≈ 4.13, the least satisfactory results when forecasting complex seasonal variations, especially extreme summer temperatures.
- **LSTM (Keras):** RMSE ≈ 3.53. The model confidently forecasts weather conditions, but accuracy is degraded during extreme heat.
- **LSTM (PyTorch):** RMSE ≈ 3.56. Comparable to the results of the Keras version, which confirms the stability of the LSTM-based approach to time series.

The overall trend shows that LSTM-based networks are better than RNN at handling "remote dependencies" in time series, especially during periods with extreme temperatures.

Economic effect

1. **Loss prevention:** more accurate weather forecasts help reduce losses in agriculture, logistics and the power industry, which, in turn, improves the financial stability of regions.
2. **Growth of investment attractiveness:** The implementation of hi-tech solutions improves the competitive position of countries of the Global South and East and encourages the arrival of investors and development of AI startups.

Social effect

1. **Enhanced safety:** Accurate forecasts help warn the population of natural disasters in a timely manner. This is especially important in coastal and mountainous regions that are at risk of floods or hurricanes.
2. **Closing the digital divide:** The training of professionals and dissemination of AI technologies stimulate the development of educational programmes and build new competencies among young people and leaders.
3. **Building the tech ecosystem:** The development of neural networks in meteorology pulls related sectors along, from IoT devices to platform solutions for urban planning and big data analysis.

Therefore, the large-scale application of neural networks for weather data analysis serve as a catalyst for global growth, combining economic benefits with social stability.

The results confirm that:

1. **RNN** is capable of solving basic forecasting tasks, but it is visibly inferior to LSTM models in terms of accuracy.
2. **LSTM (Keras) and LSTM (PyTorch)** demonstrate high efficiency, although they remain vulnerable to temperature extremes.
3. The optimum choice of architecture for meteorological time series most commonly tends towards LSTM, taking better processing of long series and more stable error parameters (RMSE) into account.

In the long term, the application of neural networks for weather forecasting will grow, encompassing more and more regions and scenarios (agriculture, water resource management, power industry). This will ensure accelerated technology development in countries with a vulnerable infrastructure, create incentives for scientific and commercial collaboration, and contribute to global stability in the face of climate challenges.

References

1. Smirnov, S. M., Kuznetsov, K. K., & Novikov, N. N. (2023). Global Warming and its Consequences for Humanity. *Mirovaya politika*, 3, 34–48. (in Russian)
2. https://openweathermap.org/api – open API for receiving weather data at different levels of detail.

UZBEKISTAN

Venera Karimova
Associate Professor

MGIMO-Tashkent

Generative artificial intelligence as a tool for developing digital competencies of university leaders

This essay focuses on the integration of generative artificial intelligence (AI) into the training of higher education management staff. The aim is to show how the targeted formation of digital competencies and critical thinking through AI improves the quality of management and the adaptability of higher education institutions to technological challenges.

Relevance and background

Modern higher education institutions face the dual challenge of the digital age: the need to innovate in order to stay competitive and the risk of mindless 'automation' when algorithms replace critical thinking. On the one hand, generative AI (capable of analysing data, generating content and predicting scenarios) offers great opportunities for optimising management and educational processes. On the other hand, the introduction of complex technologies requires the training of managers who can effectively apply AI for decision-making.

In 2023, the UN highlighted that the development of digital skills in educational leaders is a key component of achieving SDG 4 [1]. However, according to HolonIQ, only 34% of higher education institutions implement AI training programmes for managers [2]. This suggests the need for a more systematic approach to the formation of digital literacy in the educational sphere.

Thematic vector

The focus is on analysing the role of generative AI as means of building managerial skills and digital competencies necessary for the sustainable development of higher education institutions. Special emphasis is placed on how managers who have mastered AI tools create a new decision-making culture within educational organisations.

Hypothesis and methodology of the study

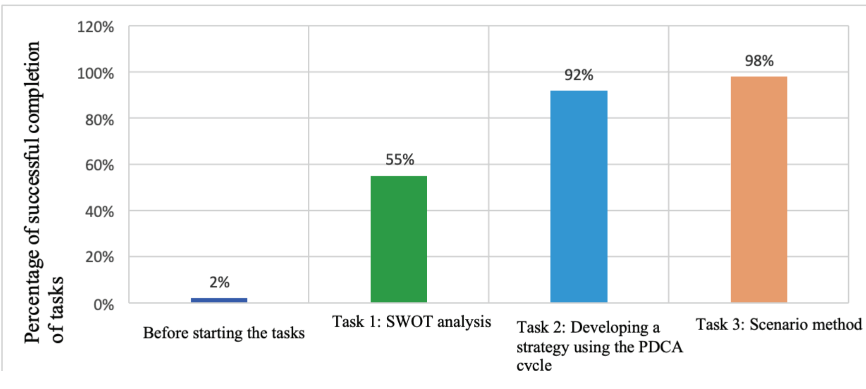
Hypothesis: Systematic training of managerial staff in generative AI techniques helps improve their digital competencies, managerial performance and critical thinking, which ultimately contributes to qualitative change in higher education institutions.

The study is based on a pedagogical experiment (2023–2024) involving 444 university managers. Before the start of the experiment, a survey was conducted, which showed that 1-2% of respondents actively used tools like GPT, 3-5% tried to use them, and 90% only 'knew about the existence' of AI.

During the training the participants:

- Learned how to make correct queries to chatbots (GPT, DeepSeek, etc.);
- Conducted SWOT analysis and developed strategies using the PDCA cycle;
- Developed higher education scenarios, including data visualization.

Figure 1 presents a chart that illustrates the dynamics of AI competence improvement among the course participants at different stages of their training.



Month	Number of participants	Task 1 (%)	Task 2 (%)	Task 3 (%)
2023				
January	17	50	89	95
February	21	52	90	96
March	18	55	92	97
April	25	58	93	98
May	18	60	94	99
June	10	53	95	100
September	8	57	91	98
October	27	54	89	97
November	13	56	90	99
December	19	59	93	100
2024				
January	19	51	92	96
February	28	55	94	98
March	28	57	95	99
April	44	53	90	97
May	34	58	91	98
June	20	54	93	100
September	41	56	94	99
October	54	60	95	100

Figure 1 presents a chart that illustrates the dynamics of AI competence improvement among the course participants at different stages of their training.

The comparative analysis of the results using the non-parametric Friedman criterion showed a statistically significant ($p<0.05$) increase ($p<0.05$) in the proportion of successfully completed tasks, from about 50–60% at the first stage to 90–99% at the final stage. The Wilcoxon signed rank criterion (with Bonferroni correction) confirmed that the use of AI was a key factor in the improvement. Statistical tests ($p<0.05$) confirmed that the changes were not random but were due specifically to the use of AI in the learning process.

Key results and analytics

1. Increased digital skills: Participants learnt how to structure tasks, critically evaluate AI results and formulate clarifying queries.
2. Increased analytical flexibility: Working with different models (GPT, DeepSeek) increased opportunities for forecasting, scenario analysis and resource optimisation.
3. Spreading the impact: AI-enabled managers have launched digital transformation processes in their universities by introducing chatbots nd analytical platforms to support management and educational processes.

Economic and social effects

Economic aspect:

- Lower costs for analytics and document management by automating routine operations;
- Improving the accuracy of management decisions, which helps optimise resource allocation;
- Strengthening the competitiveness of universities in the educational services market and attracting partners/investors.

Social aspect:

- Improving the quality of the educational process: teachers get access to massive data sets and adaptive learning tools;
- Developing critical thinking and digital literacy: a new generation of managers capable of making informed, ethical and transparent decisions;
- Creating a cultural environment that encourages innovation and interdisciplinary collaborations.

An example is the projects implemented with the support of leaders from Tashkent University of Information Technologies [3] and Renaissance University of Education [4], where AI has become a key tool for management processes and scientific research.

General conclusions and expected results

The findings demonstrate that the purposeful introduction of generative AI into the training of university managers not only improves their digital competences but also stimulates critical thinking and informed decision-making. Even in the course of the experiment, the participants have already implemented new approaches to management in their organisations, which has had an impact on the quality of educational programmes and HEIs' activities in general.

Expected long-term effects:

1. Sustained improvement in the quality of management: AI-enabled managers are more efficient in allocating resources and more flexible in responding to change.
2. Dissemination of best practices: participants' experience serves as a basis for methodological recommendations and new educational programmes that improve the overall level of digital culture in higher education institutions.

3. Strengthening competitiveness: systematic implementation of AI makes higher education institutions more attractive to applicants and partners, expanding opportunities for international cooperation.
4. Long-term social impact: an environment emerges where technology is used responsibly and effectively, linking science, education and innovation.

In this way, a learning model focused on generative AI can lay the foundation for systemic digital transformation of the entire higher education system, shaping a new generation of leaders prepared for the challenges of the digital age.

Sources

1. UNESCO report "Digital transformation in education" // [Electronic resource] – URL: https://unesdoc.unesco.org/
2. HolonIQ report (2023): Global Survey on AI in Higher Education // [Electronic resource] – URL: https://www.holoniq.com/
3. Tashkent University of Information Technologies // [Electronic resource] – URL: https://tuit.uz/post/suniy-intellekt- texnologiyalaridan-foydalanish-savodxonligini-oshirish
4. Renaissance University of Education // [Electronic resource] – URL: https://renessans-edu.uz/ru/article

RUSSIA

Konstantin Korneev

Senior Researcher
PhD

Institute of China and
Contemporary Asia of the
Russian Academy of Sciences

Hydrogen energy development: current achievements and opportunities for cooperation within BRICS

Hydrogen energy has been gaining ground over the past 10 years or so as an important building block in a global decarbonisation strategy to reduce greenhouse gas emissions. The International Energy Agency estimates that by 2050, the use of hydrogen will reduce global greenhouse gas emissions by almost 6 Gt (gigatons) annually[1] For the BRICS countries (Brazil, Russia, India, China, South Africa),[2] which together account for about 40% of global emissions, this could be a major step towards achieving climate goals.

In this context, the BRICS countries, given their combined domestic market capacity and technological sophistication, have an excellent opportunity to become world leaders in the development of low-carbon hydrogen technologies and the creation of the necessary infrastructure.[3]

1 IEA Global Hydrogen Review 2024. Executive summary. URL: https://www.iea.org/reports global-hydrogen-review-2024/executive-summary

2 The focus is on the 'old' members of the BRICS alliance. However, the involvement of recently joined states has the potential to seriously strengthen the BRICS position in the emerging global hydrogen energy market.

3 Low-carbon hydrogen is defined as hydrogen produced from fossil fuels using carbon capture and storage facilities, or by water electrolysis with electricity from renewable energy sources, the standard criterion being an emission threshold of 9.8-4.4 kg CO2-eq/kg H2 and below.

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A qualitative definition and statistical analysis of quantitative indicators of hydrogen energy development have been presented by the author in a recent article comparing China, which is smoothly transitioning to a model of scaling its own technologies, and Japan, which relies on cooperation with Western countries.[4]

Part 1. Examples of successful hydrogen energy projects implemented in BRICS countries

Below are some examples (one for each BRICS country, starting with China, so far excluding new members) of projects in the field of environmentally friendly hydrogen, which allow us to confirm the hypothesis about the importance of this area, laying the foundation for interstate cooperation on the horizon of the next 10-15 years.

China

The 260 MW Kuqa project was commissioned in August 2023. A storage tank capable of storing about 210,000 m^3 of hydrogen has been installed to ensure its further transport through a pipeline with a total capacity of 28,000 m^3 per hour. Production is provided by thirteen electrolysers assembled in China using Belgian technology, but with a fairly high level of localisation of components. The energy source is a 361 MW power plant generating 1,060 GWh of electricity annually.[5]

India

A low-carbon hydrogen project is being implemented in the Pudimadaka village, the state of Andhra Pradesh, since early January 2025. This project, estimated at USD 21 billion, aims to produce hydrogen with electricity supplied from renewable energy sources. It is expected to produce 1,500 tonnes of low-carbon hydrogen and 7,500 tonnes of its derivatives, such as green methanol and green ammonia, on a daily basis. To achieve the stated goals, up to 20 GW of renewable energy capacity is planned to be commissioned. The main suppliers of electrolysis equipment are Western companies from Belgium, Germany, the Netherlands, and the United States.[6]

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4 Korneev K.A., Tomberg I.R. Development of low-carbon energy in China and Japan: a comparative analysis // Japanese Studies. 2024. No. 4. P. 70–86. DOI: http://dx.doi org/10.55105/2500-2872-2024-4-70-86

5 China's Hydrogen Ambitions May Ride on Sinopec's Kuqa Project in Xinjiang. S&P Global Analysis. URL: https://www.spglobal.com/commodity-insights/en/news-research/lates-news/energy-transition/011124-chinas-hydrogen-ambitions-may-ride-on-sinopecs-kuqa project-in-xinjiang

6 PM to Visit Andhra Pradesh and Odisha on 8th-9th January. India Prime Minister's Office Press Releases. URL: https://pib.gov.in/PressReleaseIframePage aspx?PRID=2090664&ref=delhibriefing.in

Russia

Rosatom State Corporation is planning to build a plant on Sakhalin to produce low-carbon hydrogen from natural gas, both for domestic consumption and for export to Asia-Pacific countries. The project under the general name 'Blue Hydrogen/Ammonia' involves the production of hydrogen by steam conversion of methane with CO_2 capture. Several stages are expected to be commissioned in order to reach the level of annual production of 100,000 tonnes of hydrogen by 2030.[7] In addition to this project, a number of other initiatives are being implemented on Sakhalin. On 16 July 2024, Russia's first hydrogen test site was launched, featuring an electrolyser with a capacity of 5 m^3 per hour. In the second phase (2026), once the main line is commissioned, the capacity of the system will increase to 30 m^3 per hour.[8]

Brasil

In 2023, Spain's Solatio Energia received a preliminary environmental impact assessment authorisation from the authorities of the Brazilian state of Piauí to implement a large-scale clean hydrogen project with a total capacity of around 11 GW (combined capacity of power plants and electrolysis plants). Solatio Energia plans to invest over USD 20 billion in both projects by 2030. The plant's capacity is 4,000 tonnes of low-carbon hydrogen daily.[9]

South Africa

In South Africa, one of the first projects is the nuGen TM Zero Emission Haulage Solution by the mining company Anglo American. This is a 510 tonne mine haul truck that was fitted with a hydrogen engine in 2022, with the fuel (99.98% purified hydrogen) produced locally using electrolysis. The test operation of the dump truck is ongoing.[10]

The above examples show that China is the only BRICS country capable of launching large-scale low-carbon hydrogen production projects today. India and Brazil have ambitious plans, while Russia and South Africa also have promising

7 Large-scale plans for technology implementation. Central dispatching department of the fuel and energy complex. URL: https://www.cdu.ru/tek_russia/issue/2023/4/1136/

8 Sakhalin officially launched Russia's first hydrogen test site. Astv.ru news portal. URL: https:/ astv.ru/news/politics/2024-07-16-na-sahaline-zapustili-pervyj-v-rossii-vodorodnyj-poligon

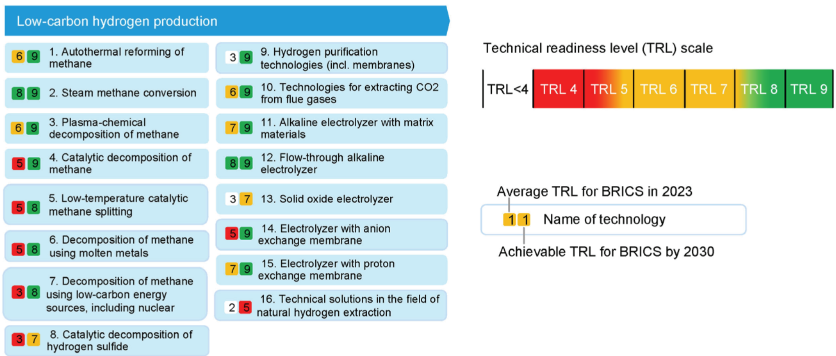
9 Massive Green Hydrogen Project Announced in Brazil. URL: https://taiyangnews.info markets/massive-green-hydrogen-project-announced-in-brazil

10 Anglo American Combines nuGen with First Mode and Invests $200m to Accelerate Zero Emissions Haulage Solution. http://angloamerican.com/media/press releases/2022/07-12-2022

technological achievements. Most of the BRICS countries on the way to hydrogen energy development have to enter into collaboration with Western equipment manufacturers, but the improvement of cooperation mechanisms within the association and the launch of a number of joint initiatives can turn this trend around as soon as by 2030.

Part 2. Potential for cooperation among the BRICS countries on the development and implementation of hydrogen energy technologies

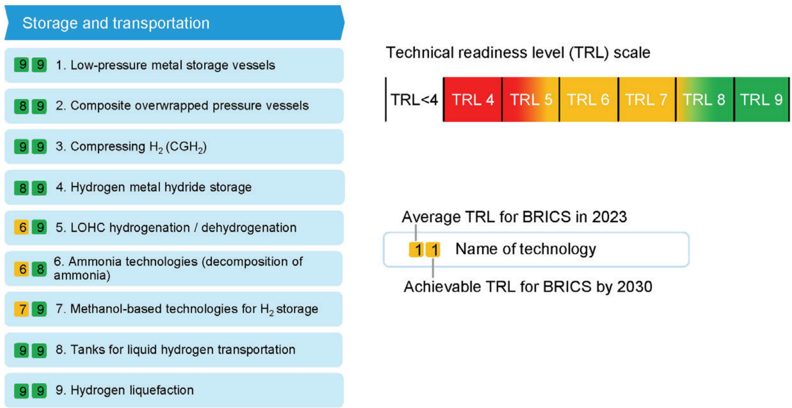
The BRICS countries have appropriate resources and capabilities that can be combined to create innovative hydrogen energy technologies; a list of selected technologies is provided below. This list was compiled by experts and mainly includes technologies that seem the most feasible to develop cooperation within the BRICS framework, taking into account current global trends. The scale of technological readiness levels represents average values for the BRICS countries based on the analysis of a large number of different sources – therefore, it should be understood that individual countries, for example, China, may have slightly higher TRLs for some items, which does not cancel the main trends for the BRICS as a whole.[11] The achievable TRL is based on the results of cross-country cooperation (e.g. between Belgium and Germany), which significantly accelerates the development and deployment of certain technologies (many times faster than efforts made by one country alone).



Picture 1. Key low-carbon hydrogen production technologies

11 Technology Readiness Level (TRL) is a method of assessing technology maturity. The higher the value, the more mature the technology is considered to be. For example, 8 is the assembly of a real device that is being tested as part of a system under expected operating conditions, while 9 is a comprehensive test of readiness for production. A TRL of 4-6 indicates that pilot tests are still ongoing; below 3 – the target applications of the technology and its critical elements are just being defined. For more details, see: https://digital.gov.ru/uploaded/files urovni-gotovnosti-tehnologii-gost-58048-2017.pdf.

Electrolysis technologies – based on alkaline, proton exchange membrane and anion exchange membrane – will be most in demand in the phase up to 2030–2035. As for the first two technologies, the BRICS countries have achieved quite high TRL levels and it's more about scaling them up, while the third one is considered promising but very challenging in terms of creating models that can work consistently for a long time (at least 1-3 years, not 3-6 months as it is now)[12].

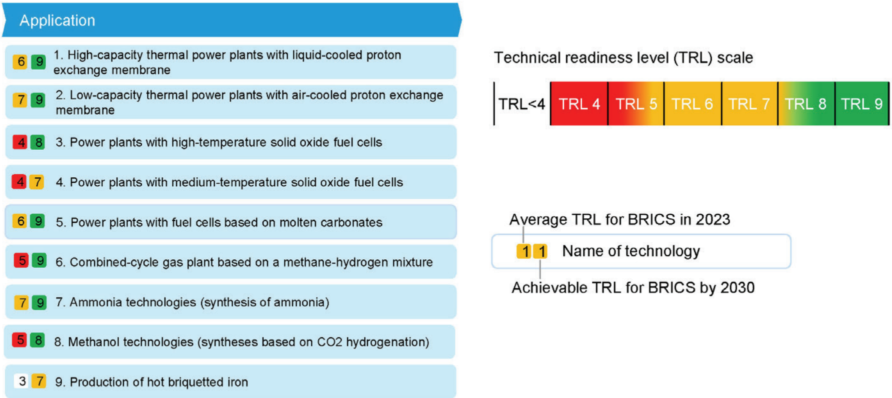


Picture 2. Key hydrogen storage and transport technologies

In this segment, the most interesting solutions are metal and composite vessels, metal hydride storage, and ammonia and methanol technologies. In general, it is evident that the BRICS countries have sufficient technological independence in hydrogen transport and storage and are capable of implementing projects that involve the transport of large volumes of hydrogen over significant distances.

As for the application of low-carbon hydrogen, it is obvious that this field is still underdeveloped within the BRICS, with its member states just making the first steps. However, the author of the essay is confident that mutually beneficial cooperation among the BRICS countries on the development and implementation of hydrogen technologies will provide socioeconomic effects in the form of direct contribution to the GDP of the member states in the range of 0.5-1% through the production and use of high-tech products, the creation of new jobs, the emergence of additional educational programmes in universities, etc.

12 Ziyu Fang, Chao Ye, Tao Ling, Huiping Ji et al. Stability Challenges of Anion-Exchange Membrane Water Electrolyzers from Components to Integration Level // Chem Catalysis. – 2024. – Vol. 4 (10). – 101145. DOI: https://doi.org/10.1016/j.checat.2024.101145



Picture 3. Key hydrogen application technologies

It seems more reasonable to start with scientific collaborations and launching hydrogen test sites in order to test technologies under conditions close to real-life operation. A good example is the Snowflake (Snezhinka) International Arctic Station, a year-round complex based on renewable energy sources and hydrogen power, which is being created on the initiative of the Moscow Institute of Physics and Technology (MIPT) and the Russian Ministry of Education and Science in the Yamalo-Nenets Autonomous Okrug.[13] China plans to join the project as early as 2025, and negotiations are also underway with India and Brazil.

Conclusion

In conclusion, it should be said that cooperation within the association (bearing in mind the accession of new members and the transition to the BRICS+ format) will facilitate the exchange of information, knowledge and resources, which will help overcome various obstacles related to the introduction of hydrogen technologies. Joint projects and initiatives can accelerate the deployment of related infrastructure for hydrogen production, storage and transport. In addition, cooperation among the BRICS+ countries will give a strong impetus on the development of global hydrogen energy standards and norms, which will facilitate the integration of low-carbon hydrogen technologies into the global energy arena.

13 Snowflake International Arctic Station. URL: https://arctic-mipt.com/en.

Krundyshev Vasiliy
Associate Professor
PhD in Technology

Peter the Great St. Petersburg
Polytechnic University

Ensuring Cyber Resilience of Smart City Digital Environment Through Protected Distributed Ledger Technology

Preamble: rationale behind the essay, relevance of the topic (from the challenge/opportunity standpoint)

The data integrity and availability assurance issues in "smart city" communication and information systems are of relevance due to the importance and critical nature of digitalization of industries in Russia and worldwide. Digital infrastructure of "smart cities" is a component of the economic infrastructure, and its partial or complete failure can directly impact the life and health of people, business continuity, reliability of the social sector and urgency of emergencies. The project is also of importance for SafeNet, a security product (security system) market of the National Technological Initiative. The project topic aligns with the current research and development programmes implemented by the world's IT market leaders and by the "Digital Economy of the Russian Federation" government programme (approved by Decree of the Government of the Russian Federation dated 28/07/2017 No.1632-r), which includes technologies for building distributed ledger systems and ensuring their information security among the key end-to-end digital technologies. The anticipated project results fully meet the world criteria of research in terms of ensuring the security and resilience of critical infrastructure facilities, “smart city” facilities and other infrastructure components of the economy, which are undergoing digital transformation (“Industrie 4.0” in Germany, “Made in China 2025” in the PRC, “Industry Innovation 3.0” in South Korea, etc.).

The scientific relevance of this problem involves broadening the scientific and methodological basics of information security of distributed ledgers by developing a suite of new models and methods for ensuring data accessibility and integrity on the basis of elliptic curve isogeny-based directed digital signature with delegated validation rights. Applying the project results for upgrading existing municipal communication and information systems will substantially accelerate their transition to a digital format and catalyze the technological, methodological and legal development of a digital economy.

Explaining the hypothesis based on analysis, statistical data or forecasts

The project for developing the technological concept of “smart cities” is, from the government’s perspective, one of the most significant avenues of economic development (the meeting minutes of the Digital Economy Subcommittee of the Government Committee for the use of information technologies for improving the quality of life and business environment dated 19/01/2018). Cities are undergoing a fundamental transformation. Their further development and ability to seamlessly integrate in the digitalization of the global economy will require architecture based on smart data storage, processing and transmission systems. The “smart city” concept aims to solve these problems. According to calculations of McKinsey experts, there will be approximately 600 “smart cities” globally by 2025. In five more years these cities will generate almost 2/3 of the world’s GDP.

However, digitalization of the urban infrastructure requires not only transferring industrial and business processes in an information environment but also ensuring their mutual integration in order to establish a common IT ecosystem of the city. This necessitates building distributed ledgers that simultaneously represent a collection of data from various branches of the “smart city” and technologies enabling secure and efficient work with these data. These include the blockchain technology. The blockchain technology has a set of properties that help substantially enhance the operating security of “smart city” mechanisms and ensure its transparency and resilience to various types of adversity. Immutability of data already on the chain and the need for transactions to be confirmed by other participants of the process makes the authenticity of the stored information undoubtable and allows for recording specific events in the interest of future incident investigations. Storage of the chains by all the blockchain participants ensures resilience to failures of individual members and improves the overall system reliability.

Implementation of the blockchain technology in modern distributed ledgers is associated with a number of restrictions and information security problems:

- insecurity of "young" blockchains (a "51% attack"). None of the miners (entities directly writing to the blockchain) can control over one half of the total computing of the network. "Young" blockchains do not usually have many independent miners, making it easier for an adversary to gain control over a majority of the computing power (by cooperation or purchasing additional computing power) and modify the blockchain;
- low resistance to network separation. If the network separates into several isolated segments (e.g. due to communication link failures), each segment will develop its own version of the blockchain over time. When the network segments are reunited after restoring the communication links, the chain of block will contain a fork; as a result, the blockchain will only retain transactions belonging to the longest branch. All other transactions will be cancelled;
- difficulty storing the blockchain on devices with limited disk space (the blockchain size grows linearly with time). At present, the blockchain size of bitcoin, a cryptocurrency (and the largest blockchain), exceeds 120 Gb;
- long startup time for new nodes. New network nodes must download and verify the entire blockchain. At present, the blockchain of bitcoin takes several days to download and verify;
- slow confirmation of transactions. Adding a new transaction to the blockchain may take minutes to hours.
- the need to encourage legitimate network participants in order to maintain infrastructure security by attracting new computing power.

Additionally, attacks on decentralized systems built using the blockchain technology have been known to allow attackers to limit access to distributed ledgers with pinpoint accuracy, deanonymize users of such systems, block transactions and carry out denial-of-service attacks (e.g., time counter attacks). These shortcomings do not sufficiently guarantee the integrity and availability of distributed ledgers and, consequently, make them unsuitable as a basis for critical information infrastructure of "smart cities".

Research carried out under the project should eliminate these shortcomings and solve the fundamental problem of ensuring the integrity and availability of distributed ledgers of "smart city" data by using blockchain-like data storage systems and elliptic curve isogeny-based directed digital signature schemes with delegated validation rights.

Emphasis on the socioeconomic effects

From a practical standpoint, the entire set of project results and its individual achievements are to be used in information system protection design and assurance for critical and general-purpose systems. Specifically, the models and methods developed under the project will make it possible to enhance the protection of such systems. Moreover, there are plans to use the distributed ledger model in specific practical solutions for the design, optimisation and management of information processing in heterogeneous systems in smart home, smart building and smart city environments. Such protected distributed ledger systems will also be useful for digital manufacturing systems, unmanned transport control systems, digital power generation systems (digital substations and power distribution control systems). Methods for distributed ledger protection against integrity and availability threats to be developed under the project may be extrapolated to numerous similar blockchain systems that are used for secure information processing in information systems across a range of scales. The set of methods under development can also be borrowed by BRICS+ countries for building an independent payment system using digital currencies and blockchain. New secure settlement mechanisms and digital tools are expected to boost the trade volume among BRICS+ countries by 5–7% growth annually and step up mutual settlements in national currencies, reducing the dependency on the US dollar and, in general, streamlining international economic cooperation.

Alignment of the project with Russia's Scientific and Technological Development Strategy helps to develop Russian technologies for protecting buoyant large-scale information systems against cyberthreats by implementing protection methods not only at the processing level but also at the meta-level of transaction safety monitoring during data block transfer. Consequently, the solutions under development fall within the range of activities aimed at the development of unique Russian technologies and products to counter cyberthreats to the society, economy and government.

Overall conclusions, expected results

The project is anticipated to yield the following results:

1. A set of methods and algorithms for ensuring the integrity and availability of distributed ledgers for "smart city" data based on the blockchain technology:
2. A method and algorithm for transaction verification on the basis of consortium-oriented rules for solving the security problems of "young" blockchains and reward users for performing the work of transaction block verification;
3. A network traffic anonymization method for blockchain system nodes making it possible to protect oneself from access restriction to blockchain systems and feeding false information on the condition of blockchain systems;
4. A method for obtaining confidential information on the system time of nodes storing a distributed ledger, making it possible to defend from time counter attacks;
5. A method for using one-time keys (wallets, addresses) that substantially complicate the deanonymization of users in blockchain systems;
6. A method for distributed ledger data anonymization on the basis of elliptic curve

isogeny-based directed digital signature with delegated validation rights that ensures secure collective access of authorized subjects to distributed ledgers.

7. A set of methods and algorithms for improving the operability of distributed ledgers in large-scale “smart city” systems.
8. A blockchain building method on the basis of directed acyclic graphs making it possible to solve problems of low resilience to network separation and slow addition of new transactions to the blockchain;
9. A floating genesis block blockchain building method solving the problems of storing the blockchain at nodes of low-capacity disk storage and long initialization times for new nodes.
10. A software suite of integrity and accessibility assurance tools for “smart city” distributed ledgers implementing the developed methods.
11. An experimental segment of “smart city” digital infrastructure implemented in a virtual environment.
12. An architecture and prototype of a universal software platform for protected distributed ledgers implementing the developed technology for an experimental “smart city” segment.

The scientific relevance of this problem involves broadening the scientific and methodological basics of information security of distributed ledgers by developing a suite of new models and methods for ensuring data accessibility and integrity on the basis of elliptic curve isogeny-based directed digital signature with delegated validation rights. This is an important scientific breakthrough that can be used by a number of sectors where not only confidentiality (as in public administration or industry) but also integrity of data is critical (e.g. in digital services of city infrastructure, such as transport, utilities and wide area surveillance systems).

Recent international publication in the project domain (their analysis is presented in a separate form under this application) reflect a shift from solving individual distributed ledger security problems to universal and comprehensive approaches (the analysis spans the period from 2018 to 2025). However, as indicated by post-hoc analysis, problems of ensuring distributed ledger integrity and availability are not adequately investigated, to say nothing of being solved, which emphasizes the relevance of the problems addressed in this project and determines the novelty of the proposed solutions. The suggested approach is advanced from the standpoint of using a comprehensive solution for distributed ledger security problems.

The novelty of the anticipated results of the project lies in broadening the scientific and methodological basics of information security of distributed ledgers by developing a suite of new models and methods for ensuring data accessibility and integrity on the basis of elliptic curve isogeny-based directed digital signature with delegated validation rights.

The interdisciplinary aspect of the project is due to the nature of distributed ledger systems and information security problems viewed through the lens of distributed ledger security as a protected asset. The distributed ledger technology is viewed and used as a data protection mechanism in distributed ledger systems but our knowledge about distributed ledgers as protected assets (asset requiring protection from a particular class of cyberthreats) is still limited. Information security problems lie at an intersection of technical sciences, control theory, legal and social sciences.

The social significance of the problem is due to the development of new, unprecedented methods and tools for the protection of distributed ledger technology, which eliminate security threats in smart city digital environments.

This is a large-scale project that implies obtaining multiple novel world-class scientific and applied results. Results of the project will be officially registered as two pieces of software, its scientific results and data will be published in 6 high-impact international journals, 4 journals included in the RSCI and presented at international conferences.

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PERU

Enrique Alejandro La Torre Gallegos

Admissions Representative in Latin America, Master in International Business

Higher school of economics

Overcoming digital divide: steps towards equal opportunities

Digitalization is a key component of Industry 4.0, driving the industrialization of processes and driving the growth of the digital economy. Digital technologies have emerged as crucial in the 21st century for industrial transformation, economic development, education, health, and social inclusion (Butollo et al. 2022). Despite clear advancements in technology, many emerging economies continue to face significant digital exclusion due to inadequate infrastructure, high costs, and low levels of digital literacy. The digital divide not only sustains internal socioeconomic inequalities, but also discourages their ability to utilize technology to its maximum potential in sustaining global competitiveness. The digital divide is also a moral, economic, as well as practical, imperative given that it immediately affects productivity, innovation, and global competitiveness (Guillén & Suárez, 2005). In this context, BRICS+ countries stand in a strategic position to act first in addressing the digital divide. By investing in infrastructure, improving internet access, and encouraging digital education initiatives, these countries can not only reduce the gap within their territories, but also contribute to a more balanced digital world. This essay explores the issue of digital divide, examines effective programs using case studies, discusses practical solutions to bridge the digital divide, and strategic steps for immediate implementation with clear benchmarks for progress. Through practical strategies, financing insights, and quantifiable plans, it aims to accelerate efforts toward equal opportunities.

Digital divide is known as the difference between those who have easy access to computers, the internet, and digital literacy abilities and those who do not. Many communities, particularly those in rural and economically challenged areas, still lack enough digital resources in spite of the quick advances in technology. Inequalities in social connectivity, work, healthcare, and education are all sustained by this gap. Inadequate internet access puts people at danger of slipping behind (Hartnett, 2019). Also, even in developed regions, social and economic factors can exclude certain populations, limiting their access to digital tools and skills. The lack of digital literacy training, high costs, poor infrastructure, and limited local support make it much harder for people to get online and fully participate in the digital world. This gap is not just about access. It can hold back innovation, widen socioeconomic inequalities, and weaken the skills needed for long-term economic development (Choudhary, Heena & Bansal, 2022). Effectively bridging the digital divide requires more than just access to technology. It demands an approach that integrates technological advancements, educational initiatives, and community support systems.

In the current digital era, having access to technology is essential for civic engagement, work, and education (Haleem et al., 2022). A comprehensive approach that incorporates digital literacy, supportive legislation, economic empowerment, and active community involvement in addition to infrastructure and devices is needed to close this gap. A more equitable and inclusive digital environment can be fostered by addressing these critical issues.

Many underprivileged communities struggle with poor internet access and a lack of modern digital devices, making it difficult for them to stay informed, access online services, or take advantage of educational opportunities. Bridging this gap requires investment in local broadband infrastructure, collaboration between the public and private sectors, and initiatives such as mobile internet units and free community Wi-Fi in rural areas. Additionally, providing affordable digital devices for low-income families can help ensure more people stay connected (Afzal et al., 2023).

However, technology alone is not enough; digital literacy is equally important. Without the necessary skills, individuals cannot fully use technology for education, employment, or basic online interactions. Establishing community centers with regular technology workshops, incorporating digital skills into school syllabuses, and connecting beginners with experienced users through mentorship programs can significantly enhance digital confidence (Bashar & Naaz, 2024).

Government policies play a significant role in ensuring equitable access to technology. Regions with well-developed digital policies and regulations tend to reduce the digital divide more effectively. Supporting investment in underserved areas through tax incentives, safeguarding net neutrality, and maintaining fair internet costs can all contribute to a more inclusive online environment (OECD, 2019).

Economic challenges, such as unemployment and poverty, contribute to the digital divide. Offering job training in technology-related fields, providing small business loans for digital tools, and supporting local entrepreneurs through tech-focused incubators and co-working spaces can help create new economic opportunities while improving access to technology (Arbelaez, Giraldo, & Lotero-Vélez, 2023).

Digital inclusion efforts should prioritize direct community involvement to ensure more effective and sustainable solutions. When local residents participate in the decision-making process, initiatives are more likely to meet their specific needs. Organizing town hall meetings, establishing advisory groups, and developing digital content that reflects the culture of the community and concerns can significantly enhance these efforts. Collaborative approaches play a crucial role in creating a more connected and inclusive digital environment (Bauer & Bauer, 2024).

Technological integration has played a crucial role in development across different regions (Wu, Ling-rong & Chen, Weizhong, 2023). Three case studies from Asia, Africa, and Latin America to identify strategies that can be applied in other contexts were examined. By analyzing these examples, it is possible to understand the key factors that contribute to effective implementation and long-term success. The findings highlight practical approaches that can help improve technological adoption in many regions.

In India, a digital literacy program was implemented through the collaboration of government and non-governmental organizations (NGOs) to support women and youth in remote villages. The initiative used mobile classrooms, temporary digital hubs, and locally designed educational materials to reach over 300,000 villages. Its success was largely attributed to partnerships with local government units to secure funding, the training of community leaders as digital ambassadors, and the development of culturally relevant learning modules in native languages (Google, n.d.).

In Kenya, an initiative focused on improving digital connectivity and skill development in urban slums provided affordable high-speed internet and established community-run technology hubs. Through partnerships with global technology firms, the program enabled local youth to develop IT skills, leading to access to online education and employment opportunities. More than 10,000 residents benefited, contributing to a decline in unemployment rates. The effectiveness of the program was linked to the formation of public-private partnerships for infrastructure funding, the implementation of intensive digital skills training, and collaboration with local businesses to facilitate job placement. Similar strategies could be applied by governments seeking to enhance digital access and workforce development (1 World Connected, n.d.).

Colombia pursued a policy-driven strategy to promote digital inclusion, focusing on broadband expansion and subsidized technology training for marginalized communities. This initiative not only facilitated the immediate adoption of digital tools but also contributed to long-term economic development. The approach involved comprehensive digital policies that included financial incentives, the participation of educational institutions in technology training programs, and the establishment of monitoring bodies to track progress and maintain transparency (World Economic Forum, 2024).

Building on the case studies and empirical evidence, a clear step-by-step implementation framework is proposed for communities seeking to overcome digital inequality. The first step in this framework is assessment. It is crucial to conduct a baseline survey to measure current levels of digital access and literacy. This helps in identifying local infrastructural challenges, socio-economic barriers, and potential partnerships. Establishing clear benchmarks and metrics for success ensures that progress can be tracked effectively.

The next step is planning. A collaborative plan should be created involving local stakeholders, including government agencies, community leaders, and private entities. Setting goals with assigned responsibilities ensures accountability. Additionally, developing culturally relevant educational content and training modules enhances the impact of digital literacy programs.

Once planning is complete, implementation follows. Mobilizing resources through grants, public-private partnerships, or local fundraising initiatives is essential to support digital expansion efforts. Rolling out digital infrastructure projects alongside educational initiatives ensures that access and knowledge development progress together. Regular monitoring against established benchmarks allows for necessary adjustments to the strategy, ensuring its effectiveness.

Evaluation is a critical phase in this framework. Clear metrics should be applied to assess the reduction in digital inequality. Gathering feedback from community members and measuring improvements in employment, education, and civic engagement provide insights into the effectiveness of the initiatives. Reporting findings and using both quantitative and qualitative data help in refining policies and improving future digital inclusion efforts.

To ensure long-term success, sustainability must be prioritized. Institutionalizing successful practices by integrating digital initiatives into ongoing community and educational programs is key. Promoting continuous training, media literacy, and advanced digital skills development supports ongoing learning. Additionally, policy adjustments should facilitate innovation and research in digital equity, ensuring that communities continue to benefit from technological advancements.

In addition to these steps, measuring progress through clear metrics is essential. The percentage increase in broadband connectivity in targeted areas, the number of individuals completing certified digital literacy and vocational training programs, and employment rates in sectors requiring digital knowledge and skills are significant indicators. Furthermore, community feedback and engagement levels, such as attendance in digital literacy sessions and the usage frequency of community internet centers, provide qualitative insights. A reduction in the digital access gap between urban and rural populations also serves as a crucial measure of success.

The evidence presented in this essay reinforces that bridging the digital divide is not solely a technological or policy challenge, but a comprehensive socioeconomic imperative. By focusing on robust infrastructure development, enhanced digital literacy, supportive governance, economic empowerment, and active community engagement, stakeholders can collectively turn the promise of digital revolution into a globally shared reality. Overcoming the digital divide requires coordinated efforts at multiple levels to overcome structural inequities and empower all citizens.

Finally, as technology continues to shape the future of human capital, proactive measures and innovative policy interventions today will determine the equitable distribution of its numerous benefits tomorrow. The journey towards digital equality is arduous but achievable with deliberate, inclusive, and adaptive strategies.

References

1. Butollo, F., Gereffi, G., Yang, C., & Krzywdzinski, M. (2022). Digital transformation and value chains: Introduction. Global Networks, 22, 585–594. https://doi.org/10.1111/glob.1238
2. Mauro F. Guillén, Sandra L. Suárez, Explaining the Global Digital Divide: Economic, Political and Sociological Drivers of Cross-National Internet Use, Social Forces, Volume 84, Issue 2, December 2005, Pages 681–708, https://doi.org/10.1353/sof.2006.0015
3. Hartnett, M. (2019). Digital divides. Oxford Bibliographies. https://www.oxfordbibliographies.com/display/document/obo-9780199756810/obo-9780199756810-0222.xml
4. Choudhary, Heena & Bansal, Nidhi. (2022). Barriers Affecting the Effectiveness of Digital Literacy Training Programs (DLTPs) for Marginalised Populations: A Systematic Literature Review. Journal of Technical Education and Training. 14. 111-127. 10.30880/jtet.2022.14.01.010.
5. Haleem, Abid & Javaid, Mohd & Qadri, Mohd & Suman, Rajiv. (2022). Understanding the Role of Digital Technologies in Education: A review. Sustainable Operations and Computers. 3. 10.1016/j.susoc.2022.05.004.
6. Afzal, Arfa & Khan, Saima & Daud, Sana & Ahmed, Zahoor & Butt, Ayesha. (2023). Addressing the Digital Divide: Access and Use of Technology in Education. 3. 883-895. 10.54183/jssr.v3i2.326.
7. Bashar, Ummul & Naaz, Ishrat. (2024). DIGITAL LITERACY: THE IMPORTANCE, INITIATIVES AND CHALLENGES. 10.56726/IRJMETS56658.
8. OECD (2019), Going Digital: Shaping Policies, Improving Lives, OECD Publishing, Paris, https://doi.org/10.1787/9789264312012-en
9. Arbelaez, Mauricio & Giraldo, Diana & Lotero-Vélez, Laura. (2023). Influence of digital divide in the entrepreneurial motor of a digital economy: a system dynamics approach. Journal of Open Innovation: Technology, Market, and Complexity. 9. 100046. 10.1016/j.joitmc.2023.100046.
10. Bauer, K., & Bauer, K. (2024, November 6). Why is Community Engagement Important? Granicus. https://granicus.com/blog/why-is-community-engagement-important/
11. Wu, Ling-rong & Chen, Weizhong. (2023). Technological achievements in regional economic development: An econometrics analysis based on DEA. Heliyon. 9. e17023. 10.1016/j.heliyon.2023.e17023.
12. Google. (n.d.). Internet Saathi. Google. Retrieved March 2, 2025, from https://about.google/values-in-action/internet-saathi/
13. 1 World Connected. (n.d.). Africa community network digital skills: TunapandaNet, Kenya. Retrieved March 3, 2025, from https://1worldconnected.org/project/africa_communitynetwork_digitalskills_tunapandanetkenya/africa_communitynetwork_digitalskills_tunapandanetkenya.pdf

14. World Economic Forum. (2024). Colombia's digital inclusion strategy is bolstering financial inclusion, especially for women. Retrieved March 5, 2025, from https://www.weforum.org/stories/2024/08/colombias-digital-inclusion-strategy-is-bolstering-financial-inclusion-especially-for-women/frica_communitynetwork_digitalskills_tunapandanetkenya.pdf

ITALY

Leone Bernald

Entrepreneurship & Innovation Expert

Multi Organization

Open Dialogue: World's Future as a New Platform for Global Growth Investing in Technologies

Introduction

In the recent decades, the world has seen turbo-charged technological progress transforming all aspects of our lives. From communications to manufacturing and from education to healthcare, the advancing technologies have revolutionized the way we live and work. According to the 2022 McKinsey report, the contribution of technologies to the global GDP could reach as much as 60% by 2030, driven mostly by artificial intelligence (AI) and digital technologies.

Digitalization has had a profound impact on the labor market. According to the WEF The Future of Jobs Report 2020, over 50% of jobs will be automated, giving rise to new roles and competencies. This transformation, however, will encounter challenges, such as the need to reskill the workforce and ensure an equitable transition for all.

In 2023, investment in technology startups hit a record high of $300 billion globally, according to CB Insights. This upward trend will continue with investors focusing on AI, blockchain, Internet of Things (IoT), and biotechnologies.

Technological evolutions have also enhanced global connectivity. Based on the 2021 report of the International Telecommunications Union (ITU), over 4.6 billion people, or 59% of the world's population, have access to the Internet today. Such connectivity has driven swift and widespread deployment of innovations as well as unprecedented cooperation between different countries and cultures.

This essay takes a look at the global technology context, future investment projections, best bets in advanced technologies, and future scenarios that could shape the world in the years to come.

1. Global Technology Context

1.1. High-tech revolution

Technology revolution, which started in the 1980s with the advent of personal computers and the Internet, laid the groundwork for the digital transformation. Over the last two decades, technological innovation has been fast-forwarded by cloud computing, 5G mobile networks and AI breakthroughs. For instance, cloud computing systems provide on-demand access to computing power, cutting costs and boosting operational performance for businesses. The 5G technology offers higher broadband speeds and reliability of communications, enabling such applications as connected automobiles or the Internet of Things (IoT).

1.2. Digital impact

Digitalization has fundamentally changed the way companies operate and interact with customers. Data management has become central to business strategies as data analytics can support better informed evidence-based decision-making. Process automation has improved operational efficiency, reducing errors and increasing productivity. Moreover, digitalization led to the emergence of new business models, such as e-commerce platforms and streaming services that have transformed traditional sectors, including retail and entertainment.

1.3. Globalization and connectivity

Global interconnectedness has enabled fast dissemination of innovation and unprecedented cooperation between different countries and cultures. While helping to strengthen international cooperation in areas like scientific research and technology development, globalization has brought about new challenges associated with cybersecurity and crossborder regulation. Cyberattacks, for example, have become a global threat that calls for closer cooperation between governments and organizations to protect critical infrastructure.

2. Projected Global Investments

2.1. Technology investment trends

Technology investments have been growing relentlessly, especially into innovation startups and emerging technologies. In 2023, CB Insights reported that global investments in tech startups hit a record high of $300 billion, the most popular sectors being AI, blockchain, IoT and biotech. Investors tend to look for opportunities in fast-growing sectors with potential for transforming the global economy.

2.2. Government policy and fiscal stimulus

Many governments are pursuing strategies to promote technology innovation through tax incentives, subsidies and public-private partnerships. For example, the European Union launched its €95.5 billion Horizon Europe program for 2021–2027 to fund R&D and innovation projects. Russia has also invested quite heavily in the technology sector, especially AI, robotics and defense tech, where investments exceeded ₽1 trillion (about $15 billion) in 2022. China has set up the National Venture Capital Guidance Fund to mobilize nearly ¥1 trillion (about $138 billion) for supporting innovative technology startups. In 2021, the United States invested over $1 trillion in the IT sector. Such policy aims to create a nurturing environment for startups and support emerging technologies. Also, companies have been offered tax benefits, such as R&D tax credits, to encourage investment in innovation projects.

2.3. Priority investment sectors

Top priority sectors for investing are digital healthcare, renewable energy, cybersecurity and industrial automation. Digital healthcare includes telemedicine and wearable health monitoring devices that increase accessibility and quality of healthcare services. Renewable energy is another key sector where investments in solar and wind technology contribute to the low-carbon economy transition. Cybersecurity has become a top priority because of the growing number of cyber-attacks, underscoring the need to develop innovative solutions to protect data and critical infrastructure.

3. Transformative Technologies as Investment Opportunities

3.1. AI and machine learning

Artificial intelligence and machine learning have been driving revolutionary transformations across multiple sectors, from healthcare to finance. Its applications include advanced medical diagnostics, smart virtual assistants and predictive analytics. Machine learning algorithms can process huge arrays of medical data to identify patterns and predict diseases, delivering substantial improvements in the quality of diagnosis and treatment. AI-based virtual assistants provide efficient customer support, helping to raise the quality of service and drive down operational costs.

3.2. Blockchain and cryptocurrencies

Blockchain offers a safe and transparent mechanism to record transactions. It is the underlying system for cryptocurrencies, such as Bitcoin and Ethereum, which are transforming the financial sector, and is also increasingly used in supply chain management and smart contracts. Blockchain offers tools to track product provenance and movement along supply chains, increasing transparency and minimizing fraud risks. Smart contracts, which can self-execute using blockchain, allow companies to streamline business processes and cut transactional costs.

3.3. Internet of Things (IoT)

The Internet of Things connects devices and systems to support data collection and exchange. Its applications vary from smart homes to connected industrial systems where it boosts process efficiency and provides the basis for new business models. For example, IoT devices in smart homes can automatically control lighting, heating and security systems, making homes more comfortable and energy efficient. In manufacturing, IoT sensors are used to monitor equipment performance and predict potential breakdowns, cutting downtime and enhancing productivity.

3.4. Virtual reality and augmented reality

Virtual reality (VR) and augmented reality (AR) have been transforming the entertainment industry, education and trade. These technologies create immersive and interactive experience, transforming how we learn, work and have fun. VR can be used to simulate a realistic training environment that allows employees to safely learn new skills. AR augments the real world with digital information, expanding user experience in such areas as retail commerce and tourism.

3.5. Biotechnologies and personalized medicine

Biotechnologies have radically changed healthcare capabilities in genomics, gene therapy and regenerative medicine. Personalized medicine offers customized treatments based on the patient's genetic profile, considerably increasing the effectiveness of medical interventions. Genomics uses biotechnology to analyze patients' DNA to identify genetic mutations and predispositions to diseases, enabling preventive interventions and target therapy. Gene therapy, in turn, seeks to correct genetic defects that are the root cause of some diseases, giving the hope of curing previously incurable conditions.

4. Future Scenarios

4.1. Socioeconomic implications of new technologies

New technologies can potentially raise the quality of life, create new jobs, and stimulate economic growth. However, they can also exacerbate inequalities and need a balanced management approach to avoid damaging social consequences. Automation, for instance, can erode employment in some sectors that would require reskilling programs and supporting measures for affected workers. Additionally, it is critical to ensure universal access to advanced technologies to avoid the digital divide that can further widen social and economic inequalities.

4.2. Ethical and regulatory challenges

Adoption of new technologies raises important ethical and regulatory questions. Data privacy, cybersecurity and responsible AI application are only some of the challenges that governments and organizations have to deal with. For example, the use of AI for business decision-making and government administration raises concerns regarding transparency and accountability. Regulatory frameworks should be updated to safeguard the rights of citizens and ensure ethical application of new technologies.

4.3. Looking forward

In the future, we are likely to witness further acceleration of the technological progress and arrival of innovative solutions that we can only imagine today. Global cooperation and investments in R&D are becoming key to resolving new problems and taking full advantage of emerging opportunities. The WEF report estimates that, by 2030, 70% of new skills that will be in demand on the labor market will be related to new technologies. Furthermore, disruptive technologies, like thermonuclear fusion and quantum computing, could even more radically redefine the technology landscape, opening up unprecedented opportunities and creating new challenges.

Conclusions

In conclusion, it would be fair to say that the technological progress will remain the primary driver for innovation and global development. Investment in advanced technologies will play a decisive role in overcoming future challenges and shaping a more connected and thriving world. It is fundamentally important that governments, companies and citizens join forces to ensure ethical and sustainable use of these technologies for the good of all humanity.

In order to alleviate economic and strategic tensions, it would be advisable to create a global platform for open innovations. It could be used by countries to freely and openly share technologies without any barriers or restrictions, allowing each state to borrow from others technologies which they do not possess or which are not as advanced as what they currently have.

This sharing process would help to:

- reduce duplication of technologies;
- cut costs (e.g. administrative, healthcare, transactional, etc.);
- optimize allocation of human resources and investments;
- establish fair trade relations;
- provide better quality services for most people in the world;
- deepen the links between states and ease economic conflicts.

This may seem to be a titanic task, but technologies in their early stages have always promoted the progress of human civilization, which later gave rise to conflicts of various kinds.

An open technology platform could contribute to equitable and lasting progress, helping to unite people and improve the quality of life for the nations.

Supplementary information

Growth of technology spending. According to Deloitte's 2023 Global Technology Leadership Study, corporate technology spending demonstrates growth around the globe. The average tech budget as a percentage of revenue was up from 4.25% in 2020 to 5.49% in 2022 and expected to rise to 9.8% by 2025.

Impact on labor market. AI and automation are transforming the labor market. According to the World Economic Forum data, automation may affect 85 jobs by 2025, creating 97 million new functions. However, it is important to manage this transition carefully to avoid inequalities and secure a fair distribution of technology gains.

Future technology trends. Key projected technology trends in 2025 include advanced AI systems, post-quantum cryptography (PQC) and collaborative robots.

These technologies will have a significant impact on automated decision-making and the nature of interactions between people.

Growth opportunities. Investors show considerable interest for new technologies, such as AI, semiconductors, cloud computing and renewable energy. The global economy is expected to provide a powerful impetus to the tech sector development in 2025.

Ethical and regulatory challenges. Adoption of new technologies raises a number of serious ethical and regulatory questions. Data privacy, cybersecurity and responsible AI application are only some of the challenges that governments and organizations have to deal with. Regulatory frameworks need to be updated to safeguard the rights of citizens and ensure ethical application of technology.

VENEZUELA

Ratmi Sari Machado Rodriguez

Deputy Director

Institute of Higher Studies Pedro Gual (IAEDPG)

Digital Transformation as a Strategy for Social Innovation Case Study: The EatCloud Platform, Colombia

This paper focuses on the use of technology tools to transform the food industry – exponential technologies to manage unsellable food – and the economic, social, and environmental impact this has on Colombia. It is an interesting social innovation strategy to eradicate hunger and make productive use of food waste, using technology to drive processes to ensure that products arrive on time and can be used both by companies and by social organizations that receive food donations.

It is huge challenge to get social organizations, NGOs, foundations, and public institutions, as organizations that typically consider expertise in a given field and the use of technologies as resources that help people understand projects, to see exponential technologies as tools that guarantee the sustainability of projects. On the other hand, some see exponential technologies as an investment undertaken exclusively by private companies that take a transformative approach, identify opportunities, and improve social conditions, while assessing the social, economic, and environmental impact of these actions, using social innovation methodologies and incorporating new technologies. And this implicitly entails a paradigm shift. For example, facing "resistance to change, which yields good results."

In the case of Latin America, the shortcomings in the control of technological resources such as apps, freeware, and LINUX could be viewed as a disruptive factor, weakening the governance of such technologies, rather than as an opportunity to transform itself as an agent of change, train itself, and make the leap to new methods of working. A survey conducted by Salesforce revealed that 85% of nonprofits agree that technology is important for long-term success, yet only 23% have a strategy or vision in place for how they would use this technology (Celep; Coolidge; Bartczak, 2021). In other words, there is an awareness of the need to adapt working methods to respond to social needs, but this requires funding and the implementation of public policies to train those responsible for ensuring effective care.

Despite the general agreement that we need harness technology; companies are silently resisting this. As J. Llorente (2019) has stated, we live in a reality that is increasingly less governable, more volatile, uncertain, complex, ambiguous (the VUCA world), which describes "a new scenario, much more multifaceted, rugged and unstable [...] it is uncommonly topical at present, when technology and the social changes it brings and accelerates confront us with an unknown reality that is developing at breakneck speed with new rules and rituals."

The spread of COVID-19 inevitably accelerated the use of technological resources in our daily lives. People who were unfamiliar with specialized platforms for holding meetings, teaching classes, and making video calls experienced higher levels of stress due to their failure to adapt to this new social paradigm shift. From food purchases to the development of countries' economic dynamics, the use of technologies has accelerated. It is, therefore, clear that we need organisations capable of maintaining sustainable environment and balancing the social inequalities that exist currently or may exist in the future. In fact, the system will weed out those who fail to adapt to these new ways of working, have no skills in various technologies, or whose living conditions are compromised.

Social indicators that point to a large gap in access to and use of technologies, as the paper "Rural Connectivity in Latin America and the Caribbean – a Bridge to Sustainable Development During a Pandemic" published jointly by the Inter-American Institute for Cooperation on Agriculture (IICA), the Inter-American Development Bank (IDB), and Microsoft in October 2020 shows, at least 77 million people living in rural areas of Latin America and the Caribbean lack even the minimum level of connectivity. If we add the number of people living in urban areas and neglected by public services, then this means that around 100 million people will not be able to benefit from the economic and social advantages provided by connectivity – these are potential customers or users if we manage to ensure the qualitative leap that will strengthen their technological capacities.[1]

As part of an open debate or dialogue, we will explore the case of the EatCloud digital platform as an example of good practice in the use of technology in a network of socially responsible and collaborative companies located in Medellín,

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1 https://ssires.tec.mx/es/noticia/tres-areas-que-las-organizaciones-sin-fines-de-lucro-deben-priorizar-raiz-de-la-cov

Colombia. EatCloud is a food management software developed and prototyped in 2019 that has brought new knowledge into the sector by combining social, environmental, and economic achievements of the companies concerned, with the main idea being to bring human sense to the strategy of food utilization. EatCloud is not the first successful project for its founders, who gave us the Centinela ("Sentinel") app, the purpose of which is to identify potential dangers to human life, for example, natural disasters and warn users about them. Not to mention the Aquí Estoy ("Here I Am") app, which is designed to record and reduce child street labour. In 2010, the team was nominated for a Mobile Premier Award in Spain, and in 2020, it won a Latin American Green Award for Responsible Production and Consumption. The experience of the EatCloud founders allows us to visualize a global strategy that connects or articulates efforts to protect vulnerable population groups, for example, migrants or those living in poverty, in real time, thus reducing food waste.

EatCloud is an AI-assisted digital platform developed by NODRIZZA NETWORK and the Colombian Food Bank Association (ABACO) that provides the necessary logistics for purchasing, accepting, storing, sorting, classification, conservation, and distribution of donated food. The platform connects the food ecosystem (the food industry, supermarkets, restaurants, hotels, and agricultural producers) with the social ecosystem (food banks and foundations that provide aid to vulnerable population groups). Acting as a "link between surplus food in perfect condition that cannot be sold or consumed through multiple channels and the institutions and communities that really need it, no matter where they are."[2]

The idea is to help clients or food companies manage their surpluses effectively through the use of exponential technologies, connecting companies with donors and beneficiaries based on geographical location, food characteristics, the location of food donation banks, and the demographics that will receive the donations (nursing mothers, children, the elderly, etc.). It is a cloud-based program that matches donors to recipients based on the data they have provided and the parameters listed. This allows for food that is close to expiration to be quickly collected and consumed while it is still in optimal condition. The initiative has produced concrete results, working with more than 1800 foundations that accept donations and collect and deliver them to vulnerable population groups.

The project's sustainability can be attributed to the fact that it brings dynamic consumer goods companies and brands, retailers, communities, and the social sector together in a single space, a model that it implements in three main steps. First, every item of food is converted into a piece of data; food that is not earmarked for disposal and is suitable for consumption is uploaded to the cloud, which optimizes storage and distribution centres. Second, every piece of data is converted into an opportunity; the entire process is monitored in terms of traceability and

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2 EatCloud. (2019) https://www.eatcloud.com/

transparency. As a result, donations are completed within a maximum of 24 hours. Third, every opportunity is converted into a wake-up call; to improve processes and use resources efficiently, EatCloud measures its impact and compiles data that optimizes the organization's management and thus reduces food waste margins. Watch the following video.

In 2020, the COVID-19 pandemic pushed the launch of the platform forward throughout Colombia and precipitated its rapid expansion. In three months, they connected 1700 food industry participants, both retail and restaurants. The 40 foundations that have joined the platform thus far work with nearly 2000 industry participants in 230 cities and municipalities across Colombia. It is estimated that for every tonne of food produced in Colombia, the industry pays between $60,000 and $1,000,000 in waste disposal costs. Meanwhile, EatCloud, with just 20% of that amount, rescues and distributes food to people in need. Plus, companies receive significant tax benefits by donating food. It is a strategic decision made by companies, public institutions that manage waste, and foundations that ask for donations.

In line with the digital transformation processes of social impact organization EatCloud meets the following parameters (Martín [2021]):

The digital transformation of social organizations starts with people. They focus their value proposition on people's wellbeing, leveraging technology in the conscious management of food companies, and incorporating the triple impact standards (people, planet, profit). The application reduces food waste and helps in the fight against hunger in Colombia. As such, it contributes to meeting Sustainable Development Goal 2: Zero Hunger, helping rescue 14,550 tonnes of food, or 34,660,000 plates, to date

Digital transformation requires a strategy of openness and collaborative economy. EatCloud's social innovation encompasses an AI-powered food ecosystem. The digital platform connects the agro-industry and food sector companies to a social ecosystem made up of nonprofit social organizations, food banks, and foundations. This has led to the creation of a collaborative network where each segment or group has its responsibilities, such as the logistics of distributing and transporting food donations, tax incentives, controlled waste management, new links, and cooperation with other private and public institutions.

Digital transformation requires new working methodologies.

The app was designed with new working methods, including proper product handling, logistics, and distribution. Its database of donors and foundations that accept donations is of much interest. The use of Lean Startup, Agile, and Design Thinking is evident, based on the notion that the most effective innovation is one that focuses on solving a real user demand.

Digital transformation involves analysing, understanding, and leveraging data. In addition to creating new data, the app produces, in real time, analytical data that is tailored to the needs and interests of each individual organization – for example, data on the economic, social, and environmental impact of the decision to not throw food away. This incentivizes organizations both to manage food waste and to donate food to foundations that deserve support.

Digital transformation involves taking advantage of exponential technologies, primarily artificial intelligence. The platform uses artificial intelligence to connect donors with beneficiaries and selects, schedules, and verifies donations. The entire process is carried out through the app.

Digital transformation requires the development of new disruptive business models. Being innovative requires a dedicated team for that purpose. The search for truth and experimentation is the driving force behind EatCloud. They promote the freedom to work through experiments, repetition, and trial and error.

It is a challenge to think of social inclusion as a mechanism to expand businesses using the triple impact standards, given its social focus. However, it is essential to democratize or universalize access to and the use of technologies. States, social organizations, and public institutions need to implement institutional change that transforms rigid bureaucracy to understand the new demands and their role in the changes that have already taken place in society. It is also essential to promote spaces that are more collaborative and cooperate with private organizations and international bodies, with transformational leadership that responds to new demands; push values such as solidarity; and be adaptive throughout the process of providing social services.

In the case of Venezuela, the management of food waste and food loss is a pressing issue. The country is in an advantageous position in this respect, as it has large areas of fertile land, economic resources, and burgeoning sectors such as tourism. Proper management of food losses allows for food to be distributed in the correct manner, through the Local Committees for Supply and Production, and the programme for the distribution of certain imported basic foods promoted by the government, and which in some cases also includes national products. The programme is built around the culture and nutritional needs of the people receiving aid. This could be combined with health studies aimed at improving the wellbeing of the population. The state would guarantee the efficient and effective distribution of quality food with the responsible participation of entrepreneurs, organizations, and institutions.

SOUTH OSSETIA

Magkoeva Lana
Associate Professor

South Ossetian State
University Named After
A.A. Tibilov

GLOBAL TRENDS: INTERNATIONAL TRADE AND TRANSNATIONAL CORPORATION

The principal challenge and unique feature of today's stage in humanity's technological development is general unawareness of the tremendous technological leap that transpires in the world. This unawareness can be observed not only among general populace, but also in international business, including transnational corporations. Winners in the time of robotics and artificial intelligence will be those who will foresee future in a timely manner and develop appropriate strategies.

Translational corporations operating on the global market face the need to adapt to the rapidly changing conditions. Introducing innovative technologies, such as process automation and artificial intelligence, is becoming the key factor in having a competitive edge. Companies capable of integrating these technologies into their operations will gain an advantage in efficiency and in cutting costs.

Kodak is an example of a company that failed to adapt to technological changes in time. Kodak engineers were the ones to design the world's first digital camera in 1975, yet the company's management failed to see the true significance of this invention as they feared that digital technologies would undermine the sales of their principal product, photo film. Consequently, when digital photography swept through the world, Kodak wasn't ready for changes on the market and filed for bankruptcy in 2012.[1]

Amazon, on the contrary, demonstrated its ability to foresee technological trends and adapt accordingly. Amazon started out as an online bookseller, then invested into developing cloud technologies and launched the Amazon Web Services (AWS), becoming the leading cloud services provider. Additionally, the company is aggressively introducing robotics and artificial intelligence into its logistics, thereby gaining a competitive edge on the market.[2]

However, along with opportunities, technological progress also brings new risks. Questions of cyber security, data protection, and ethics of using AI are becoming increasingly pressing. Transnational corporations should take these facts into account when developing their strategies, as they need to ensure reliable information protection and compliance with international standards.

As an example, we can consider the case of Portugal's energy company Energias de Portugal (EDP). In April 2020, EDP was attacked by the Ragnar Locker ransomware; cyber criminals encrypted the company's ICT systems and demanded a ransom of USD 10.9 m. Hackers claimed to have stolen over 10 TB of confidential data and threatened to leak them should the company fail to pay up.[3]

The case of the above-mentioned Amazon is a good case study of ethics in using artificial intelligence. Attempting to automate their hiring process, Amazon developed an AI system for assessing job applications. However, the algorithm turned out to be biased against women as it graded their applications lower than men's. It happened because the system was trained on male-dominated data, which resulted in gender discrimination.[4]

Alongside new opportunities, technological progress also brings grave risks. Transnational corporations should take these factors into account in developing their strategies and should ensure reliable information protection and compliance with international standards; they should also carefully consider the ethics of introducing new technologies.

Globalization and international trade development result in a greater competition on global markets. Companies are forced to seek new approaches to doing business, such as diversifying their suppliers, localizing manufacturing, and estab-

1 Kodak's Story: From A Giant of the Photo Industry to Bankruptcy. https://onlinepatent.ru/journal/istoriya-kodak/?utm_source=chatgpt.com (in Russian)

2 AWS CISO On Why Its Security Strategy Tops Microsoft, Google. By Mark Haranas. https://www.crn.com/news/cloud/aws-ciso-on-why-its-security-strategy-tops-microsoft-google

3 The major ransomware attacks. https://www.kaspersky.ru/resource-center/threats/top-ransomware-2020 (in Russian)

4 Zhilina I.Yu. "Artificial Intelligence in E-Commerce" // Sotsial'nye i gumanitarnye nauki: Otechestvennaia i zarubezhnaia literatura. Ser. 2, Ekonomika: Referativnyi zhurnal [Social Sciences and the Humanities: Russian and International Literature. Series 2: Economics: Abstract Journal]. 2020. No 2. (in Russian)

lishing partnerships with other market players. Flexibility and ability to rapidly respond to changes become keys to success today.

For instance, seeking to minimize the risks involved in depending on individual suppliers and regions, Toyota introduced the strategy of diversifying its supply chains as it cooperates with different suppliers throughout the world. Additionally, the company massively localizes manufacturing building assembly lines in the countries where it is present. That cuts the costs of logistics, allows for a quicker response to changes in demand, and helps the company take into account local market specifics.[5]

Having faced the great variety of tastes and cultures across the globe, Switzerland's Nestlé adapted its products to local markets designing products that aligned with local preferances and met local needs. Additionally, Nestlé establishes partnerships with local manufacturers and suppliers thereby bolstering its global market position and improving its competitive edge.[6]

Those transnational corporations that realize the scale of current technological changes and are ready to adapt have greater chances for successful development in today's global economy. Developing and implementing carefully thought-through strategies that account for both opportunities and risks will allow businesses to boost their international standing.

General Electric (GE) is actively investing into digital technologies and the industrial Internet of Things (IIoT); it is designing the Predix platform to collect and analyze industrial equipment data. It allows GE to offer its clients innovative solutions that improve efficiency and reliability of their operations.[7]

Siemens is introducing its own digitization strategy combining its traditional engineering prowess with cutting-edge ICT solutions. The company has developed the MindSphere platform, a cloud OS for the Internet of Things that allows companies to optimize their processes and the operations of their equipment. Being geared toward digital technologies bolsters Siemens' standing on the global market and promotes its further development amid the rapidly developing technological environment.[8]

Naturally, amid globalization, when the world is functioning as a single economic system, the winners will be those who have an advantage in personnel,

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5 Dolgan A.G., Tsoi A.S. "Sociocultural Aspect in Toyota's Development" // Mezhdunarodnyi zhurnal gumanitarnykh i estestvennykh nauk [International Journal of Humanities and Natural Sciences]. 2016. No. 1. (in Russian)

6 Andreyuk Denis S, Ochkovskaya Marina S. "Relevance of context of brand mentions in fiction to the contemporary brand values and target audience (the case of Nestlé in K. Chukovsky's memoirs about A. Akhmatova)" // Vestnik Sankt-Peterburgskogo universiteta. Menedzhment [St. Petersburg University Bulletin. Management]. 2022. No 4. (in Russian)

7 Budagov, A.. (2020). Problems Of Effective Business Digital Transformation Management. 428-434. 10.15405/epsbs.2020.10.03.48.

8 Novikov, Sergey & Sazonov, Andrey. (2019). Application of the open operating system 'MindSphere' in digital transformation of high-tech enterprises. Econimics Journal. 1. 20-26. 10.46502/issn.2711-2454/2019.1.03.

ideas, efficient institutional practices, new technologies, and a stronger resource base.[9] Transnational corporations shape these advantages. Their ability to attract and develop talented professionals, introduce innovative ideas, and adapt cutting-edge management practices allows them to retain their competitive edge in the rapidly changing world.

Despite their major resources and influence, transnational corporations face a series of challenges. One such challenge is the need to account for the specifics of local markets they operate on. Cultural differences, different regulatory environments and economic conditions require that companies remain flexible and able to adapt their strategies to specific conditions.

Sustainable development and social responsibility of businesses become increasingly important in today's world. The public and governments increasingly expect major corporations to be economically efficient and also to contribute to handling social and environmental problems.[10] These expectations require that transnational companies revise their approaches to doing business, integrate sustainable development principles into their corporate strategies, and actively engage with local communities.

Amid growing global competition and rapidly changing technological environment, transnational corporations should constantly invest in R&D and in their employees' training and development. That is the only way for them to maintain high levels of innovations and adaptability, which is the key success factor in today's global economy.

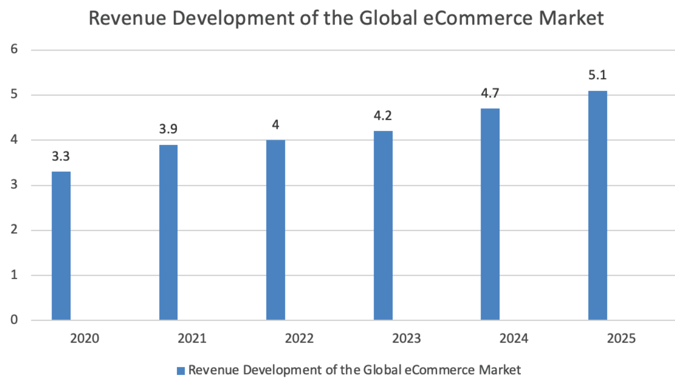

Fig 1. Dynamics of the Global eCommerce Market Growth[11]

9 Kyove, Justine & Streltsova, Katerina & Odibo, Ufuoma & Cirella, Giuseppe. (2021). Globalization Impact on Multinational Enterprises. World. 2. 216-230. 10.3390/world2020014.

10 Zaitsev Stanislav Yu. "Transnational Corporations as Agents of Globalization" // Obshchestvo: politika, ekonomika, pravo. [Society: Politics, Economics, Law] 2018. No. 1. (in Russian)

11 Global eCommerce Market 2024: Market Growth, Top Players & Online Share. https://ecommercedb.com/insights/global-ecommerce-market-2024-size-market-growth-online-share/4784

References:

1. Andreyuk Denis S, Ochkovskaya Marina S. “Relevance of context of brand mentions in fiction to the contemporary brand values and target audience (the case of Nestlé in K. Chukovsky’s memoirs about A. Akhmatova)” // Vestnik Sankt-Peterburgskogo universiteta. Menedzhment [St. Petersburg University Bulletin. Management]. 2022. No 4. (in Russian)
2. Dolgan A.G., Tsoi A.S. “Sociocultural Aspect in Toyota’s Development” // Mezhdunarodnyi zhurnal gumanitarnykh i estestvennykh nauk [International Journal of Humanities and Natural Sciences]. 2016. No. 1. (in Russian)
3. Zhilina I.Yu. “Artificial Intelligence in E-Commerce” // Sotsial’nye i gumanitarnye nauki: Otechestvennaia i zarubezhnaia literatura. Ser. 2, Ekonomika: Referativnyi zhurnal [Social Sciences and the Humanities: Russian and International Literature. Series 2: Economics: Abstract Journal]. 2020. No 2. (in Russian)
4. Zaitsev Stanislav Yu. “Transnational Corporations as Agents of Globalization” // Obshchestvo: politika, ekonomika, pravo. [Society: Politics, Economics, Law] 2018. No. 1. (in Russian)
5. Kodak’s Story: From A Giant of the Photo Industry to Bankruptcy. https://onlinepatent.ru/journal/istoriya-kodak/?utm_source=chatgpt.com (in Russian)
6. The major ransomware attacks. https://www.kaspersky.ru/resource-center/threats/top-ransomware-2020 (in Russian)
7. AWS CISO On Why Its Security Strategy Tops Microsoft, Google. By Mark Haranas. https://www.crn.com/news/cloud/aws-ciso-on-why-its-security-strategy-tops-microsoft-google
8. Budagov, A.. (2020). Problems Of Effective Business Digital Transformation Management. 428-434. 10.15405/epsbs.2020.10.03.48.
9. Global eCommerce Market 2024: Market Growth, Top Players & Online Share. https://ecommercedb.com/insights/global-ecommerce-market-2024-size-market-growth-online-share/4784
10. Kyove, Justine & Streltsova, Katerina & Odibo, Ufuoma & Cirella, Giuseppe. (2021). Globalization Impact on Multinational Enterprises. World. 2. 216-230. 10.3390/world2020014.
11. Novikov, Sergey & Sazonov, Andrey. (2019). Application of the open operating system ‘MindSphere’ in digital transformation of high-tech enterprises. Econimics Journal. 1. 20-26. 10.46502/issn.2711-2454/2019.1.03.

INDIA

Mahajan Gaurav
Partner

The Precept Law Offices

Technological innovation and economic growth

Introduction

Global Capability Centres (GCCs), also known as Global In-House Centres (GICs), have revolutionized multinational corporations (MNCs) by establishing offshore units for various services, from IT support to research and development (HSBC Business Go). Initially conceived as back-office operations handling routine tasks, GCCs have evolved into dynamic hubs of innovation and technological excellence. This evolution has been particularly prominent in India, which has emerged as a preferred destination for GCCs due to its abundant skilled workforce, cost advantages, and supportive government policies (IBEF).

The strategic importance of investing in GCCs in India cannot be overstated. These investments are pivotal in fostering technological advancements and catalysing economic growth. GCCs in India have become crucial drivers of digital transformation, adopting cutting-edge technologies such as artificial intelligence (AI), machine learning (ML), blockchain, and the Internet of Things (IoT). These technologies enhance the operational efficiencies of MNCs and contribute to India's broader technological ecosystem (Grant Thornton Bharat).

Moreover, the economic implications of investing in GCCs are profound. They have a substantial impact on India's Gross Domestic Product (GDP) by generating high- quality employment opportunities and driving business process enhancements. GCCs enable MNCs to leverage cost efficiencies associated with lower labour and infrastructure expenses, enhancing their competitiveness in the global market. Furthermore, GCCs provide access to a highly skilled and educated workforce, facilitating specialized expertise critical for innovation and growth (JLL, Grant Thornton Bharat).

This paper aims to elucidate the critical role of GCCs in the technology sector,

underscore the necessity of sustained investment, and explore the associated benefits and challenges. The objectives are to analyse technological advancements driven by GCCs in India, assess their economic impact, highlight benefits for MNCs and the Indian economy, identify challenges and gaps, and propose strategies for attracting and sustaining investment in GCCs.

Technological advancements driven by QCCS

1. Innovation Hubs

GCCs have emerged as pivotal innovation hubs, driving the adoption and implementation of cutting-edge technologies. They are at the forefront of digital transformation, leveraging advancements in AI, ML, blockchain, and Iot. The establishment of innovation labs within GCCs has enabled the incubation of new ideas and the development of innovative solutions tailored to the global market (HSBC Business Go, IBEF).

For example, GCCs have developed AI-powered solutions for predictive maintenance in the manufacturing sector. By analysing large datasets from machinery and equipment, AI algorithms can predict potential failures and recommend timely interventions, reducing downtime and increasing operational efficiency.

2. Emerging Technologies

GCCs are instrumental in exploring and implementing emerging technologies such as 5G, quantum computing, augmented reality (AR), and virtual reality (VR). These technologies have the potential to revolutionize various industries and enhance operational efficiencies. For instance, GCCs are working on 5G technology to enable faster and more reliable communication networks, essential for the seamless operation of IoT devices. Quantum computing research within GCCs aims to solve complex problems that traditional computers cannot address, such as advanced cryptographic algorithms and large-scale simulations (Grant Thornton Bharat).

3. Research and Development (R&D)

Investment in R&D within GCCs has been instrumental in driving technological advancements. GCCs serve as R&D hubs for MNCs, fostering a culture of innovation and enabling the development of new products, services, and solutions that can be scaled globally (JLL, Grant Thornton Bharat).

In the pharmaceutical sector, GCCs have been pivotal in developing new drugs and therapies. By conducting clinical trials, analysing patient data, and collaborating with global research teams, these centres contribute to the creation of life-saving medicines and treatments.

4. Digital Engineering

GCCs have made substantial contributions to digital engineering. By leveraging advanced digital tools and methodologies, they have driven innovations in sectors such as aerospace, defence, and automotive. Digital engineering involves the use of digital twins, simulation models, and advanced analytics to design, test, and optimize complex systems and processes.

In the aerospace sector, GCCs have played a crucial role in developing next-generation aircraft. Using digital twins to simulate aircraft performance under various conditions, engineers can identify potential issues and optimize designs before physical prototypes are built. This approach reduces development costs and accelerates time-to-market for new aircraft models.

5. Sector-Specific Technological Innovations

Technological advancements driven by GCCs have had a profound impact on various sectors. In healthcare, GCCs have developed AI-powered diagnostic tools that assist doctors in identifying diseases at an early stage. In financial services, GCCs have implemented blockchain solutions to enhance security and transparency in transactions.

For example, a global logistics firm's GCC in Hyderabad implemented a blockchain- based solution to enhance transparency and traceability in the supply chain. This solution allowed real-time tracking of goods from origin to destination, improving efficiency and security (JLL).

6. Collaboration and Partnerships

GCCs foster collaboration between MNCs, startups, and academic institutions. These collaborations lead to the exchange of ideas, resources, and expertise, driving innovation and technological advancements.

A leading multinational technology company established a GCC in Bangalore to develop AI and ML solutions for various industries. The centre has created AI-powered chatbots for customer service, ML algorithms for supply chain optimization, and predictive analytics tools for healthcare decision-making (HSBC Business Go).

Economic impact of GCCS in India

1. Contribution to GDP

GCCs play a pivotal role in boosting India's GDP. The presence of these centres has attracted substantial foreign direct investment (FDI) from MNCs, leading to increased economic activity. According to the Indian Brand Equity Foundation (IBEF), GCCs contribute approximately 1% to India's GDP, a figure expected to rise as more GCCs are established (IBEF).The economic contributions of GCCs are multifaceted. By driving technological innovation and improving business processes, GCCs enhance the productivity and efficiency of their parent companies, generating increased revenue and economic output. Additionally, the export of services provided by GCCs contributes to India's balance of payments, further bolstering economic growth (Grant Thornton Bharat).

2. Employment Generation

GCCs are significant contributors to employment generation in India. They leverage India's large pool of skilled professionals, creating high-quality job opportunities in various fields, including IT, R&D, finance, and customer support. According to a NASSCOM report, GCCs in India employ over 1.3 million professionals, with the number expected to increase (NASSCOM).

The creation of high-quality employment opportunities has several positive implications for the Indian economy. It reduces unemployment, provides stable income, enhances workforce skills through training programs, and has a multiplier effect on the economy through increased consumer spending.

3. Enhancement of Business Processes

GCCs contribute to the enhancement of business processes by leveraging advanced technologies and innovative solutions. The integration of digital tools such as automation, AI, and data analytics has streamlined operations and improved efficiency across various industries.

For example, GCCs in the financial services sector have implemented AI-powered chatbots to handle customer queries and transactions, reducing the need for human intervention and improving response times. Similarly, GCCs in manufacturing have adopted automation and predictive maintenance solutions to optimize production processes (Grant Thornton Bharat).

4. Regional Economic Development

GCCs have a positive impact on regional economic development by creating economic opportunities in various parts of the country. While major metropolitan areas like Bangalore, Hyderabad, and Mumbai host many GCCs, smaller cities are also becoming attractive destinations.

The establishment of GCCs in Tier 2 and Tier 3 cities has led to infrastructure development, improved access to education and healthcare, and increased employment opportunities. For instance, Pune has emerged as a hub for aerospace and automotive GCCs, driving regional economic growth (IBEF).

Benefits for multinational corporations

1. Cost Efficiency

Establishing GCCs in India offers significant cost efficiency. By leveraging lower labour and infrastructure costs, MNCs can reduce operational expenses while maintaining high-quality service delivery. According to JLL, the cost of setting up and operating a GCC in India is approximately 20-30% lower than in developed countries (JLL).

The cost savings enable MNCs to allocate resources more efficiently, invest in innovation, and enhance overall competitiveness. For example, Cisco has benefited from its Bangalore GCC by reducing costs and accelerating new technology development.

2. Access to Skilled Workforce

India's vast pool of highly skilled and educated professionals makes it an ideal location for GCCs. The availability of talent in various fields allows MNCs to access specialized expertise critical for their operations.

GCCs provide MNCs with a diverse talent pool that drives innovation and improves business processes. For example, Pfizer's Mumbai GCC has access to skilled researchers and scientists contributing to new drug development (Grant Thornton Bharat).

3. Business Agility

GCCs enhance business agility by enabling MNCs to quickly adapt to market changes and implement new technologies. The strategic location of GCCs in India allows MNCs to operate in different time zones, providing round-the-clock support and services to their global operations.

The innovative culture within GCCs encourages the rapid development and deployment of new technologies and solutions. For example, GCCs in the financial services sector have implemented AI-powered chatbots to handle customer queries and transactions, significantly improving response times and customer satisfaction (Grant Thornton Bharat).

4. Strategic Advantage

Investing in GCCs provides MNCs with a strategic advantage by improving competitiveness and fostering innovation. The presence of GCCs allows MNCs to leverage India's cost advantages, access to talent, and technological capabilities to enhance their global operations.

GCCs also enable MNCs to diversify their operations and reduce reliance on a single geographic location. For example, Boeing's Pune GCC has allowed the company to diversify its R&D activities and reduce dependence on its primary research facilities in the United States (IBEF).

5. Innovation and R&D

GCCs have become centres of innovation and R&D for MNCs, fostering a culture of continuous improvement and technological advancement. By investing in GCCs, MNCs can leverage India's strong R&D capabilities to drive innovation and develop new products and solutions.

For example, Microsoft established its largest R&D centre outside the United States in Hyderabad. The centre focuses on cutting-edge research in AI, cloud computing, and cybersecurity, contributing to innovative products like AI-powered tools for Microsoft Office (Grant Thornton Bharat).

6. Cultural and Market Insights

GCCs provide MNCs with valuable cultural and market insights crucial for expanding operations in new regions. By having a presence in India, MNCs can gain a deeper understanding of local market trends, customer preferences, and regulatory requirements.

For example, Procter & Gambles Mumbai GCC has played a key role in understanding the Indian consumer market and developing products that cater to local preferences, driving significant growth and market penetration (IBEF).

7. Ecosystem Collaboration

GCCs foster collaboration between MNCs, startups, academic institutions, and research organizations, creating a vibrant ecosystem of innovation and growth. By partnering with local startups and universities, GCCs can access new ideas, technologies, and talent.

For instance, Google's Bangalore GCC collaborates with several Indian startups and research institutions on AI and machine learning projects, leading to innovative solutions in healthcare, agriculture, and education (NASSCOM).

Benefits and opportunities in India's emerging data centre and semiconductor chip conductor business

Data Centre Business

1. Economic Growth and Employment

The data centre business in India is experiencing rapid growth, driven by the increasing demand for cloud computing, big data analytics, and digital services. This growth is creating significant economic opportunities and employment for skilled professionals in areas such as IT infrastructure, network engineering, and data security.

According to a report by NASSCOM, the data centre sector in India is expected to create over 500,000 jobs by 2025, including roles in data centre operations, maintenance, and management. These jobs will contribute to the development of a skilled workforce and enhance India's position as a global hub for digital services.

2. Infrastructure Development

The expansion of data centres requires substantial investment in infrastructure, including power, cooling, and connectivity. This has led to the development of advanced infrastructure in regions hosting data centres, improving overall connectivity and power reliability.

For example, the establishment of data centres in Tier 2 and Tier 3 cities has driven infrastructure development, including the construction of high-speed fibre-optic networks and power distribution systems. This infrastructure development benefits not only the data centre industry but also other sectors reliant on reliable connectivity and power.

3. Attracting Investment

The data centre business in India has attracted significant investment from both domestic and international companies. Major players such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud have established large-scale data centres in India, recognizing the country's potential as a global data hub.

The governments supportive policies, including tax incentives and simplified regulatory frameworks, have further enhanced India's attractiveness as a destination for data centre investments. These investments contribute to the country's economic growth and technological advancement.

Semiconductor chip conductor business

1. Technological Advancements

The semiconductor chip conductor business in India is emerging as a critical sector, driven by the increasing demand for electronic devices and the push for self-reliance in technology. This sector is fostering significant technological advancements, including the development of advanced chip manufacturing processes and specialized semiconductor materials.

Indian companies and research institutions are increasingly investing in R&D to develop cutting-edge semiconductor technologies. For example, the Indian Institute of Technology (IIT) system and other research institutions are conducting pioneering research in areas such as nanotechnology, quantum computing, and advanced materials, contributing to the growth of the semiconductor industry.

2. Supply Chain Resilience

The semiconductor chip conductor business is crucial for building a resilient supply chain, particularly in the context of global supply chain disruptions. By developing domestic semiconductor manufacturing capabilities, India can reduce its dependence on imported chips and ensure a stable supply of critical components for various industries, including electronics, automotive, and telecommunications.

The government's initiatives, such as the Production Linked Incentive (PLI) scheme for semiconductors, aim to attract investment and promote domestic manufacturing. These initiatives are expected to boost the growth of the semiconductor industry and enhance India's supply chain resilience.

3. Job Creation and Skill Development

The semiconductor chip conductor business is creating high-quality employment opportunities in various fields, including chip design, manufacturing, testing, and packaging. This sector requires a highly skilled workforce, driving the development of specialized training programs and educational initiatives. Institutions such as the Indian Institute of Electronics and Telecommunication Research (IETR) and the VLSI Design and Technology Institute (VDTI) are playing a key role in providing specialized training and education in semiconductor technologies. These initiatives are equipping the workforce with the skills needed to meet the growing demand in the semiconductor industry.

4. **Global Collaboration and Market Access**

India's emerging semiconductor chip conductor business is fostering global collaboration and market access. Indian companies are increasingly partnering with international firms and research institutions to access advanced technologies and market opportunities.

For example, collaborations between Indian semiconductor companies and global technology leaders are enabling the transfer of advanced manufacturing technologies and expertise. These collaborations are enhancing India's position in the global semiconductor market and opening new opportunities for growth and innovation.

Challenges and gaps

1. **Skill Gap and Digital Skills Demand**

One of the primary challenges faced by GCCs is the skill gap in the workforce, particularly in digital skills. As GCCs adopt advanced technologies, there is a growing demand for professionals with expertise in these areas. However, the supply of skilled talent has not kept pace with demand (NASSCOM).

2. **Cybersecurity Infrastructure**

Cybersecurity is a major concern for GCCs handling sensitive data and critical business operations. The increasing frequency and sophistication of cyber threats pose significant risks. Ensuring robust cybersecurity infrastructure is essential.

3. **R&D Investment Challenges**

Investment in R&D is critical for innovation, but GCCs often face challenges in securing adequate funding and resources. This is particularly true for sectors requiring substantial investment in infrastructure and equipment.

4. **Talent Retention and Employee Engagement**

High attrition rates in the tech industry pose a significant challenge for GCCs. Talent retention is critical for sustaining growth and success, as frequent turnover can disrupt operations and increase costs.

5. **Regulatory and Compliance Challenges**

GCCs face regulatory and compliance challenges related to data protection, intellectual property rights, and labour laws. Navigating India's complex regulatory landscape can be challenging for MNCs.

Data privacy and data protection in GCCS

1. **Importance of Data Privacy and Data Protection**

Data privacy refers to the rights of individuals to control their personal information. Data protection involves securing data from unauthorized access and breaches. For GCCs, adhering to data privacy and protection regulations is crucial to avoid legalrepercussions and protect data integrity.

2. Regulatory Frameworks

Various regulatory frameworks govern data privacy and protection, such as the GDPR in the EU, the CCPA in the US, and India's upcoming Personal Data Protection Bill. GCCs must ensure compliance by implementing robust data protection policies, conducting regular audits, and providing training to employees.

Cross-border data sharing

1. Benefits and Challenges

Cross-border data sharing allows GCCs to leverage global resources and expertise but presents challenges related to data sovereignty, security, and compliance with diverse regulatory requirements.

2. Best Practices

To navigate these complexities, GCCs should adopt best practices such as data localization, encryption, and establishing clear data transfer agreements. Collaboration with legal experts and regulatory bodies can help stay informed about the latest developments in data privacy laws.

Ethical use of AI

1. Ethical Concerns

AI systems can perpetuate biases present in training data, leading to unfair outcomes. Ensuring transparency in AI algorithms and making them interpretable is crucial to build trust and accountability.

2. Implementing Ethical AI Practices

GCCs can adopt ethical AI practices by:

- Conducting regular audits to identify and mitigate biases.
- Ensuring transparency by making AI algorithms interpretable.
- Establishing clear guidelines for responsible AI use.
- Collaborating with stakeholders to create a framework for ethical AI development.

Balancing technological growth with protection and responsibilities

1. Striking the Right Balance

GCCs must balance leveraging cutting-edge technologies with maintaining robust data privacy, protection, and ethical standards. This involves adopting a proactive approach to data governance, investing in cybersecurity infrastructure, and fostering a culture of ethical responsibility.

Conclusion

GCCs have emerged as pivotal players in driving technological advancements and economic growth in India. They have transformed from back-office operations to hubs of innovation, research, and technological excellence. Through the exploration of technological advancements, economic impact, benefits to MNCs, and challenges faced by GCCs, this paper has provided a comprehensive understanding of their critical role in shaping India's technological landscape.

The technological advancements driven by GCCs, including AI, blockchain, and digital engineering, have significantly contributed to innovative solutions and enhanced business processes across various sectors. GCCs have also played a crucial role in fostering R&D activities, leading to the creation of new products and services that can be scaled globally.

Economically, GCCs have made substantial contributions to India's GDP by attracting FDI, generating high-quality employment opportunities, and driving regional economic development. The presence of GCCs has also enhanced the competitiveness of Indian firms in the global market, attracting further investment and fostering a conducive environment for business growth.

For multinational corporations, investing in GCCs offers numerous benefits, including cost efficiency, access to a skilled workforce, enhanced business agility, and strategic advantages. These centres enable MNCs to leverage India's cost advantages, access to talent, and technological capabilities, driving their global operations and innovation efforts.

The benefits and opportunities in India's emerging data centre and semiconductor chip conductor business further highlight the potential for growth and technological advancement. The data centre sector is creating significant economic opportunities and employment, while the semiconductor chip conductor business is fostering technological advancements and supply chain resilience.

However, the growth and effectiveness of GCCs are not without challenges. Skill gaps, cybersecurity concerns, R&investment hurdles, talent retention issues, and regulatory compliance challenges must be addressed to maximize their potential. By adopting global best practices, stakeholders can overcome these challenges and ensure the sustained success of GCCs.

The future of GCCs lies in their ability to navigate the complexities of data privacy, cross- border data sharing, and ethical AI use. By prioritizing these aspects, GCCs can drive sustainable technological growth, maintain stakeholder trust, and contribute to a secure and responsible digital ecosystem.

In conclusion, investing in Global Capability Centres is pivotal for driving technological advancements and economic growth in India. GCCs have the potential to transform India into a global hub for innovation and technology, contributing significantly to regional development and economic prosperity. By addressing challenges and fostering a conducive environment for investment, India can maximize the benefits of GCCs and sustain its growth trajectory. The future outlook for GCCs in India is promising, with an expected market value of USD 110 billion by 2030. Continued support from the government, industry stakeholders, and educational institutions will be key to unlocking the full potential of GCCs and positioning India as a leader in the global technology landscape.

MEXICO

Martínez Barbosa Sarahí
Student

National Autonomous
University of Mexico

Investments in technologies: Technologies for affordable and sustainable energy

Thematic Vector

This essay explores Russia's technological resilience under international sanctions, emphasising its reliance on rare earth elements, the potential of Siberian permafrost, and cooperation with China. The essay examines the economic and social effects of these strategies, alongside the opportunities and challenges they present for Russia's future as a technological power.

Preamble

In a world that is increasingly interconnected and reliant on technology, Russia faces a unique challenge: preserving its technological relevance while contending with international sanctions and geopolitical tensions. This essay examines Russia's responses to these pressures and raises critical questions about the long-term viability of its strategies. The significance of this topic lies in its global implications, as Russia's success or failure in this domain could reshape the technological and economic dynamics of the 21st century.

Essence of the Hypothesis

Despite Russia's impressive resilience in the face of sanctions, its future as a technological power hinges on its capacity to overcome internal limitations and establish sustainable strategic alliances. This hypothesis is substantiated by data analysis and predictive forecasts:

1. Technological Resilience and Sanctions. Russia has managed to sustain critical industries such as defence and space, but its ability to produce advanced microchips remains limited. According to Bloomberg (2023), the country is heavily dependent on imported equipment and materials, which undermines its claims of self-sufficiency. Additionally, the ongoing brain drain, with thousands of scientists and technologists leaving Russia for various reasons, poses a significant threat to its capacity for innovation.
2. Rare Earths and Cooperation with China. Russia possesses 10% of the world's rare earth reserves (USGS, 2022), yet its production remains limited due to insufficient infrastructure and advanced technology; "China presently produces some 60% of the world's rare earth elements and processes 85% of them" (Brooking's Institution, 2023), this presents opportunities but also introduces geopolitical risks. A critical concern is whether China might use its monopoly over rare earths as a tool for political leverage.
3. Ukraine possesses substantial reserves of rare earth elements, particularly in the Black Sea region. However, the conflict between Russia and Ukraine has rendered any form of cooperation in this area impossible. This raises a provocative question: could the joint exploitation of these resources serve as an incentive for peace? While the idea is appealing, the reality is that the conflict has created deep mistrust between the two nations, making any form of collaboration difficult to achieve.
4. Moreover, the Black Sea, with its strategic significance and abundant mineral resources, has the potential to become a focal point of international tension. Are global actors prepared to mediate in the conflict to facilitate access to these resources? More importantly, could the exploitation of Ukraine's rare earths benefit local communities, or would it merely perpetuate cycles of dependency and exploitation?
5. Siberian Permafrost and Sustainability. Siberian permafrost represents one of the planet's last unexplored frontiers, offering immense potential for mineral and scientific discoveries. However, its exploitation poses significant ethical and environmental dilemmas. While the Russian Academy of Sciences' Permafrost Project is a step in the right direction, questions remain as to whether it is sufficient to ensure long-term sustainability.
6. Private Investment and International Cooperation. The involvement

of Western private investors could offer an alternative solution, but it is fraught with political and regulatory risks. Would Western businesses be willing to invest in a country facing sanctions and with a history of asset expropriation and corruption?

Cooperation with China in fields like artificial intelligence and quantum computing holds significant promise but also entails considerable risks. Is Russia prepared to share its scientific advancements with China, even if doing so means losing control over critical strategic technologies?

Emphasis on Economic and Social Effects

1. **Economic Effects:**

- The exploitation of rare earths and Siberian permafrost could potentially revitalise the Russian economy by creating jobs and attracting investments. However, reliance on China and the impact of international sanctions might limit these benefits.
- Private investment from the West could help diversify the Russian economy, but this would require ensuring transparency and regulatory stability to make such investments viable.

2. **Social Effects:**

- The exploitation of resources in Siberia and the Arctic could potentially benefit local communities, but it also risks triggering social and environmental conflicts.
- The ongoing brain drain poses a significant threat to Russia's future innovation capabilities, potentially having a detrimental impact on both education and scientific research.

General Conclusions and Expected Results

While Russia has the potential to emerge as a global leader in technology, this future remains uncertain. The nation faces significant challenges, including international sanctions, dependence on China, environmental concerns, and geopolitical tensions. Additionally, the Russian government's autocratic approach, while effective in achieving short-term goals, may hinder its ability to foster innovation and compete in an increasingly interconnected global landscape.

To address these challenges, Russia must adopt a comprehensive strategy that integrates technological investment, environmental stewardship, and international cooperation. However, this shift demands moving from confrontation to partnership. Is Russia prepared to embrace this transformation, and, more importantly, is the global community ready to welcome it with open arms?

Ultimately, Russia's technological future hinges not only on its natural resources and scientific capacity but also on its ability to adapt to a constantly evolving global landscape. Whether Russia can rise above these limitations to establish itself as a true technological leader or remain trapped in a cycle of dependency and isolation is a question only time can answer.

References

1. Bloomberg (2023). "Russia's Chip Industry Struggles Under Sanctions". URL: https://www.bloomberg.com
2. USGS (2022). "Mineral Commodity Summaries: Rare Earths". URL: https://www.usgs.gov
3. The Diplomat (2023). "The Russia-China Tech Alliance". URL: https://thediplomat.com
4. Reuters. (2021). "Ukraine's Potential in Rare Earth Minerals". Recuperado de https://www.reuters.com

Matrunchik Andrei
Head of direction

Public Joint Stock Company
«T Plus»

Investments in technologies: Technologies for affordable and sustainable energy

Preamble:

In the modern world, energy is one of the key foundations of economic development and social wellbeing. However, access to sustainable and affordable energy remains a major challenge for countries of the Global South and East. According to the International Energy Agency (IEA), approximately 760 million people still have no access to electricity, and more than 2.6 billion use traditional types of biomass for cooking, which negatively affects their health and the environment.

Energy technologies can become the solution to these problems, as they not only ensure access to energy, but also create preconditions for sustainable development. Under conditions of the global energy transition caused by climate change and the need to reduce greenhouse gas emissions, countries of the Global South and East are facing a dual challenge: to ensure energy security and simultaneously switch to low carbon energy sources.

Russia being one of the major players on the global energy market can play an important role in this process. Having significant resources and technological expertise Russia is able to offer solutions that will help countries of the Global

South and East to overcome energy poverty and achieve goals of sustainable development.

The essence of the hypothesis:

Hypothesis of this essay is that development of technologies for affordable and sustainable energy can become a driver of global growth, especially for countries of the Global South and East. This requires concentration on several key aspects:

1. Renewable energy sources (RES). Solar and wind energy becomes more accessible. According to report by IRENA (International Renewable Energy Agency), over the past decade, the cost of solar energy reduced by 85%, and that of wind energy reduced by 56%. This makes RES attractive for countries with limited financial resources.
2. Energy efficiency and smart grids. Implementation of energy efficiency and smart grid technologies enables energy consumption optimisation and loss reduction. For example, in India implementation of smart grids helped to reduce energy losses by 15%, which is equivalent to annual savings of USD 6 billion.
3. Hydrogen energy. Hydrogen, especially “green” hydrogen (i.e. produced using RES), is considered to be the key element of the future energy system. Russia is actively developing this area and plans to occupy 20% of the world's hydrogen market by 2030.
4. Small modular reactors (SMR). SMRs can become the solution to energy shortage in countries with limited infrastructure. Russia already operates “Akademik Lomonosov” floating nuclear power plant that supplies energy to remote regions.

Focus on economic and social effects

Development of affordable and sustainable energy has significant economic and social consequences:

- Economic effect. Access to energy stimulates industrial development, creation of new job opportunities, and GDP growth. For example, in Africa, introduction of solar power plants in rural areas made it possible to create thousands of job opportunities and increase incomes of local communities.
- Social effect. Energy improves quality of life: it provides access to education, healthcare, and modern communications. In Bangladesh, a program of solar panel installation in houses allowed 20 million people to gain access to electricity, which positively affected the level of education and health.
- Ecological effect. Switch to low carbon energy sources reduces greenhouse gas emissions and improves ecological situation. For example, in

China introduction of wind power plants helped to reduce CO_2 emissions by 200 million tons a year.

General conclusions, expected results:

Technologies for affordable and sustainable energy are not only a tool to solve energy problems, but also a powerful driver of global growth. These technologies provide new opportunities for economic development and improved quality of life in countries of the Global South and East.

Having significant resources and technological expertise Russia can play the key role in this process. Support of such areas as RES, hydrogen energy, SMR, and smart grids will not only strengthen Russia's position on the global energy market, but also contribute to the achievement of global sustainable development goals.

Expected results include:

- Reduced energy poverty in the countries of the Global South and East.
- New markets for Russian technologies and equipment.
- Strengthening of international cooperation in the energy sector.
- Achievement of the goals of the Paris climate agreement.
- Thus, technologies for affordable and sustainable energy are not just a fashionable trend, but a necessary condition for sustainable and equitable future.

Mehrabova Naila

Supervisory Board Member

Azersun Holding

Digital Blockchain Platform for Exports, Logistics, and Insurance as a Tool for Growth and Integration

Abstract. A digital blockchain platform for exports, logistics, and insurance serves as an instrument for uniting key participants in international trade. The platform unites manufacturers, logistics services, banks, and governmental bodies as it creates a single digital space. Automating payments through blockchain cuts costs and increases transparency, which promotes sustainable economic growth of Russian companies, improves their competitive edge, and also harmonizes financial flows in global trade.

Relevance. In 2025, BRICS will account for 37% of the global GDP, yet its member states' potential is restricted by their dependence on an outdated financial and linking infrastructure. The Global South is facing a paradox: being in possession of 60% of global resources, it controls only 15% of financial flows.[1] Amid globalization and evolving digital technologies, GDP growth largely depends on the possibility of going onto international markets. Developing a digital platform therefore becomes the key instrument that integrates manufacturers, logistics services, banks, governmental support institutions, and foreign buyers. This multifunctional eco-system is

1 World Bank. 2023. Global Economic https://www.worldbank.org/en/publication/global-economic-prospects

intended to automate complex business processes, cut away some of the red tape, and ensure comprehensive support for exporters.

Hypothesis

Introducing a blockchain payments platform will allow Russian companies by 2030 to:

- ensure GDP growth from 2.7 to 3.5%[2] relative to 2025[3]
- attract USD 50 bn. in direct investment via tokenization[4];
- ensure financial inclusion for 200 million people.[5]

Methodology

To analyze our hypothesis, we will use an interdisciplinary approach that combines research in economics, international trade, and digital technologies.

This methodology involves a comparative analysis of traditional systems and innovative platforms that use machine learning, big data analytics, and blockchain. The efficiency of automated processes was evaluated using comparative analysis of costs and profits with an emphasis on cutting overhead and improving transaction transparency (Brynjolfsson & McAfee, 2014; Tapscott & Tapscott, 2016).

Predicted results of introducing the digital blockchain platform

1. Integrating members of export chains

Digital platforms serve as information systems and integrate key elements of international trade. Automating searches for partners, payments, certification and logistics helps save time and cut costs. Effective coordination between members of a given chain helps improve competitive edge and economic efficiency (Porter, 1990; Uzzi, 1997). Thus, integrating various market agents into a single digital ecosystem is an important prerequisite for optimizing trade processes.

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2 According to the calculation methodology used in the Kazan (Volga) Federal University and Center for Prospective Economic Research at the Academy of Sciences of the Republic of Tatarstan. Link to the study: Safiullin M.R., El'shin L.A., Burganov R.T. Economic Growth in Russia with Integration of Cross-Border Payments into the Blockcahin Environment [in Russian] // Finansy: teoriia i praktika [Finances: Theory and Practice] 2024/ 28(5): 31-43. DOI: 10.26794/2587-5671-2024-28-5-31-43

3 Introducing a blockchain platform for international payments has an indirect economic effect of increasing trust between partners. The French economists Yann Algan and Pierre Cahuc calculated that an 10% increase in trust aligns with per capita GDP growth of 13.1%.

4 By 2030, the tokenized assets market will be worth no less than USD 1.3 trillion. https://coinspaidmedia.com/ru/news/rwa-market-grow-least-13t-2030/

5 The methodology for assessing the financial inclusion effect was developed by Stellar Development Foundation and PricewaterhouseCoopers International. Stellar, PwC publish 'framework' to judge emerging market blockchain projects. https://cointelegraph.com/news/stellar-pwc-framework-judge-emerging-market-blockchain-projects

2. Analytics and operations automation

Using machine learning algorithms in analytical tools allows researchers to conduct detailed analysis of foreign markets with account for demand, competitive environment, and legal restrictions.

Financial indicators such as cost, tax and customs payments, logistics and certification costs are calculated automatically. That helps to minimize the risk of erroneously choosing the international trade area and to shape strategic managerial decisions based on objective data (Kogut, 1985). Blockchain technologies ensure data protection and transparency of financial operations, which becomes a cornerstone amid growing cyber threats.

3. Integrating state support measures

State exporter support programs play an important role in successfully introducing innovative solutions. Synchronizing the digital platform with governmental bodies in charge of customs clearance, subsidizing, and insuring exports is conducive to creating a synergetic effect.

The research model of interactions between state and business amid digital transformation demonstrates that such pooling of efforts may significantly accelerate infrastructure development and innovations in international trade (OECD, 2019). Thus, integrating platform solutions with state support measures facilitates a more efficient use of resources and improving participants' competitive edge.

4. Technological innovation as the driving engine

We may identify several areas of key technological solutions:

Algorithmic stablecoin based on a currency basket and capable of stabilizing financial flows amid volatility. Such solutions involve using algorithms to automatically adjust reserves, for instance, using FedAvg combined with LSTM to promptly respond to changes in macroeconomic indicators (cf. drop in inflation in some countries following introduction of digital currencies, 2023).

Tokenizing social and infrastructural projects by using smart contracts, which makes it possible to distribute a share of profits to benefit local communities, which both increases transparency and contributes to businesses' social responsibility. We may cite the example of energy projects implemented via NFT where a major chunk of profits was channeled into local development (World Bank, 2021).

Decentralized Autonomous Organizations (DAOs) use multilevel voting and zero-knowledge proof technologies to minimize corruption risks. Cutting-edge developments in this area make it possible to ensure anonymity and reliability of the management system, which is an important aspect of international cooperation (Narayanan et al., 2016).

Such technological innovations potentially help significantly improve platforms' efficiency, reduce operational costs, and build trust between parties to international transactions.

Conclusion

The analysis of the provided data confirms our hypothesis that introducing a digital blockchain platform for exports, logistics, and insurance holds major potential for transforming international trade. Automating key business processes, integrating them with governmental support measures, and using cutting-edge technologies such as machine learning and blockchain lay the foundations for increasing transaction transparency and cutting off some of the red tape. Despite existing challenges, the set of measures helps optimize commercial processes; it could also become an important factor in ensuring sustainable economic growth particularly for countries with dynamically developing economies, such as BRICS member states.

References

1. World Bank. 2021. Global Reports and Statistics.
2. Brynjolfsson, E., & McAfee, A. (2014). The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies. W. W. Norton & Company.
3. IMF. (2022). World Economic Outlook Database. International Monetary Fund.
4. Kogut, B. (1985). Designing Global Strategies. Sloan Management Review.
5. Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). Bitcoin and Cryptocurrency Technologies. Princeton University Press.
6. OECD. (2019). Government at a Glance. Organisation for Economic Co-operation and Development.
7. Porter, M. E. (1990). The Competitive Advantage of Nations. Free Press.
8. Tapscott, D., & Tapscott, A. (2016). Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World. Portfolio.
9. Uzzi, B. (1997). Social Structure and Competition in Interfirm Networks:
10. The Paradox of Embeddedness. Administrative Science Quarterly.

RUSSIA

Mikhaylov Alexey
Associate Professor

Financial University under the Government of the Russian Federation

Investments in technology

Preamble

Fintech is clearly an industry that combines financial technologies and innovations to improve provision of financial services and simplify financial operations. Rapid development of fintech industry commenced in the last decade and this sector continues to actively develop till present. Companies actively implementing fintech solutions have a good chance of success on the market and can stay ahead of competitors in terms of development of new products and services, this is why fintech industry is a unique business area that provides new opportunities to improve financial services and operations.

Hypothesis

Due to new technologies and innovations such as artificial intelligence, machine learning, and data analytics fintech companies can offer more convenient, fast, and efficient financial services: these are, for example, digital payments, online lending, investment management, insurance, as well as blockchain and cryptocurrencies. Besides, active development of financial technologies is associated with the changing needs and expectations of clients, as well as various economic and political factors. Based on the above, following positive factors for fintech sector development were considered: first of all, significant increase in global investments in financial technologies in recent years, secondly, COVID-19 pandemic that forced companies and consumers to actively seek digital solutions for financial operations, thirdly, regulation of fintech sector aimed at its successful functioning and scaling, fourthly, rapid development of import substitution processes that promote development of domestic fintech market and stimulate competition on it. Russian solutions of 2022-2023 were considered as an example of active development and implementation of fintech solutions under conditions of sanctions and refusal from imported technologies. Based on the above factors and statistical analysis of data for different periods of time, positive correlation between fintech development and considered factors will be established.

Effects

Prior to formulation of a definition for fintech, it is worth starting with the fact that there is no generally accepted concept for it. On one hand, financial technologies mean software and other modern technologies used by enterprises providing automated and improved financial services, on the other hand, fintech is defined as an industry comprised of multiple companies that improve efficiency of financial systems. Based on these definitions it is possible to state that financial technologies are an integral system that joins the sectors of innovative technologies and financial services and related infrastructure: thus, fintech has a wide scope of application and is divided into such segments as payments and transfers, digital banking, financing, wealth management, business support, insurance, and regulatory technologies.

The main role of fintech is to enable digital transformation of various areas with financial services through new financial technologies, such as, for example, artificial intelligence (AI), machine learning (ML), and Internet of things (IoT) that allow optimization and significant reduction in operational costs of financial services, as well as improvement of reliability and speed of their provision. Thus, fintech enable time and money savings through financial services in digital format, which, in turn, meets the needs of modern society. On the other hand, financial technologies provide businesses with the opportunity to optimize their business processes, as well as to create new business models and products.

Although fintech sphere is quite "young," as it appeared in late 20th century, at present, it is spreading on the world market at extremely high pace: thus, the global fintech penetration index as of 2015 was 16% and 33% in 2017. Already in 2017 the average fintech market index on such emerging markets as, for example, China, Brazil, India and South Africa, was approximately 50%. In 2019, the global fintech service penetration index almost doubled as compared to 2017 and amounted to 64% while the leaders in terms of this index were China and India with 89% and 87%, respectively. Similarly to the global index, all-Russian one shows stable growth: in 2017, in amounted to 43%, and it was 82% in 2019, i.e. in 2017 - 2019 this index in Russia almost doubled, similarly to the global one.

Development of fintech sector around the world became possible due to a number of factors, one of which is the rapidly increasing amount of global investments in fintech companies: USD 22.2 billion in 2015 and USD 42.5 billion in 2019. Besides, it shall be mentioned that financial technology market is currently leading in terms of investment dynamics among others.

Another factor that affected active development of the fintech sector is COVID-19 pandemics that extremely negatively affected both the global financial sector and global economy in general. COVID-19 provided the basis for accelerated fintech integration into global economy, as financial technologies facilitate remote provision of financial services. An example of such integration was development of electronic banking: global banks developed multiple online platforms using contactless payments and providing various online financial services that are actively used by the clients. A research by deVere Group financial advisory firm found that soon after commencement of COVID-19 pandemics the use of native fintech apps in Europe increased by 72%. In turn, in Russia, during the pandemics approximately 43% of clients preferred cashless payments over cash ones, 22% started to use cards and other means of payment instead of cash, approximately 50% of clients began to use contactless cards more actively, and 16% used contactless payments for the first time.

Getting back to fintech, its main driving force is the high cost of financial intermediation. Besides, fintech implies influx of investments into cloud infrastructure and analytics, as it is oftentimes associated with big data. Thus, fintech has seen great development in the area of data analysis and machine learning.

Economic development is possible only based on development of the real sector of economy, i.e. industrial production. This is the course used by most developed countries. Development of this sector ensures increased employment and productivity, as well as improved production culture and increased domestic demand. Thus, the notion of import substitution implies following - the process of a single country in the economy, where the state produces necessary products relying on domestic manufacturers. Let's discuss China as an example of import substitution, as its model is based on priority development of domestic market and reduced dependency on foreign technologies and supplies of component parts for the key hi-tech industries. Chinese import substitution policy is called "smart" because it is based on and assumes active use of external factors and support of globalization.

In this connection, Russia under conditions of the sanctions pressure only accelerated its import substitution policy, one of the basics of which shall be breakthrough development of enterprises in the context of changing technological order. Creation of production information ecosystems that include digital systems and modern technologies will ensure synergistic effect, which will positively affect enterprise loading and sales and reduce operational costs, as well as manual processing of operations. Thus, this will improve financial indices of companies. Achievement of the goals requires Russian microelectronics and software market, of course, with the help of government support programs. Development in this area will promote leveling out of the technological gap with the West. Besides, in the context of globalization, it is necessary to promote and develop international expansion, i.e. expansion of the company's activities outside of its country, which increases sales. The main method here is export of goods and services. However, this method is limited due to the sanctions pressure.

Possible prospects for the state include immediate control of funds (corruption, money laundering), for business these are fast transfers, reduced cash flow gaps, and better growth opportunities, for private clients these are the possibility of offline payments and use of a system similar to pay-service. In addition, introduction of ruble value reduces the cost of transactions. Digital ruble also is and can compete with and be an alternative to global payment systems. However, its implementation is associated with the threat of destruction of the existing banking system, for example, due to outflow of deposits or the risk of loss of commercial banks' liquidity.

Conclusions

At present, development of fintech is of great relevance, frequency of its use is growing both among the population and among companies, organizations, and states. This is due to the fact that it uses modern IT solutions not only to speed up and facilitate the work in the financial sector, but also makes it more flexible, scaleable, resilient, and accessible. Over the last 3 years, there has been a huge increase in implementation and use of fintech. In future, this pace will not only be maintained, but will also grow steadily. Factors having positive external influence on fintech industry development were analyzed and confirmed. The link between positive impact of COVID-19 and the leap in financial technology development was revealed. Besides, positive impact of investments and import substitution policy on the search for and formation of new solutions that are actively used in fintech sector was confirmed. Of course, regulation also has its place in this process, as it guides it towards successful functioning and influences scalability of this sector. Besides, examples of import substitution under the influence of sanctions were analyzed using the example of Russian solutions of 2022-2023. Based on the above factors and analysis of data for different periods of time positive correlation between fintech development and factors considered was identified successfully.

Minazov Rustam
Head of Department

Shilin Alexandr

Federal autonomous Institution "Main Department of State Expertise"

Investments in technology

Tackling Healthcare Challenges Through Technologies: Example of State Budgetary Healthcare Institution 'Lugansk Republican Centre of Emergency and Disaster Medicine'

State Budgetary Healthcare Institution 'Lugansk Republican Centre of Emergency and Disaster Medicine' (an emergency healthcare institution, which is a state emergency service subordinate to the Ministry of Healthcare of the Lugansk People's Republic.

The structure includes the Centre and its 8 subsidiaries, encompassing 38 substations and 30 posts. The Centre's operations cover the whole geography of the Lugansk People's Republic.

The IT infrastructure is supported by the Automated Control Systems (ACS) Department, servicing the emergency medicine automated control system (EM ACS). It is a complex of software and hardware optimizing emergency medicine operations. The ACS Department also services the Centre's computer fleet, comprising over 240 PC's and over 150 auxiliary appliances used at the work stations of the data processing centre associates, its administrative staff, the staff of its subsidiaries and telemedicine services.

The main and key IT project implemented today at the Lugansk Republican Centre of Emergency and Disaster Medicine is the modernization of its EM ACS. It is a large-scale initiative impacting all the aspects of emergency medicine operations.

The EM ACS is being upgraded in order to enhance the effectiveness and quality of emergency medical services by optimizing all its processes, from response to calls to patient admission.

The project aims to shorten the response time, increase the quality of medical assistance, optimize the use of resources, make the service's operations more transparent and improve its interactions with other services, facilitate the work of the dispatchers and emergency response teams, and enhance the patient experience.

The analysing of the current situation showed the need for a complete upgrade of the Lugansk ER's "Dispetcherskaya 103" automated control system due to its complete technical and conceptual obsolescence. This system was produced by the Kharkov company Escape back in 2009.

Terms of reference were prepared based on this analysis, with the key tasks of bringing the Lugansk emergency medicine automated control system up to the modern national standards of Russia, including the functionality of sending ER team reports via tablets, supporting statistical data collection and generation of reports using model federal forms; reducing the time to get to a patient; and considerably saving fuel through integration with the Glonass satellite system and automated routing.

We also needed to ensure interoperability of the EM ACS platform (1C: Enterprise) and post-warranty servicing of the EM ACS by the ACS department staff.

Based on a market study, we selected the supplier of the EM ACS.

The ACS Department designed a workstation diagram for the equipment purchased for the project and prepared a schedule of training for the Data Processing Centre staff, approved by the EM ACS supplier.

The system has now been implemented in Lugansk and operated in pilot mode. It is being fine-tuned, and we have a plan of integrating the EM ACS of all the Republican substations.

Our future objectives are:

- technical support and service of the system following its commissioning, troubleshooting, software updates;
- follow-up analysis of the upgrade results and indicators, identifying residual issues, and planning further development of the system.

An important aspect of EM ACS modernization is its integration with other information systems, such as regional medical IS, systems of the Ministry of Emergencies and the police, GIS, etc. This ensures effective information exchange and operational coordination of different services in emergency response.

The project has been faced with a number of objective issues, including difficulties with keeping the maps updated due to the impact of the Special Military Operation on the cross-border regions; the challenge of keeping traffic data updated; and having to integrate with outdated EM ACS systems. In order to mitigate their impact, it is recommended to use real-time navigation service data, update the maps and infrastructure data regularly, and use mobile GIS apps for ER teams. GIS data analysis is also necessary to optimize the ER substations' location.

The project is further complicated by the need to use the client-server software of the Kharkov Escape company, made in 2009, for the Lugansk ER EM ACS. Dispetcherskaya 103 (server type) is located on a database server run with Windows Server 2005, while its client is run with Windows XP or Windows 7. There is no technical support or updates.

Another difficulty lies in the use of physically and technologically obsolete fleet of computers and office equipment. The automated workstations dating back to 2010 and older need to be upgraded, at the very least.

We have formulated proposals on new information technologies, including an AI-based medical decision-making system.

The system would analyse structured or unstructured patient data (complaints, personal history, examination results, wearable device data, electronic medical records, and x-rays), generate a list of potential diagnoses with probability indicators, and provide treatment suggestions based on clinical recommendations, knowledge databases, and Big Data analysis. The system may be deployed locally or in a cloud, ensuring its scalability and resilience.

The system would help ER staff, especially young professionals, diagnose quicker and more accurately in complicated cases, reducing the rate of medical errors, and help select the optimal treatment, which is especially relevant for ER teams' time shortage and high workload.

Another proposal concerning new information technologies is using a system of patient monitoring with wearable devices.

The system uses an IoT platform to collect data from patient wearable devices (smart watches, fitness trackers, or medical sensors) and transmit them wirelessly to a secure server for processing and analysis in real time. The system uses machine learning algorithms to identify anomalies and warn of potential health issues. Web interfaces and mobile devices are used for data visualization and sending warnings to medical staff. The system can be integrated with the EM ACS, allowing for automated call ticket generation when necessary. Encryption and multi-factor authentication technologies are used for data protection.

The system would support timely detection of deterioration of a patient's condition and allow to address them, preventing complications and late admissions. This would enhance the effectiveness of preventive and treatment measures for chronic diseases and reduce the ER workload.

Another proposal is to introduce VR technologies for training ER staff and modelling emergencies. A VR system, with a helmet, movement sensors and special software, can create an immersive environment. 3D modeling and gamification can be used to create realistic scenarios and interactive settings. The system would track the user's activity, providing feedback and assessment of their effectiveness. Training data could be stored in a database and used for analysis and customization of trainings. The system can be integrated with a remote learning platform for process management. For a more realistic experience, tactile feedback could be used.

As we have seen, our ER IT infrastructure has a potential for effective work through highly-skilled professionals and implemented systems, but the tight budget and understaffing create considerable impediments for its development. To improve performance, we need to focus on optimizing the existing resources, finding low-cost IT solutions, and building our human resource capacity. A special focus should be made on cybersecurity, since budget-funded organizations are an easy target for cyberattacks.

TANZANIA

Michael Bernard Mwidete
Student

National Institute of Transport (NIT)

Employing Drone Technology for Precision Farming and Sustainable Growth

Have you ever thought about a picture in your mind of how a silent robot fleet gliding over a wide field of open ground could revolutionize the way food is planted? No longer are the grounds checked with only the eyes of man but with sleek unmanned vehicles that can gather in-depth information about the type of land, plant stress, and requirement for water in real-time. The population in the world is on the threshold of crossing a figure close to 9 billion and conventional agriculture is in threat because of labor shortages and global warming. Newer technologies in the form of drones are surfacing as useful tools in today's agriculture. Drone technology with precision crop mapping, precision placement of the inputs, and monitoring in real-time is revolutionizing agricultural practice and ensuring food production on a practical basis.

Precision Crop Mapping and Soil Analysis, one of the biggest agricultural problems is how to manage vast amounts of variability in a field. It is slow, labor-intensive, and not correct with old-fashioned methods of monitoring crop health or soils. It was proven in recent research that high-resolution cameras and multi-spectral sensors on a drone can generate extremely correct 3D models of agricultural land. According to Kalamkar et al. (2020) (source link), drones are capable of capturing imagery that reveals variations in soil properties and crop conditions across large areas. These images, processed using indices such as the Normalized Difference Vegetation Index (NDVI), offer critical insights into nutrient deficiencies, water stress, and pest infestations even before visible symptoms appear. For instance, NDVI values range from –1 to +1, with values close to +1 showing healthy, green vegetation. By overlaying these kinds of NDVI maps on field layouts, farmers can decide which areas need intervention, thereby improving fertilizer application and irrigation. This kind of precision mapping not only improves crop yields but also minimizes the environmental footprint by decreasing the application of excess chemicals win-win for both the farmer and the environment.

Enhancing Efficiency Through Precision Spraying and Seed Planting, Drones have also transformed the delivery of inputs such as fertilizers, herbicides, and pesticides into crops. Traditional tractor- or manned aerial vehicle-based spraying methods are uneven and can result in excessive chemical runoff. Drone-based spraying systems, by contrast, are designed for precision. As highlighted in the review by Dutta and Goswami (2020) (source link), drones can be programmed to follow exact flight paths, adjusting spray rates in real-time based on spatial data collected from the field. Consider the emerging technology of drone seed planting. Some startups are field-testing systems that "shoot" seed pods into pre-trenched ground, saving labor and planting time by an enormous amount. Similarly, precision spraying with systems mounted on UAVs only deposits chemicals where plants are in their most critical stages of need. Not only does this method reduce the total level of pesticides and fertilizers used, but it also reduces the risk of polluting the environment and exposing humans. In areas where labor shortages are severe, these drone systems are especially useful, offering a scalable approach that can respond to both small farms and large-scale agricultural operations.

Real-Time Crop Health and Water Stress Monitoring, Water stress and nutrient stress are two of the most important drivers of crop yields. In a world where climate change is worsening droughts and unpredictable rainfall, early detection of water stress is essential. Thermal sensor drones are at the forefront of this. By detecting canopy temperature, a key indicator of plant transpiration and water loss, these drones can detect early drought stresses. As noted in the review by Dutta and Goswami (2020) (source link), thermal imaging can reveal subtle temperature variations that indicate insufficient water supply long before wilting becomes evident. In combination with thermal information, multispectral cameras capture images that allow for the computation of vegetation indices like NDVI and the Photochemical Reflectance Index (PRI). These indices provide an actual reading of plant health, allowing farmers to find when and where to water. For example, a survey of a big orchard by a drone would find specific areas where there are water deficiencies, and this would prompt a focused irrigation strategy that conserves water and reaps the maximum. This real-time monitoring capability turns reactive farming practices proactive, drastically enhancing resource efficiency.

Early Detection of Diseases, Nutrient Deficiencies, and Pest Infestations, apart from monitoring water stress, drones play a vital role in the early detection of crop diseases, nutrient deficiencies, and pest infestation. Equipped with infrared and hyperspectral sensors, drones can detect anomalies in plant color and reflectance that are invisible to human eyes. Kalamkar et al. (2020) (source link) emphasize that such early detection enables farmers to implement remedial measures swiftly whether by adjusting nutrient inputs or applying targeted treatments against pests and diseases. For instance, in rice paddies where rice blasts can wipe out crops, drones can capture high-resolution images that reveal early signs of infection. Based on this information, farmers can treat infected sections independently and apply treatment directly, rather than blanket-spraying entire fields. Not only does this conserve chemicals, but it also reduces environmental impact. Similarly, nutrient deficiencies such as nitrogen or potassium deficiency can be diagnosed using spectral analysis. When paired with data fusion technology that captures RGB, thermal, and multispectral images, drones offer a holistic view of crop health and allow one to take targeted interventions that enhance overall productivity.

Weed Management and Precision Agriculture, Weeds are a major challenge for farmers because they compete with crops for valuable resources and are usually dealt with by the application of environmentally hazardous herbicides. With their ability to perform high-resolution surveys, drones are being increasingly used for precision mapping of weeds. Drones, with the use of hyperspectral imaging, can distinguish between weeds and crop plants based on their unique spectral signatures. This is a technology that enables site-specific weed management where herbicides are applied on infested locations only and not across the whole field. Research by Dutta and Goswami (2020) (source link) indicates that such precision in weed control not only reduces the amount of herbicide needed but also minimizes the risk of developing herbicide-resistant weed strains. By targeting weeds with pinpoint accuracy, drone technology supports sustainable farming practices that protect both the crop and the environment.

Integrating Drones into the Future of Farming, the potential is not limited to standalone uses. Collectively, these technologies help shape a picture of precision agriculture where decision-making is based on information and is revolutionizing the entire process of farming. Be it mapping and monitoring, or precision interventions, drones give farmers the ability to better and sustainably manage their resources. Countries like Japan have already proven the financial and operational benefits of drone technology. Over 2,000 Yamaha RMAX drones are already deployed in monitoring rice paddies in Japan alone, and the country already boasts a model for the implementation of UAV technology in commercial agriculture. In developing economies where conventional agricultural practice would not necessarily catch up with food demand expansion, drones are a practical solution for streamlining agriculture, efficiency gain, and integrating youth into agriculture. Also, as technological advances and costs of production go down, farming applications of drones are going to become more acceptable. Not only is this going to provide higher yields of crops, but it is also going to infuse sustainability into the environment in the form of less chemical misuse, improved water conservation, and less impact of global warming.

In conclusion, in a world in the future where food production is going to require a major uplift to support an increasing population, agricultural drone technology is a necessity and a possibility. The applications of drones for high-resolution crop mapping and water stress monitoring, disease detection, and weeds are shaking the traditional method of agricultural practice. The capability offered by drones is aiding farmers in making intelligent decisions with the delivery of real-time actionable data, leading to higher yields and effective use of resources. Reflecting on what these drone technologies would be capable of, we are left with a simple yet inescapable question: What would future agriculture with every field, a commercial field, and a smallholder field, run with such precision and information? By ongoing exploitation of potential in drone technology, we are growing agricultural production and constructing a basic food system better and more secure.

Nikiema Issaka
Publication Director

Digital Magazine Burkina

Cybersecurity in the Age of Big Data Economy

1. Summary

The big data economy, which has recently witnessed exponential growth, plays a major role in global economic development. However, this expansion is accompanied by significant cybersecurity challenges. This analysis examines the cybersecurity risks associated with big data to identify the key issues and propose appropriate protection strategies. The discussion highlights the importance of robust cybersecurity systems to ensure digital trust and foster sustainable economic development in the age of big data.

2. Introduction

2.1 General context

In the digital age, the big data economy has become a key driver of global economic development. Businesses, governments and institutions are using enormous arrays of data to make strategic decisions, streamline processes, customize services and generate innovations. However, this massive data exploitation is associated with considerable cybersecurity risks. The amount and diversity of collected data expand the attack surface, making systems more vulnerable to cyberattacks, data breaches and unauthorized access.

2.2 Topic relevance

The subject of cybersecurity in the age big data economy is highly pertinent for a number of reasons. First, data security has become a priority, considering the frequency and sophistication of cyberattacks that target critical infrastructure, companies and large databases. Besides, as big data often contains sensitive, personal or strategic information, its protection is critical for avoiding privacy breaches, financial losses, reputational damage and infringement of national sovereignty. Finally, cybersecurity is essential for strengthening customer trust and trust between partners in the digital economy. A security breach can have a lasting effect on an organization's credibility.

2.3 Current challenges

The variety, volume and speed of data make it difficult to manage and secure. Adding to the challenge, cybercrime techniques are continuously evolving and require development of adaptive defense systems. The lack of specialized cybersecurity skills is also a major barrier. Finally, massive data exchanges between heterogeneous systems increase the risk of security breaches.

2.4 Current opportunities

The development of advanced technologies (AI, blockchain and encryption) offers new solutions for bolstering cybersecurity. Increased awareness of the risks is driving companies to invest more in data protection. As a result, the adoption of tighter policies and regulations helps to improve cybersecurity practices. The growing demand for cybersecurity professionals opens up career opportunities in the digital sector.

3. Analysis and forecast

“The development of big data has transformed the global economy, giving companies incredible analytical and decision-making capabilities. However, this massive exploitation of data is accompanied by major cybersecurity challenges. Cyberattacks are on the rise, targeting critical infrastructure and large databases. For example, in 2024, the CNIL (the National Commission for Information Technology and Freedoms, an independent French data protection authority) registered 5,629 data breaches, a 20% increase compared to 2023.”

https://www.linf ormaticien.com (30 January 2025)

Cyberattacks have increased dramatically in recent years, affecting countries around the world. The United States stands out as the most targeted, with 156 major cyberattacks recorded over the past 14 years, suffering an average of 11 attacks per year according to fr.statista.com (14 January 2022). In Europe, Russia has been the top target, accounting for nearly 57 % of all cyberattacks on the continent, with France coming second as the most affected.

According to a survey by Crucial, “Russia was the most targeted country in 2022, with more than 50,000,000 breaches in the first three quarters. This also means Russia has the highest number of breaches per capita, with 34,560 per 100,000 inhabitants. The recent conflict with Ukraine made Russia a target for cyberattacks, as cyber warfare is more prominent than ever." https://itrnews. com/ (16 March 2023)

"The cybersecurity outlook for 2025 appears to be in line with the trends observed in 2024. However, there will be one big factor coming into play: the multiplication of attacks using artificial intelligence. With AI becoming a primary tool in cybercrime strategies, the world is expected to see an explosion in automated attacks, more targeted and harder to detect. Nevertheless, the defense is also getting ready for a fight." https://guardia.school (9 January 2025)

4. Economic and social impact

The big data economy unlocks immense opportunities for innovation and economic development. However, without robust cybersecurity measures, these benefits can be compromised.

4.1 Economic impact

4.1.1 Potential benefits

Effective cybersecurity can limit financial losses from cyberattacks. Given that the estimated average cost of a data breach runs to several million euros, preventive measures can significantly mitigate the risk. Also note that secure companies inspire confidence in partners and customers, which improves their positioning on the market. Moreover, investors prefer companies with reliable security infrastructure to protect their digital assets. Strong data security allows complex processes to be automated while reducing the risk of disruption due to cyber threats.

4.1.2 Negative effects in case of failure

A single cyberattack can lead to revenue losses, ransom payments and penalties for regulatory incompliance. Subsequent efforts to recover data, fortify corporate systems and rebuild the company's reputation would also add to the costs. Fear of cyberattacks can hold back initiatives based on big data. Small businesses, often less protected, can be hard hit and even forced to shut down.

4.2 Social impact

4.2.1 Potential benefits

Enhanced cybersecurity ensures the confidentiality and integrity of citizens' data, helping to preserve privacy. So users have greater confidence in digital services and online platforms, which stimulates widespread application of technological solutions.

The cybersecurity sector creates career opportunities, especially in such strategic areas as risk analysis, incident management and security engineering. The growing importance of cybersecurity is encouraging the development of educational programs and awareness campaigns.

4.2.2 Social risks of inadequate security

Personal data leaks can lead to serious consequences like identity theft or blackmail. Repeated security breaches can slow down deployment of technologies, limiting social benefits provided by digital solutions.

Vulnerable groups are less informed about the risks and therefore are often the most affected by cyberattacks.

5. BRICS+ countries

BRICS+ countries recognize the importance of strengthening their digital infrastructure to maintain economic growth. For example, according to the UN report of October 24, 2023, the Russian Federation is implementing capacity-building programs aimed at improving young people's digital skills, especially in the Commonwealth of Independent States (CIS) and in Africa. Initiatives such as the Forum on China–Africa Cooperation illustrate China's commitment to supporting African countries in their digital development, without interfering in their internal affairs. Russia is also taking part in programs aimed at improving the digital skills of young people in the CIS and in Africa, thus strengthening cooperation in the field of cybersecurity. BRICS+ countries face a number of challenges, including the need to increase the digital literacy of the general public, secure critical infrastructure and adapt to a rapidly changing technology environment.

6. Conclusions

The future of cybersecurity in the big data economy will be driven by technology innovation, regulatory evolution and raising stakeholder awareness. The expected outcomes, such as the reduction in the number of attacks, higher digital trust, and economic growth depend on the ability of businesses and governments to anticipate threats and invest in sustainable solutions.

Key recommendations:

- Adopt scalable, proactive security strategies.
- Invest in cybersecurity research and development.
- Raise awareness of the importance of data protection among economic and social actors.

Such comprehensive approach will maximize the benefits of big data while mitigating cybersecurity risks.

References

1. UN Report dated 24 October 2023
2. Forum on China-Africa Cooperation Beijing Action Plan (2025-2027)
3. fr.statista.com
4. https://guardia.schoo l
5. https://www.linformaticien.com
6. https://it rnews.com /

RUSSIA

Nikiforov Ruslan
Student

Saint Petersburg State University

Technological shield: Artificial Intelligence and collective security of the World Majority countries

In the context of rapid changes in the global landscape caused by technological revolutions, the question of the future of the world order becomes especially relevant. Modern challenges, such as climate change, economic instability, geopolitical restructuring, and pandemics require countries not only to adapt, but also to actively implement innovative solutions. Artificial intelligence (AI) becomes the key end-to-end technology that can not only ensure economic growth, but also improve the level of security at the national and international levels. Investments in AI provide new opportunities for the World Majority countries, especially BRICS+, as they offer paths to sustainable development and cooperation under conditions of the above mentioned global challenges.

Hypothesis of this research is that investments in AI constitute strategic priority to ensure security and sustainable growth of the World Majority countries. According to report by McKinsey Global Institute, by 2030, AI can add up to USD 13 trillion to the global GDP, which is approximately 1.2% of the annual growth. This highlights not only the economic potential of the technology, but also its ability to solve security related problems[1].

1 To spread the neural networks: AI can increase GDP by more than 11 trillion roubles by 2030.

According to report by MarketsandMarkets, market of AI in the area of security and defense will grow from USD 1.7 billion in 2023 up to USD 7.5 billion by 2030 with the average annual growth rate (CAGR) of 24.1%. This suggests increased acknowledgement of AI importance as a tool to strengthen national security[2].

Analysis shows that AI can be used to predict and prevent threats. For example, use of machine learning algorithms to analyze big data enables real time identification of potential risks. According to the World Economic Forum, 86% of managers believe that AI will help to improve security at the level of companies and states.

Forecasts suggest that countries actively investing in AI will have competitive advantage. In particular, the World Majority countries demonstrate interest in development and implementation of AI technologies in various sectors: from public healthcare to defense. This means the need for urgent forming of own AI based technology ecosystem for developing economies. Successful integration of AI technologies will require significant investments, establishment of favorable regulatory framework, and development of educational programs. Development of national programs to train experts in the area of AI is of special importance. According to forecasts of the World Economic Forum, by 2027, new jobs will be created in AI sector with the expected growth by 120%.

Economic effects of investments in AI include increased labor performance and reduced operational costs. For example, process automation with the use of AI can reduce production costs by 20-30%, which is especially important for developing economies of BRICS+. Social effects are equally significant: AI implementation in education and public healthcare can improve quality of life of the population, as it provides access to new technologies and services.

According to the analytical research, 70% of BRICS+ countries are planning to introduce AI systems in the key government structures by 2030. At the same time, over the past three years amount of investments in AI technology development in these countries increased by 147%. Particular attention is paid to cybersecurity (42% of all investments), public administration (28%), and social sphere (20%)[3].

Besides, AI can improve crisis management. Under conditions of post-pandemic recovery use of AI to monitor the spread of viruses and optimise public healthcare resources proved to be efficient. This highlights the importance of AI integration into national security and public administration systems. In terms of security, AI can become an efficient tool to fight terrorism, organized crime, and corruption through big data analysis and behavioral anomaly detection. Unique study that covered 500 government organizations of BRICS+ countries revealed

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2 How artificial intelligence improves cybersecurity. URL: https://www.rbc.ru/neweconomy/news/6554cc119a79477fa20d3dda (date of access: 26.02.2025)

3 Yakov and Partners. Trends and prospects of generative AI in BRICS+ countries. / URL: https://ict.moscow/research/genai-brics-2025/?ysclid=m7mb2aq11932030917 (date of access: 26.02.2025)

that AI system implementation reduces the time of response to cyber threats by 65%, improves accuracy of social risk forecasting by 72%, and optimizes expenses on public administration by 45%. This provides an additional incentive for investments in relevant technology development[4].

Following strategy is offered to ensure successful and seamless implementation of AI technologies: creation of an interstate data exchange platform, development of unified security standards, establishment of a staff training system, and implementation of pilot projects in the key industries. Predictive research conducted with the participation of experts from BRICS+ countries suggests that in case of implementation of the said strategy it is possible to increase GDP by 12-15% by 2030 due to AI introduction, reduction of expenses on security by 40%, creation of more than 5 million of new job opportunities, and improvement of public administration efficiency by 60%[5].

Subject to correct approach to investments, it is possible to ensure improved resistance to cyber threats, optimization of state expenses, creation of new opportunities for economic growth, improvement of the quality of state services, and establishment of technological sovereignty.

To conclude, it is possible to state that investments in AI constitute a strategically important step for the World Majority countries in the context of national security. Under conditions of the global technological transformation, the World Majority countries have a unique opportunity not only to protect their interests, but also to take the leading position in new technological areas and ensure solid foundation for the future prosperity.

It is expected that active implementation of AI will cause significant economic and social transformations, which will promote sustainable development and cooperation between countries. Artificial intelligence has potential to become the key element of the technological shield. Investments in AI-technology development may ensure significant improvement in the level of national security, as well as positively affect economy and society. This, in turn, will support establishment of the new growth platform based on cooperation and mutual respect.

Thus, investments in AI-technology development are not only a fashionable trend, but strategic necessity to ensure security and prosperity of the World Majority countries in the 21st century.

4 Economic effect from AI implementation in BRICS+ countries will reach USD 600 billion. https://mltimes.ai/ekonomicheskij-effekt-ot-vnedreniya-ii-v-stranah-briks-dostignet-600-mlrd/ (date of access: 26.02.2025)

5 Collective intelligence: how the national strategy of AI development changed. / URL: https://www.forbes.ru/tekhnologii/506392-kollektivnyj-razum-kak-izmenilas-nacstrategia-razvitia-ii?ysclid=m7mbad2ha6737904183

RUSSIA

Osadchuk Evgenii

Director of the Artificial Intelligence department

Autonomous non-profit organization «Digital economy»

Integration Project for AI Development

Preamble

The end-to-end nature of modern digital technologies, first of all technologies of artificial intelligence, result in high level of their influence on performance of countries, organizations, and individuals. Besides, development of these technologies seems to be a significant contribution to the solution of important problems faced by the countries of the Global South and East. However, realization of the full potential of modern technologies requires a large scale project that would cover the key spheres of scientific and technological activities in the area of artificial intelligence and mobilize resources of the countries of the Global South and East. Such project can be offered by the Russian Federation as a response to the challenges faced by the world in connection with attempts of the West, in particular, US, to establish dominance in development and use of artificial intelligence technologies through significant financial and computing resources, production of microelectronics, and fundamental researches. The wider goal of the project, the expected result applicable in geographical terms, in particular, to BRICS+ countries, is to use the maximum opportunities offered by AI-technologies to the countries of the Global South and East.

The essay provides most general description of the main blocks of work within the possible international project in the area of artificial intelligence.

Essence of the hypothesis

I. About the need to join efforts of the countries of the Global South and East

As the economic pole is shifting towards the countries of the Global South and East, first of all BRICS member countries, countries of the West are making desperate attempts to secure their economic and technological superiority.

In the area of artificial intelligence these attempts take form of, for example, infusion of significant budgetary funds into development of artificial intelligence infrastructure. Just 2 days after Donald Trump's Inauguration as the 47th US president, he declared allocation of funds to the private sector for investments in artificial intelligence infrastructure for the amount of up to USD 500 billion[1].

Besides, according to report by Stanford University[2], in 2023 financial year, US government agencies allocated a total of USD 1.8 billion for research and development in the area of artificial intelligence. Starting from 2018 financial year, financing of research and development in the area of artificial intelligence annually increased more than 3 times. Budget for 2024 financial year was requested in the amount of USD 1.9 billion.

At the same time, combined budget of two Russian federal projects of the same name, i.e. Artificial Intelligence within the Digital Economy of the Russian Federation national program (completed in 2024) and Data Economy and Digital Transformation of the State national program (commenced in 2025) for the entire term of implementation (2020-2030) is approximately USD 1.1 billion.

To successfully compete with the West, countries of the Global South and East, BRICS members, shall ensure the amount of investments in artificial intelligence development at least at the equal level.

However, even in this case financing of researches shall be of concentrated nature. Accumulated resources shall be distributed according to clearly defined and coordinated areas of scientific researches. At the same time, all parties should understand that unity of the goals implies refusal from those studies that regardless of being promising for a certain member country do not ensure increase in knowledge for the entire international project of the Global South and East (hereinafter referred to as AI-project of the Global South and East).

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1 Trump announces up to $500 billion in private sector AI infrastructure investment, https://www.cbsnews.com/news/trump-announces-private-sector-ai-infrastructure-investment/

2 Stanford University report for 2024 is available at https://aiindex.stanford.edu/report/

Another important condition for efficient use of accumulated funds is reasonable division of scientific and research work into separate sequential and parallel stages to be performed by the most suitable scientific teams from different countries.

Thus, scientific and technological agenda in the area of artificial intelligence must become common for the Global South and East, which, in the end, will ensure sustainable long term advantage over Western countries.

II. On the blocks of works aimed at joining of efforts of the countries of the Global South and East

Scientific world developed optimal forms of intercountry cooperation long ago, an example of which are international partnerships providing for joint work of universities, scientific institutes, and research centers of different countries.

However, under conditions of the need to concentrate resources on priority areas, entire variety of such interactions requires reasonable coordination, as well as presence of a leader of the AI-project of the Global South and East, who shall maintain the framework of scientific research and lead combined cross-national intelligence towards the established goals. It is on the basis of coordinator that regular assessment of the intermediate results of the project, and, thus, control of movement towards the goals set will be performed.

In addition to establishment of international partnerships headed by sole coordinator it is necessary to create online platform for exchange of data, ideas, and scientific research results. Such platform will become not only a site for dialogue between scientific teams participating in the project, but will also reflect results achieved by them, the very dynamics of the project plans implementation via accumulation of scientific and technical information being generated, as well as the demand for it among the platform visitors.

Besides, crucial function of the platform will be attraction of the so called non-project teams, i.e. those, who are not officially involved in scientific and research activities of the AI-project of the Global South and East. Such teams will at their own will perform researches that are consonant with the research of the project, which will ensure additional perspective on solving of the tasks at hand. Chances are that results of non-project teams will locally exceed those involved in the project. Coordinating authority of the project shall prefer the best results and, if necessary, raise the question of team replacement with the more productive one.

Thus, the main blocks of work within the AI-project of the Global South and East are following:

- accumulation of resources in the amount that is at least equal to Western investments;
- coordination of the areas of scientific and research works and their target financing;

- distribution of certain stages of the works between the most productive teams from various countries;
- coordination of international interaction in order to maintain the set framework, optimize research teams, and control intermediate results;
- creation of international online platform to present results of the project and involve in it all interested research groups, commercial companies, and organizations with public participation that are not officially included in the project.

Quantitative assessment of the economic and social impact of the AI-project implementation is a separate work and can be performed within the framework of a more profound substantiation of the project. At the same time, as regards to Western countries there is the following predictive assessment of the effect of artificial intelligence technology implementation: according to analytical report by International Data Corporation, the total global economic effect from the implementation of developments in the area of artificial intelligence by the business will make up approximately USD 19.9 trillion by 2030 inclusive[3].

III. On compliance of the goals of the AI-project of the Global South and East with the goals of the Russian Federation

Tasks of the Russian Federation within the framework of international cooperation in the area of artificial intelligence technology implementation, as well as areas of such cooperation are defined in National Strategy of Artificial Intelligence Development through 2030[4], for example:

- promotion on the international arena of values and principles that ensure equal rights and opportunities for the nations in the area of artificial intelligence technology development and implementation;
- use of technological back-log of the Russian Federation in the area of artificial intelligence to reduce the gap in terms of the level of digital technology development between various countries and improve technological potential of partner countries;
- support of the establishment by Russian scientific and other organizations jointly with foreign partners of international research centers dedicated to artificial intelligence technology development issues, as well as competence centers and laboratories in the area of artificial intelligence;
- development of a joint international base of solutions in the area of artificial intelligence based on Russian repository of secure and functionally correct solutions in the area of artificial intelligence performed under unified open standards;

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3 Quote from https://www.interfax.ru/business/982440

4 The national strategy was approved by Order of the President of the Russian Federation dated October 10, 2019, No. 490; it was updated by Order of the President of the Russian Federation dated February 15, 2024, No. 124.

- analysis of solutions in the area of artificial intelligence in the key directions of their implementation jointly with international and regional organizations and associations, including BRICS outreach and BRICS plus formats.

Thus, the goals of the Russian Federation in the area of international cooperation regarding artificial intelligence technology implementation can be achieved through the goals of the AI-project of the Global South and East.

IV. On resources of the Russian Federation for the AI-project of the Global South and East

Within the framework of the AI-project, Russia can offer both resources for researches in the area of artificial intelligence, and artificial intelligence instruments for scientific researches (instruments in the area of AI4Science[5]).

The first group of resources includes research centers in the area of artificial intelligence established on the basis of the leading scientific organizations of the Russian Federation within the framework of implementation of the Artificial Intelligence federal project under the Digital Economy of the Russian Federation national program.

At present there are 12 centers, basic organizations for which are (1) Skolkovo Institute of Science and Technology, (2) Moscow Institute of Physics and Technology, (3) Higher School of Economics National Research University, (4) V. P. Ivannikov Institute for System Programming of the Russian Academy of Sciences, (5) Innopolis University, (6) ITMO National Research University, (7) St. Petersburg State University, (8) Novosibirsk National Research State University, (9) Samara National Research University named after Academician S. P. Korolev, (10) N. N. Blokhin National Medical Research Center of Oncology, (11) MEPhI National Research Nuclear University, (12) National Research N.I. Lobachevsky State University of Nizhny Novgorod.

The said centers focus their efforts on industry-specific and inter-industry applied scientific researches in the area of artificial intelligence.

In 2025, another 6 research centers will be formed that will focus on advanced development of artificial intelligence technologies, for example, on optimization of machine learning algorithms and computing processes (in particular, that associated with development of large language models and technologies of generative artificial intelligence).

In addition, resources for the AI-project of the Global South and East that can be provided by Russia include leading commercial companies in the area of artificial intelligence technology development and implementation, for example Sber-

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5 Scientific discovery in the age of artificial intelligence / H. Wang, T. Fu, Y. Du [et al.] // Nature. 2023. Vol. 620. P. 47–60. DOI 10.1038/s41586-023-06221-2.

bank and Yandex that have their own large models of artificial intelligence, relevant computing facilities, and expert teams.

Besides, unique analytical researches on the use of artificial intelligence technologies in sectors of the Russian economy carried out by Digital Economy autonomous non-profit organization[6] reveal significant potential of middle size and small companies of the Russian Federation in terms of adaptation of the cutting edge developments in AI-sector in view of the market needs. At the same time, these very companies provide proper feedback regarding necessary areas of applied development and implementation of AI-technologies, which makes them a kind of resource for testing of scientific and technological work results obtained within the framework of the AI-project.

The second group of resources of the Russian Federation, i.e. instruments of artificial intelligence for scientific researches (AI4Science instruments), includes know-how of the above-mentioned research organizations and commercial companies used by them to optimize their own scientific and technological activities, in particular, help to explore vast areas of possible hypotheses to form theories, generate new hypotheses, plan experiments with resource usage optimization, collect large amounts of data through automation of such collection, interpret scientific data collected, improve computer modeling by better selection of the key parameters of complex systems, solving of differential equations that govern complex systems, and modeling of states in complex systems.

Thus, Russian Federation has acceptable amount of human and infrastructural resources in order to play one of the leading roles in the AI-project of the Global South and East.

Conclusion

The AI-project of the Global South and East offered for consideration matches interests of the Russian Federation in terms of joining of friendly countries' efforts to develop artificial intelligence technologies.

Expected economic and social effects will support solving of the critical problems of countries involved in the AI project.

The level of trust of the countries of the Global South and East allows Russia to claim coordinating role within the framework of the AI-project. Available scientific resources and technological competences constitute an additional argument in favor of Russia.

Implementation of the project will require significant efforts of the Russian Federation – the state, business, as well as scientific and educational commu-

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6 Links to the reports on researches are presented in the Analytics section of Digital Economy ANO web-site at https://d-economy.ru/research/?napr=48

nity. However, possible alternative here is rapid loss of fundamental competencies in the area of artificial intelligence and reduction of the role of Russian developers to primitive adaptation of third party products.

Pavlova Arina
Student

Russian State Social University

“The Risks Involved in Using IoT and the Industrial Internet of Things” for the thematic block “Investing in Technologies”

Preamble:

In today’s world where technologies play an ever-greater part in people’s everyday life, the subject of the Internet of Things (IoT) and the Industrial Internet of Things (IIoT) is becoming increasingly relevant. These technologies open up new opportunities for us, yet they are also fraught with certain risks that need to be addressed and minimized.

This essay concentrates on the IoT and IIoT that are developing at breakneck pace; these technologies are applied in a great variety of areas from smart homes and healthcare to industry and agriculture. They make it possible to automate operations, increase manufacturing efficiency, improve people’s quality of life. However, they entail new risks connected with data security, system vulnerability, possible breakdowns, and equipment malfunctioning.

The topic of risks connected with the IoT and IIoT is relevant today for a slew of reasons. Amid the prevailing trends of dynamic digitization and automation, the IoT and IIoT serve as major instruments thereof. However, their integration demands awareness of security issues and risks management.

Cybersecurity and data protection are the critical aspects that cannot be ignored. Today’s threats such as information leaks and cyberattacks can have grave consequences both for companies and for individual users, which further demonstrates the need for a comprehensive approach to cybersecurity.

Additionally, a major risk is posed by system and equipment vulnerability. Glitches and breakdowns can result in stoppages in production and losses of critically important information, which requires developing reliable strategies for ensuring reliability.

Legal regulations should also be taken into account. Everyone needs to be aware of the legal requirements in data protection and information security since compliance therewith is becoming a mandatory condition of the IoT and IIoT functioning successfully.

Finally, we should note that introducing the IoT and IIoT opens up new horizons and opportunities applicable in BRICS+ geography, yet it also faces us with new challenges. It is important to find a balance between potential advantages and risks attendant on these technologies so that we could use their potential in the most efficient manner in the interests of society and economy.

Therefore, the subject of risks involved in using the IoT and IIoT is topical and requires discussion. It also demands a careful approach and developing risk management measures. This essay will consider the principal risks involved in using the IoT and IIoT and the possible ways of minimizing them.

Advantages, Risks, and Solutions

Since Internet of Things (IoT) and Industrial Internet of Things (IIoT) technologies are developing at a breakneck pace, we need to provide an in-depth analysis of risks they entail. These technologies have the potential to transform both business operations and social structures, but they are also fraught with major threats. This essay's principal hypothesis is that despite the major potential of IoT and IIoT technologies, their use involves several risks that may negatively affect economy, society, and the environment, yet these risks can be prevented even today.

Let's start with economic effects. Gartner reports that by 2025, the number of connected devices may reach over 25 billion [1], which will create additional opportunities for business development. Yet as the number of devices increases, so do system vulnerabilities. Kaspersky Lab's studies demonstrate that 53% of companies have abandoned new business projects of introducing IoT-class solutions since they are unable to eliminate cybersecurity risks. [2] Cyber Security Forum reports that global losses caused by cybercrime may reach USD 10.5 trillion by 2025, which emphasizes the connection between new technologies and increasing risks. [3]

Social effects deserve special attention, too. The IoT and IIoT could improve quality of life by providing access to medical services, improving transit system's efficiency, and advancing efficient use of resources. Yet should there be data leaks or cyberattacks, the consequences may be disastrous. In 2020, a cyberattack on the healthcare system in a US city resulted in delays in patient treatments, which vividly demonstrates potential risks for the social sphere. [4]

We should also note that the geography of BRICS+ countries constitutes a unique platform for developing the Internet of Things (IoT) and Industrial Internet of Things (IIoT) technologies. BRICS+ members have a rich potential for introducing IoT solutions, and it may have a major effect on economy and social development in the region.

First, introducing the IoT in BRICS+ countries may have a major economic effect. China's IoT market, for instance, is predicted to possibly reach USD 300 bn. by 2025 owing to the active development of smart cities, transportation, and manufacturing. [5] As of January 2025, the data for Russia show its Internet of Things (IoT) market growing steadily. It grew by 12% compared to 2023 in both monetary and volume terms. [6] Introducing the IIoT is predicted to possibly reduce industrial costs by 20-30% thereby improving manufacturers' competitive edge. [7] It makes BRICS+ countries attractive for investing into IoT technologies. Social changes taking place in BRICS+ countries could improve their populations' quality of life. Smart technologies make it possible to optimize the use of resources, improve efficiency in healthcare and education. For instance, India's healthcare system is facing a host of challenges, and IoT technologies can provide access to medical services in remote areas thereby improving the lives of millions of people.

Nonetheless, introducing the IoT and IIoT in BRICS+ also entails certain risks. Countries with developing economies may face shortages of infrastructure and resources required for effective data protection. It is accordingly important to address social aspects as well: possible data leaks or cyberattacks may undermine their populations' confidence in new technologies.

Therefore, proceeding from the information above, we may propose a series of steps for minimizing possible problems that may arise in developing IoT and IIoT technologies:

An analysis of opportunities and risks emphasizes the need to integrate educational initiatives into cybersecurity. Companies' heads and employees should undergo training, including cybersecurity training, that will improve their awareness of possible risks and of the ways of minimizing them.

Developing and introducing standards and certifications for IoT and IIoT devices and developing an up-to-date regulatory framework. It will guarantee that equipment is compliant with security and efficiency requirements.

Companies should actively invest in cybersecurity solutions. Developing secure systems and protective measures at all levels, from devices to networks.

Using analytical tools to constantly monitor data and identify anomalies; developing artificial intelligence technologies that will optimize this process. It will allow for rapid responses to potential threats and for minimizing their consequences.

Implementing rigorous data protection measures, including encryption and authentication.

Cooperation with governmental bodies within BRICS+ geography with a view to developing regulations and policies that advance secure development of the IoT and IIoT, which is also important for common security and risk management standards.

Regularly updating software and security systems with a view to protecting devices from new threats and vulnerabilities.

Introducing measures designed to prevent industrial espionage; these measures include access control, using technologies to protect intellectual property, and monitoring suspicious activity. It is also important that security audits be held regularly.

BRICS+ countries, therefore, can make significant progress in the IoT and IIoT, thus gaining economic profits and improving social conditions. However, successful development of these technologies depends on awareness and management of cybersecurity risks and infrastructure challenges. As countries introduce new technologies, they should emphasize creating a safe, secure, and sustainable ecosystem, thereby ensuring a long-term positive effect in both economic and social areas.

Sources

1. Gartner Identifies Top-10 Strategic IoT Technologies And Trends: [Electronic resource] / Gartner. 2018. November 7. URL: https://www.gartner.com/en/newsroom/press-releases/2018-11-07-gartner-identifies-top-10-strategic-iot-technologies-and-trends (accessed on March 04, 2025).
2. IoT Risks and Protection in the Digital Age: [Electronic resource] / Kaspersky Lab. URL: https://os.kaspersky.ru/blog/iot-risks-and-protection-in-the-digital-age/ (accessed on March 04, 2025). (in Russian)
3. Roskomnazdor Compiled a List of IoT Threats: [Electronic resource] / Krasnaya Vesna Information Agency. 2021. December 13. URL: https://rossaprimavera.ru/news/cdd5ef7e (accessed on March 04, 2025). (in Russian)
4. Ransomware vs. Healthcare: [Electronic resource] / Kaspersky Lab. URL: https://www.kaspersky.ru/blog/ransomware-vs-healthcare/30604/ (accessed on March 04, 2025). (in Russian)
5. AI Review of Top 10 IoT Market Size Reports: 2024, 2025, and 2030 in India, China, Japan, Saudi Arabia, and UAE: [Electronic resource] / IoT World Magazine. 2024. August 23. URL: https://iotworldmagazine.com/2024/08/23/2378/ai-review-of-top-10-iot-market-size-reports-2024-2025-and-2030-in-india-china-japan-saudi-arabia-and-uae (accessed on March 04, 2025).
6. IIoT, the Global and Russian Industrial Internet of Things: [Electronic resource] / Euromobile.ru. URL: https://www.euromobile.ru/m2m-resheniya/iiot-mirovoy-i-rossiyskiy-promyshlennyyinternet-veshchey/ (accessed on March 04, 2025). (in Russian)

Poltavtseva Maria

Professor of the Higher School of Cybersecurity

Peter the Great St. Petersburg Polytechnic University

Cybersecurity of the Big Data Economy

When speaking about cybersecurity in the era of the big data economy, we first must talk about the security of the big data economy itself in terms of cyber-threats. In the era of the data economy, with the development of digital systems as well as state and regional digital services, we not only face the problem of collecting, processing, and storing big data, but also ensuring its comprehensive security. As the number of cyberthreats to state and private services increases, the integrity, confidentiality, and availability of big data are a key factor in their successful operation and the stability of society.

BRICS+ countries are nations with a growing economy and scientific potential whose development largely depends on advancements in the technological platform and the digitalization of industries. The digital transformation of state and municipal administration, the economy, and the social sector is not only impossible without uninterrupted Internet access, the training of skilled professionals for the IT industry, digital public administration, and the development of domestic digital platforms, software, promising inventions, and artificial intelligence, but also without ensuring cybersecurity, which is at the forefront of this area in the national project ‘Data Economy and Digital Transformation of the State’.

The growing number of cyberthreats against digital infrastructure is turning into a challenge for all countries today. According to a Bank of Russia report on different types of computer attacks in the financial sector, the FinCERT automated incident processing system recorded more than 750 attacks on the financial sector in Russia alone in 2024. What is critically important is that these attacks were carried out from almost all regions of the world, which clearly shows how difficult it is to combat such attacks from just a single state. The hackers actively exploited the infrastructure of contractors, software vulnerabilities, and social engineering. Statistics show that they are increasingly using complex chains of actions and gaining access to sensitive data through ancillary, less secure systems. We can expect attacks on digital infrastructure to continue to grow, primarily using ancillary systems, the vulnerabilities of diverse stacks of software components, and social engineering.

Data is the main asset of the new digital economy. However, intruders are gaining access to millions of data records as a result of cyberattacks. On average, during a single incident in 2024, more than 2.5 million records were leaked worldwide (more than 2.3 million in Russia). Human error has fallen by the wayside: 99% of leaks are intentional. Over the past year, the percentage of leaks in industry and trade, sports organizations, media, and NGOs has only grown. In the future, we can assume that hackers will increasingly show interest in private data sets, the generalization (enrichment) of data, its combination with OSINT technologies, and using data to put pressure on companies through possible fines, reputational risks, fraud, and other illegal activities, including planning terrorist attacks.

We can draw the following conclusions: the transition to a data economy must ensure the security of its main resource – the actual big data circulating in digital systems. Given the modern cyberthreat landscape, this is a complex task that requires various countries to consolidate their efforts both to protect assets as well as to investigate incidents and prosecute hackers. It must be effectively resolved so as not to jeopardize the confidentiality, reliability, availability, and integrity of big data of the digital economy.

We will examine the role of data in the modern digital services that underlie the new technological paradigm. The big data economy requires us to view information in at least two ways: taking decisions based on data and using data as an independent value (resource). Decision-making is what increases the intrinsic value of data. It results in new forms of relations within the knowledge society, such as data exchange or data outsourcing, as well as the creation and use of joint products based on data (e.g., artificial intelligence systems). These are essentially new forms of big data management in response to technological needs. However, the actual technologies – new non-relational DBMS for big data, distributed information management systems, and artificial intelligence systems – have vulnerabilities and security imperfections that can result in such massive leaks.

We will outline the following problems with ensuring the cybersecurity of the big data economy with respect to its main resource: a growing attack surface (including cross-border), the vulnerability of technologies, and the heterogeneity of infrastructure. As the need for data exchange and outsourcing increases, more and more people are gaining access to confidential information. This creates legal problems both in terms of obtaining consent for processing from the data owners and harmonizing legislation, as well as cybersecurity problems. The probability of data leaks in this case increases many times over, since data is becoming available to a wide range of people and starting to appear in different types of infrastructure built on the basis of various software and hardware.

The next problem is the vulnerability of technologies. On the one hand, having heterogenous infrastructure increases the likelihood of open vulnerabilities. On the other hand, modern data-driven solutions and artificial intelligence systems are also susceptible to major cyberattacks that not only aim to extract their private architecture, but also the data used to create them. Even when technologies specifically designed to maintain privacy (such as federated learning) are used in the joint creation of AI models, such attacks remain relevant.

The third problem that arises from the new paradigm of using information in the big data economy is the heterogeneity of infrastructure itself. Even within a single, fairly large company in the banking or industrial sector, data has a complex life cycle, is processed in various systems, and circulates between them as they implement various business processes. As a rule, such systems trust each other, and a hacker can gain access to all private data by accessing one of them. This is one of the reasons why hackers are increasingly using ancillary systems and infrastructure to gain access to data. This means we must take a comprehensive approach to big data security within any kind of heterogeneous infrastructure and not only protect individual components, but data management systems as a whole at the technological and not just the legal level.

As such, ensuring the protection and control of data usage in heterogeneous infrastructure is crucial to the cybersecurity of the entire data economy. Different degrees of data granulation, the lack of a single processing tool, and the heterogeneity of data sources, consumers, and information at the semantic level are what distinguish big data management systems for large-scale objects (including government services and cross-border systems) from traditional database management systems (including private clouds). These factors make it impossible to apply conventional means and methods of protection, such as end-to-end encryption and well-known methods of access control and audit, at the level of the big data management system as a whole.

To ensure the comprehensive security of big data management systems, we need a common, consistent approach to its protection that can overcome the contradictions between heterogeneous components with different data granulation. Another challenge in building secure big data management systems is the need to support existing specialized tools for structuring and transforming information, accepted business practices, data outsourcing, and the joint use of data.

Technology should be based on a new consistent approach to ensuring the security of the data management system that incorporates the principles of completeness, unity, and consistency of data and process representation, as well as the principle of minimizing trust. What makes this approach unique is the consistency both at the level of mathematical models of heterogeneous components of the data architecture as well as between information processing levels. This consistent approach allows for access control, monitoring, and auditing throughout the entire life cycle of data and also minimizes threats and ensures secure information processing in the most productive mode.

Developing solutions based on the paradigm of a consistent approach to protecting big data when conducting joint research, including as part of scientific and technical cooperation between BRICS+ countries, will enhance the confidentiality, availability, and integrity of the data economy's main resource in the face of cyberthreats. Reducing the number of data leaks, in turn, will help to avoid unforeseen expenses and significant reputational costs, simplify the international exchange of data in order to create technological products, boost the sustainability of the commercial and public sectors of the data economy, and ensure that citizens have greater trust in new technologies.

RUSSIA

Igor Prikhodko
Assistant Lecturer at the Department of International Economics

V.I. Vernadsky
Crimean Federal University

Identifying Russia's innovative development priorities based on an analysis of multipliers

This study is based on the author's diagram of the connectivity of key industries of the Russian economy with a focus on four key sectors: mechanical engineering, the automotive industry, the rocket and space industry, and the development of the Arctic. These sectors have the greatest multiplier effect since their development involves as many related industries as possible and they generate demand for high-tech products, require constant improvements to science and technology, and aim to solve unconventional problems related to innovative development.

Innovative development priorities are selected directly based on the industries that generate the largest share of added value to GDP and create as many new jobs as possible in related sectors of the economy. Such industries primarily include machine tool manufacturing, instrument making, the aviation and space industry, and the production of large-tonnage ships. Since the source of added value is actual materialized labour, selecting this priority aims to predominantly encourage labour-intensive industries to the detriment of material- and capital-intensive ones. On the one hand, this approach helps get rid of the most environmentally hazardous industries and reduce the direct use of human capital, thus increasing the duration of its effective use, while, on the other hand, it pushes the country that applies this approach to the top of international value chains.

This concept prioritizes such a criterion as the share of added value in the overall cost structure of an industry's products and the number of new jobs it creates. Jobs are created in the economy due to the multiplier effect. For example, the development of the Arctic requires expanded production in construction, the oil and gas industry, shipbuilding, and hence in mechanical engineering, science, and education. As the Russian minister of natural resources and former governor of the Yamal-Nenets Autonomous District rightly noted: "One job in the Arctic creates 14 jobs in Russia. Enterprises from 57 regions are already involved in the development of the Arctic in one way or another. The Arctic is a powerful driver of the entire country's economy" [5].

We analysed the opinions of experts [1,2,4,5,6,7,8,9] who noted the enormous magnitude of this multiplier effect. Based on the data we obtained, we constructed a diagram of the connectivity of key industries of the Russian economy (see the figure at the end of this essay), from which we identified four key sectors: mechanical engineering, the automotive industry, the rocket and space industry, and the development of the Arctic. These sectors have the greatest multiplier effect since their development involves as many related industries as possible and they generate demand for high-tech products, require constant improvements to science and technology, and aim to solve unconventional problems related to innovative development.

This approach requires a focus on labour-intensive sectors with a large amount of initial capital investments.

Let's look at a specific example. To develop the Arctic, conditions need to be created for several thousand specialists to live normally beyond the Arctic circle, which in itself is a difficult task. There is no permanent population in similar regions of Canada, since this country mainly uses rotational work shifts in the subarctic zones. In terms of building cities in the Arctic, we can confidently say that Russia undoubtedly possesses competitive advantages and has accumulated extensive experience.

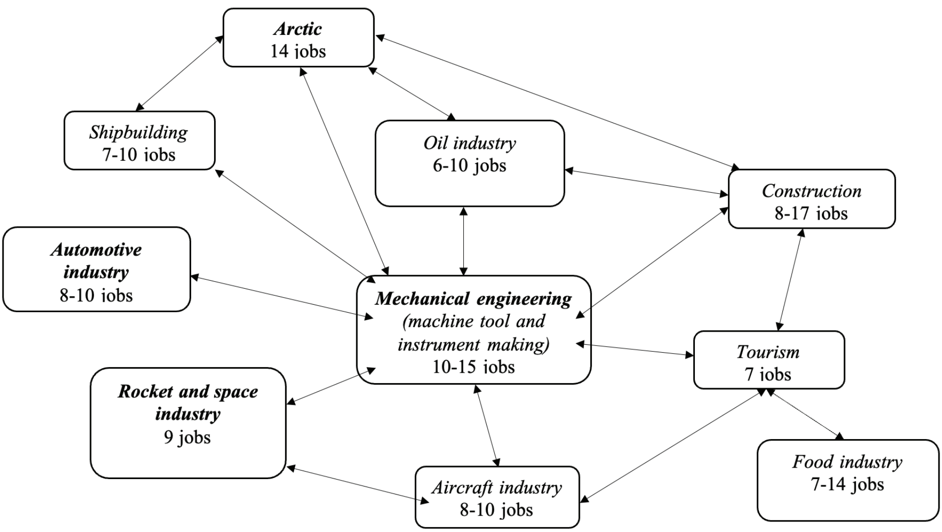
In this context, the Northern Sea Route appears to be one of the most important arteries that can ensure the proper functioning and progress of the Arctic region. The reconstruction of the Northern Sea Corridor system primarily involves modernizing nodes throughout the entire rail, sea, and river transport systems, ensuring regular supplies to these territories, as well as airports and airfields, the development of and improvements to intraregional highways, the use of new technologies to build common infrastructure systems for industrial complexes, the streamlining and expansion of energy supplies and utilities in all areas of activity, and the transition of energy consumers to centralized types of energy supply. But the most important thing is the modernization of the fleet, including the launch of new nuclear icebreakers, oil tankers, and lighter carriers [3].

A substantial increase in the volume of commercial transit cargo along the Northern Sea Route will help to drastically reduce insurance fees for vessels on this route, intensify its use for transit, and switch from per-tonne payments for the icebreaker escort of vessels to the usual fee that is charged on many sea canals. Russia's Arctic region is also home to numerous mineral resources that have already been explored, including major gas deposits in the Pechora and Kara Seas, oil from the Vankor and Tugulskoye oil fields on the Yenisei River, nickel on the Taimyr Peninsula, apatite, copper, and aluminium on the Kola Peninsula, and gold and tin on the Chukotka Peninsula.

This analysis of one of the key industries – the development of the Arctic – confirmed our conclusions: the concentration of state investment in the areas we identified will cause a multiplier effect, which will ultimately lead to the transformation of promising regions as well as progressive growth in the Russian economy as a whole.

Deep structural changes in international economic relations, as well as the socioeconomic and geopolitical revival of Russia, are expanding prospects for utilizing previously unexplored opportunities. In this context, identifying priorities for innovative development in the Arctic and Northern Sea Route is consistent with the latest global trends.

Figure 1. Multiplier effects of job creation in key sectors of the Russian economy. Source: [1,2,4,5,6,7,8,9].



List of References

1. Baverman, A. One Job in Construction Creates 17 Jobs in Other Industries / Baverman A. // 'Where Is This House?' real estate market monitoring site – Access mode: https://www.gdeetotdom.ru/news/1951733-2013-06-24-odno-rabochee-mesto-v-stroitelstve-sozdaet-rabochih-mest-v-drugih/ (accessed on: 6 April 2024).
2. Vorontsov, I. Cement Industry: Hope for Roads / Vorontsov I. // Ministry of Industry and Trade information agency – Access mode: https://www.minprom.ua/articles/253558.html (accessed on: 3 March 2024).
3. Yevdokimov, Y.A. The Northern Sea Route: Problems, Opportunities, and Prospects for Revival / Evdokimov Y. A., Batskikh Y. M., Istomin A. V. // Economic Science of Modern Russia. - 2000. - No. 2. - p. 101.
4. Ivanov, I.A. Microelectronics Creates an Ecosystem / Ivanov I. A. // Comnews Digital Transformation, Telecommunications, Broadcasting, and IT News. - Access mode: https://www.comnews.ru/node/53898 (accessed on: 3 April 2024).
5. Kobylkin, D. One Job in the Arctic Creates 14 Jobs in Russia / Kobylkin D. // Rambler Information Agency. - Access mode: https://finance.rambler.ru/economics/31862853/?utm_content=rfinance& utm_medium=read_more&utm_source=copylink (accessed on: 23 March 2024).
6. Kogogina, A. Deputy Speaks about Agenda of Off-Site Meeting of the State Duma Committee on Economic Policy / Kogogina A. // Tatar-Inform. - Access mode: https://www.tatar-inform.ru/news/2017/05/29/555232/ (accessed on: 3 April 2024).
7. Muradova, Z.R. Analysis of the Development of the Construction Industry in the Russian Federation and the North Caucasian Federal District in 2013-2015 / Muradova Z.R. // International Scientific Conference 'Society, Economy, and Law 2016'. - M., 2016. - Session 1. - pp. 23-34.
8. Reshetnikova, Y. Strategy Over Policy / Reshetnikova Y. // Russian Business Newspaper – Industrial Review. - M., 2011. - No. 40 (822). - pp. 48-59.
9. Safonov, O. One Job in the Tourism Sector Creates up to Seven Jobs in Related Industries / Safonov O. // Business News Agency. – Access mode: https://abnews.ru/2016/01/20/safonov-odno-rabochee-mesto-v-sfere-turizma-sozdaet-do-semi-rabochix-mest-v-smezhnyx-otraslyax/ (accessed on: 5 April 2024).

Saw Yu Yu Wai
Deputy Director

Department of Labour,
Ministry of Labour

The Labour Market of the Future: The Impact of AI and Personal Training

Technology advancements and disruptive ideas are driving a significant transition in the workplace. The Fourth Industrial Revolution is approaching us, changing the nature of work as we know it by redefining jobs, transforming skill requirements, and challenging traditional employment frameworks.

Recent developments in Artificial Intelligence (AI) have stoked new fears about large- scale job loss, stemming from its ability to automate a rapidly expanding set of tasks (including non-routine cognitive tasks), and its potential to affect every sector of the economy. Furthermore, there are concerns about employee well-being and the broader work environment, linked to the idea that AI may soon become pervasive in the workplace and threaten and undermine humans' place in it. However, AI also has the potential to complement and augment human capabilities, leading to higher productivity, greater demand for human labour and improved job quality.(OECD,2021)

At the same time, personal training, whether it takes the shape of online courses, professional development, or traditional education, is becoming more important than ever. Personal training is essential for preparing people for the opportunities and difficulties of the new workforce, which will require highly adaptable workers with a wide range of skills. With an emphasis on the nature of employment, the skills needed, and the importance of lifelong learning, this essay examines how artificial intelligence (AI) and personal training will affect the labor market of the future.

With AI being adopted at a rapid pace, it is important to understand its implications on employment. This paper is meant to contribute to the ongoing dialogue among policymakers, business leaders, and scholars who are still seeking a balanced view on how AI can radically change the labor market and personal training will be essential in helping workers adapt to these changes, creating new opportunities and challenges in the labour market.

Overview of AI and its Role in the Future of Work

According to the OECD (2021), artificial intelligence (AI) is a general purpose technology (GPT), a term used to characterize technologies that have the potential to be applied in a wide range of industries and professions, as well as the capacity to develop over time and produce complementary innovation. According to Agrawal et al. (2019), AI is a GPT because it can generate predictions that may be used as inputs for decision-making in a variety of fields, including teaching, radiology, and translation. They explain how machine learning and neural networks may revolutionize the innovation processes in a wide range of industries in addition to increasing productivity across those industries. They draw attention to how AI has the potential to advance scientific understanding, particularly in fields where classification and prediction are key components of study.

Demographic shifts

The world is currently experiencing two fundamental demographic shifts: an aging and declining working-age population predominantly in higher income economies, due to declining birth rates and longer life expectancy, and a growing working-age population in many lower- income economies, where younger populations are progressively entering the labour market. In higher-income nations, aging populations are increasing dependency ratios, potentially putting greater pressure on a smaller pool of working-age individuals and raising concerns about long- term labour availability. In contrast, lower-income economies may benefit from a demographic dividend.

Expected disruptions to skills

The COVID-19 pandemic, along with rapid advancements in frontier technologies, led to significant disruptions in working life and skills, prompting respondents to predict high levels of skills instability in subsequent editions of the report. The post-pandemic period, however, has seen employers adapt to these changes.

The accelerated adoption of digital tools, remote work solutions, and advanced technologies such as machine learning and generative AI provided companies with relevant experience to better understand the critical skills required to navigate rapid technological change.

The Impact of AI on the Labour Market

According to a report of the World Economic Forum, by 2025, AI will have displaced 75 million jobs globally, but will have created 133 million new jobs. This means that there will be a net gain of 58 million jobs globally, but there will still be significant job displacement in certain industries. This statistic reveals a challenge and an opportunity. The opportunity lies in unleashing unprecedented productivity and efficiency, while the challenge is for institutions and individuals to adapt and fully leverage these transitions.

Automation and Job Displacement

One of the most discussed implications of AI in the labour market is job displacement. According to a report by the World Economic Forum (WEF), automation could eliminate 85 million jobs worldwide by 2025, but it is also expected to create 97 million new roles, primarily in fields related to technology, AI development, data analysis, and digital services. While this presents a net positive outlook, it is important to consider that certain job categories are more vulnerable to automation than others.

Routine-based and manual labour jobs, especially those in industries such as manufacturing, transportation, and retail, are most susceptible to automation. Jobs like truck driving, cashiering, or data entry, which involve repetitive tasks that can be easily programmed, are at risk. For example, self-driving vehicles powered by AI could eliminate millions of driving- related jobs, and AI-powered checkout systems are already reducing the need for human cashiers in retail stores.

However, AI's ability to automate routine work does not necessarily mean an overall decrease in employment. Many AI tools are designed to augment human productivity rather than replace humans altogether. Workers will increasingly collaborate with AI systems that assist them in performing tasks more efficiently and effectively, requiring a shift in how work is perceived and executed. For instance, AI can help doctors analyze medical images more accurately, but the need for human expertise in diagnosing and communicating with patients remains critical.

Creation of New Jobs

While AI may displace some jobs, it will also create entirely new job categories that did not exist before. These roles will often require higher-level skills and expertise in areas such as AI programming, data science, and cybersecurity. For instance, as companies adopt AI technologies, there will be a growing demand for AI developers, machine learning engineers, and data analysts to design and maintain these systems. Similarly, as AI permeates various industries, professionals will need to manage and interpret the vast amounts of data generated by AI systems, leading to increased demand for data scientists and data engineers.

Moreover, the AI-driven future labour market will emphasize roles that require complex problem-solving, creativity, emotional intelligence, and human interaction—qualities that AI is not yet able to replicate fully. For example, while AI can assist in customer service tasks, human workers with strong interpersonal skills will still be needed for complex customer interactions, negotiations, and relationship management. This suggests a shift toward jobs that are more cognitively demanding, creative, or reliant on human emotional intelligence, which AI cannot replace effectively.

Personal Training and Upskilling in the Future Labour Market

As AI disrupts the labour market, workers will face the need to adapt to an evolving environment. Continuous personal training, reskilling, and lifelong learning will become essential components of career success. Given the rapid pace of technological change, education systems must evolve to prepare individuals for a world where adaptability and flexibility are critical.

The Need for New Skills

In the future labour market, traditional education systems will need to be supplemented by continuous training and reskilling programs to keep up with the demands of AI. The skills that workers need will change, and many existing jobs will require a combination of technical and soft skills. Some of the key skills expected to be in high demand include:

1. Digital Literacy and Technical Skills: The ability to understand and work with new technologies, including AI, data analytics, and automation tools, will be crucial. People who can work with AI systems, write code, and analyze data will be highly sought after. Furthermore, workers who can use digital tools to enhance productivity and communicate effectively in a digital environment will remain competitive.
2. Problem-Solving and Critical Thinking: As AI automates routine tasks, humans will be required to focus on complex decision-making, strategic planning, and creative problem-solving. Skills such as critical thinking and the ability to evaluate and interpret information will be vital for success in the future labour market.
3. Emotional Intelligence and Interpersonal Skills:While AI can assist with analytical tasks, human workers will still be needed for jobs that require

emotional intelligence, empathy, and relationship-building. Jobs in healthcare, education, and customer service will still require a human touch that AI cannot replicate. The ability to manage emotions, communicate effectively, and work in teams will remain essential.
4. Lifelong Learning and Adaptability: With the constant evolution of AI technologies, workers must remain adaptable and open to learning new skills throughout their careers. Lifelong learning will become the norm, as workers must continually update their knowledge and capabilities to remain competitive in the workforce.

Personal Training as a Solution

As automation and AI reshape the job landscape, personal training will play a pivotal role in preparing workers for the future. Personalized learning, which focuses on the needs and learning styles of individuals, can provide a tailored approach to skill acquisition and career development. The development of flexible and accessible training options, such as online courses, boot camps, and professional certifications, will be crucial for workers looking to reskill or upskill.

Online education platforms like Coursera, edX, and LinkedIn Learning have already proven that personal training can be effective, convenient, and cost-efficient. These platforms offer courses in a wide variety of fields, from data science and AI programming to soft skills like leadership and communication. By offering modular, on-demand courses, these platforms allow workers to continuously update their skill set, ensuring that they stay competitive in a rapidly changing job market.

Moreover, companies will increasingly recognize the importance of employee development. Organizations are expected to invest more in employee training programs that focus on reskilling and upskilling their workforce, ensuring that their employees remain relevant as automation and AI continue to evolve. Many tech giants, such as Google and IBM, already provide internal upskilling programs to help their employees transition to new roles as AI technologies advance.

Government and Policy Interventions

Governments will also play a critical role in shaping the labour market of the future. Public policies, such as universal basic income (UBI), retraining programs, and investment in education, can help mitigate the challenges posed by job displacement due to AI. By investing in comprehensive educational programs and promoting lifelong learning, governments can ensure that workers have access to the resources they need to stay competitive in the changing job market.

In addition, governments can incentivize businesses to invest in employee training, ensuring that workers have access to ongoing development opportunities. Public-private partnerships can help bridge the skills gap and create a more resilient workforce. Policies that foster innovation and entrepreneurship can also help stimulate the creation of new industries and job opportunities that emerge as a result of AI.

The development of AI and the growing significance of individualized training will have a substantial impact on the future labor market. AI has the potential to transform whole industries, automate repetitive tasks, and open up new career paths for qualified professionals. Workers will need to embrace lifelong learning, acquire new skills, and adapt constantly as a result of this shift. Employees will need to receive personal training in order to stay relevant in a world where technology is drastically changing the nature of employment.

As automation and AI continue to evolve, the need for workers with technical, cognitive, and emotional intelligence skills will only increase. Companies, workers, and governments must collaborate to create an ecosystem where continuous learning and upskilling are prioritized. By investing in education, reskilling programs, and flexible training options, the workforce of the future can thrive in an AI-driven economy, making the most of the opportunities that these technological advancements bring.

In conclusion, a human-centric approach will define the future of work in an increasingly automated world, where individual competencies will become the key differentiator. As routine tasks are replaced by technology, human roles will shift toward more cognitive, creative, and emotionally intelligent functions, leading to ongoing learning and adaptability for both professional and personal growth. The economic model will shift toward "everything-as-a- service," emphasizing flexibility and impact measurement across social, economic, and environmental domains. It is imperative that we adopt an agile mindset that is focused on learning, innovation, and impact in order to stay relevant and find fulfillment in a rapidly changing, technology-driven world.

Bibliography

1. Abhijeet N., a. L. (2022). Trading Geopolitics: The Long View on Growing U.S.-China Tensions.
2. Accenture. (2018). Reworking the Revolution. https://www.accenture.com/_acnmedia/PDF-69/Accenture-.
3. ADB. (2024). The future of work , artificial intelllience and digitial govenment. Forum, W. E. (2025). Future Job Report.
4. ILO. (n.d.). Mind the AI Divide. 2024.
5. OECD. (2021). The impact of Artificial Intelligence on the labourmarket: What do we know so far.

BANGLADESH

Shekh Tansen
Student

University of Dhaka

Essay on Investments in Technology

Introduction

At present, technology is the main element of modern societies and economic factors that affects the personal evolution and protects natural resources. Innovation is still a priority for governments, businesses, and public institutions that continue to invest substantially in technological developments to come up with innovative solutions and improve their competitiveness on the market and in solving global problems. Technological expenses shape the future through solutions to problems of food security systems, climate changes and cybersecurity needs through smart city planning. This essay investigates major technological advances and their significances for the economy and society as well as their advanced operational effects on corporate sectors and national systems.

Technological innovations transforming industries

Ensuring food safety: Technology is a key factor in protecting food safety because this is an issue of global importance. The technology of Blockchain makes it possible to track a product from the farm to the dining table, thereby preventing both counterfeits and contaminations. AI sensors with AI abilities to analyze the food processing areas to identify pathogens that helps in reducing the number of food related health problems. According to the market research by Markets and Markets, the food safety testing market will reach $24.4 billion by 2025 as technology-based safety is on a rise.

Advance technology in industries: Industrial revolutions happen in the Fourth Industrial Revolution through the combination of automation and Artificial Intelligence and robotics technology. Production losses are decreased by advanced manufacturing approaches that use 3D printing along with AI robotics and smart factories namely, resulting in better operational efficiency. By reducing the machinery down time of General Electric through their predictive maintenance system, not only productivity had improved, but costs had also been saved. Prior to 2021, when analysts predicted the industrial robotics market to be $31.3 billion by 2028, its current value was $16.3 billion, as automation trends increased.

Changing economic priorities: Changes in the countries' specialized industries are due to shifts in the economic focus of countries by modern technology. While China is India's priority in the semiconductor manufacturing sector, India is leading the market for IT services. Through the Green Deal program of the entire European Union, redefined industrial focus across regions is to be achieved through investment in renewable energy. Studies by the World Economic Forum shows that countries investing in high tech sectors experience a GDP growth of 15-20% for a decade, thereby clearly showing the changes in economy brought about by the technology enhancements.

AI and advanced technology reforming key sectors

AI as a key end-to-end technology: Artificial Intelligence as a whole end to end system can be implemented by the industry to achieve results of predictive analytics and automated operations with the provision of customized services. By using artificial intelligence through algorithmic systems in fiscal operations, fraud prevention operations are strengthened and the marketplace performance is improved. AI operated chatbots and recommendation technologies are used by organizations in retail to provide better customer service. Analysis of the substantial impact of AI on the global economy shows that it will generate $13 trillion value for the global economy during the next decade based on McKinsey projections.

Optimization of healthcare using AI technology: The medical sector has come to the point of healthcare optimization thanks to advanced technologies including AI in addition to telemedicine and wearable devices. IBM Watson Health is an AI diagnostic system currently being used to aid in the early detection of diseases and to develop specific medical treatment plans for each patient. Telemedicine platforms gave better healthcare services to areas that were previously isolated as a result of the COVID 19 pandemic. According to WHO figures, adoption of AI technology will decrease the healthcare expenses by 20% and the number of medical errors will decrease by 30%.

Technology for sustainability and disaster management

Technological solutions to prevent natural disasters: The Climate shows increased frequency and severity of natural disasters because of environmental change. Predictive data solutions combined with satellite technology and IoT monitoring equipment help organizations prepare for as well as respond to emergency situations. Through an AI and IoT implementation in Japan's earthquake warning system the nation has noticeably minimized the number of casualties along with minimizing property losses. The urgency for disaster management technology industry growth stems from its projected market value reaching $150 billion by 2030 as indicated by recent industry statistics.

Technological solutions for water resource management: Water scarcity affects the entire world as an urgent issue which becomes more acute because of changing climate patterns so Technological Solutions for Water resource Management in the Context of Climate Change. Smart water management solutions based on AI and smart irrigation systems and desalination technologies have different applications for water programs. Israel developed desalination plants which produce 60 percent of its drinking water while making its way to become a leader in water technology. Water technology investment enables the United Nations to forecast that sustainable water access will become available to 2 billion people by 2050.

Cybersecurity, Energy, and Smart Cities

Cybersecurity in big data economy: Cybersecurity in the time of the big data economy; The number of targets and threats both increase in the era of the big data economy. To ensure data security organizations must priorities implementing AI driven threat detection combined with blockchain security and quantum encryption using financial investments. The market value of this company reached $173 billion during 2020 before it projected to reach $366 billion by 2028. Microsoft and IBM along with other organizations maintain the position as leaders in cybersecurity innovation to establish data protection while preserving privacy.

Technology for sustainable energy: The global community currently focuses on implementing technology solutions for accessible sustainable energy. Sustainable investments in solar, wind along with energy storage technologies are almost essential. Tesla shows its advancement in battery technology alongside China by building large-scale solar farms which advance the transition to green energy. Future projections from the International Energy Agency indicate that renewable energy will provide 90% of global power capacity growth which will disconnect us from fossil fuels as a power source and establish sustainable electricity generation.

Technology to develop smart cities: IoT with AI and big data is the urban development through technology that encompasses IoT with AI and big data to generate smart city environment that is smarter and better for the city life quality: Smart cities are the use of technology platforms for bettering urban existence. The city becomes more sustainable and also more efficient by using smart management of traffic along with the implementation of energy efficient buildings and digital governance. Built through the Smart Nation initiative, Singapore is doing so through the combination of AI surveillance technology, cashless payment systems and real time analytics processing. According to cities being shifted at a very fast pace, the worldwide smart city market is expected to grow beyond $2.5 trillion in the upcoming years.

The platform economy and its economic and social effects

Uber and Airbnb and Amazon and other such platforms have transformed the entire global business operations in the platform economy through digital platforms. Digital platform develops employment markets, expand consumer access to products and help in economic development. The PwC report foresees that the worldwide sharing economy will reach $335 billion in the future until 2025. Because regulatory barriers and worker rights questions call for equilibrium to achieve equitable economic benefits, proper policy frameworks are still necessary for implementation.

Conclusions

Technological advancement is one of the most important things for modern economies, industries and societies to construct their future direction. Through their ability to enhance both food safety and healthcare delivery systems as well as the reduction of climate problems, new technology solutions give answers to worldwide problems by improving cybersecurity controls. Advantages of technological progress are the better production rates and new jobs and the changes of industries, while societal advantages are the better living standard with sustainable handling of the resources and global network connections. Research and innovation should be developed in a forward-thinking approach by governments together with businesses and individuals for the benefit of optimum use of technology ethically. With the full utilization of modern technologies, humanity can create a better future and create an inclusive and sustainable world structure.

AUSTRALIA

Sohag Kazi

Head of the Laboratory for International and Regional Economics, Academic Head of the PhD Programme in Economics, Associate Professor at the Graduate School of Economics and Management

Ural Federal University,
Russian Federation

Artificial Intelligence and Sectoral Job Market Nexus in U.S.A: An Empirical Study

Abstract

The rise of AI has significant implications for job markets. This research aims to measure the impact of artificial intelligence on the U.S. labour market across various sectors. To achieve this, a cross-quantilogram approach is employed, analysing daily data from February 2, 2020, to June 6, 2024. The findings reveal that AI positively influences the U.S. job markets, particularly in Scientific Research and Development, Software Development, Education, and Culture and Recreation sectors. Moreover, the time-frequency analysis confirms that the association between AI development and job opportunities in these relevant fields has become more pronounced after the release of ChatGPT. Consequently, this study proposes significant policy implications aimed at balancing the sector-wise job market in the United States. It emphasizes the importance of leveraging human labour while simultaneously promoting industry growth through the application of AI.

Keywords: Artificial intelligence, Sectoral job markets, Employment, Human labour, Cross- quantilogram approach, U.S.A

1. Introduction

Technological progress is a key driver of long-term economic growth and labour productivity, with the evolution of technology creating new opportunities for workflow enhancement and automation. However, the rise of artificial intelligence (AI), capable of self-training, decision- making, and executing tasks traditionally requiring human intelligence, has sparked concerns about job displacement (Lane et al., 2021). Despite these concerns, AI has limitations, particularly in areas requiring creative or social intelligence, where humans remain essential. AI doesn't replace human labour entirely but aids in addressing work challenges and boosting productivity (Dwivedi et al., 2021). Simultaneously, AI's evolution has created new jobs in the engineering, software, and IT sectors in the U.S (Cockburn et al., 2018). Amid this debate, our study aims to determine whether AI-based automation leads to a decrease or increase in labour participation in U.S. sectoral markets.

Driven by several propositions, our investigation delves into the impact of AI technology on the U.S. job market. First, the Fourth Industrial Revolution (4IR) has brought about automation in manufacturing and services, with sectors such as high-tech, automotive assembly, telecommunications, transport and logistics, financial services, retail, and healthcare leading the charge in AI adoption (Bessen et al., 2018). Despite AI technologies offering potential benefits, they also disrupt labour markets, posing a considerable threat. In fact, AI technologies are already implemented to perform human tasks in sectors including agriculture (Javaid et al., 2023), transport (Wu et al., 2022), food industry (Esmaeily et al., 2024), manufacturing (Kim et al., 2022; Nti et al., 2022), medicine (Reddy, 2022), and finance (Ahmed et al., 2022). However, the risks of job substitution due to AI technology adoption vary across different sectors, occupations and functionalities. For instance, the introduction of generative AI models like ChatGPT has been shown to adversely affect employment outcomes for knowledge workers, particularly in tasks that are easily automated, such as content creation and editing (Hui et al., 2024). Besides, while some occupations may experience job losses, others might see a transformation rather than complete automation, allowing workers to benefit from increased productivity through close interaction with AI technologies (Carbonero et al., 2023). Therefore, while AI holds the potential to enhance productivity and create new job opportunities, its adoption also poses significant risks of job substitution, particularly in roles that involve routine and easily automatable tasks. From this perspective our analysis aims to examine the impact of AI on the labour markets, specifically identifying where AI creates new job demand and where it results in substitution.

Secondly, countries actively involved in the global AI race, such as the United States, are more susceptible to the effects of AI technology. Specifically, the United States has undoubtedly become a leader in AI development, and technology giants such as Google, Facebook, and Microsoft remain key players in AI research (Rikap, 2024). Besides, Maximize Market Research predicts (2023) that the U.S. AI market will reach an impressive size of U.S.$223 billion by 2029. Although the U.S. stands to gain from its leadership in AI, it is essential to consider the potential risks and vulnerabilities associated with this technology. While the U.S. artificial intelligence market was estimated to be U.S.$ 31 billion by 2023, the American labour market is already facing the challenges posed by the rapid development and implementation of artificial intelligence technologies. Therefore, we intend to examine the impact of the development of artificial intelligence on the U.S. labour market.

Thirdly, influenced significantly by structural shifts from new technologies such as AI, the U.S. labour market is experiencing a transformation in production processes. For instance, contrary to global fears of technological unemployment, post-Great Recession employment in the U.S. manufacturing sector actually saw a boost due to robots (Leigh et al., 2020), and it's been found that increased AI usage can even reduce unemployment (Mutascu, 2021). In a move towards AI advancement, the U.S., in 2020, joined the Global Partnership on Artificial Intelligence (GPAI) (Artificial Intelligence (AI) - United States Department of State), and enacted the National Artificial Intelligence Initiative Act (NAIIA) in 2021 to ensure its leadership in AI and its integration into all societal and economic sectors (National Artificial Intelligence Initiative Act of 2020, 2020). Despite major U.S. tech firms actively exploiting AI, national adoption is still in its early stages (Beede et al., 2020). Specifically, McElheran et al. (2024) argue that fewer than 6% of U.S. firms had adopted AI-related technologies, with adoption rates slightly higher when weighted by employment, reaching just over 18%. Ethical concerns, data privacy issues, and the potential for job displacement also pose significant obstacles to AI acceptance (Rane et al., 2024). Even with a declining unemployment rate (3.6%) and reduced initial jobless claims in 2023 (U.S. Bureau of Labour Statistics; U.S. Department of Labour), there's a looming threat from computerization and automation for about 25% of total employment, or 36 million Americans (Muro et al., 2019). Predictions indicate that up to 70% of their tasks could be automated, with job losses potentially reaching 73 million by 2030 (Manyika et al., 2017), a scenario that could be further amplified by AI and neural networks. Thus, the true impact of AI expansion on the U.S. job market requires further detailed evaluation.

Given these motivations, our research aims to evaluate the impact of AI development on various U.S. labour market sectors. Our study contributes to the existing literature along different dimensions. Firstly, it is the first empirical attempt to investigate the early response of the U.S. job market to the rise of AI, using high-frequency data and disaggregating different job market sectors. To this end, we utilize AI-INDEX 15, which captures the performance of U.S. companies engaged in artificial intelligence by designing, creating, integrating or providing AI in the form of product, software or systems. AI-INDEX 15 allows to account for the development of artificial intelligence and can serve as a proxy to capture the interest of population towards the AI technologies. To represent the U.S. labour market, we use percent change of job posting on American worldwide employment platform Indeed in the United States by sectors. The Indeed combines job listings from thousands of websites, therefore this indicator can globally represent employers' demand for labour in the U.S.. Besides, to conduct a more sophisticated analysis we examine the industry level by grouping U.S. labour market sectors into economic industries, such as Accommodation and Food service, Administration, Cultural and recreational services, Engineering/Technicians, Finance and Banking, Personal and other services, Scientific Research and Development, Education and Instruction, Information Design & Documentation and technological industries, namely IT Operations and Helpdesk, Software Development. Secondly, our analysis captures extreme conditions and the dynamic impact over time, showing how new job creation in different sectors responds to AI augmentation. The analyzed period encompasses the last fourth years from February 2, 2020, to June 6, 2024. This time period is marked by significant progress in the field of artificial intelligence technologies. Thirdly, we apply several advanced methods with time series analysis features. For instance, the cross-quantile (CQ) method is employed to ascertain the influence of AI advancement on demand in a particular industry, considering different quantile combinations to evaluate the response of U.S. industries to varying degrees of AI development. By using CQ approach we can conclude whether AI generates new job demand or results in substitution in specific industry. Besides, we apply a time-varying vector autoregression (TVP- VAR) model to study the impact of AI development on U.S. labour market sectors, considering different phases of AI market development and periods of high economic uncertainty. Fourthly, our findings provide new insights into how AI development influences the U.S. job market and affirm that AI development significantly promotes job opportunities in certain sectors, including Scientific Research and Development, Software Development, Education, and Culture and Recreation. Conversely, AI development has either a negative or no significant association with less relevant sectors like Accommodation, Finance and Banking, Personal Services, and others. Finaly, the study's findings can assist policymakers in formulating pragmatic policies that effectively combine human labour with AI implementation across diverse market scenarios. This enables a better understanding of the extent to which AI engagement can contribute to the profit maximization of U.S. industries.

The remaining part of the study is organized as follows. Section 2 presents the literature review on exposure of job market to AI technology development. Section 3 provides a description of the research methodology and the data utilized. Section 4 presents the descriptive statistics and empirical results. Section 5 contains a discussion of the results including comparisons with previous studies. Section

6 summarizes the findings of the study and discusses policy implications. Finally, Section 7 emphasizes the limitations of the study and provides further research opportunities.

2. Literature review

The development of artificial intelligence (AI) is significantly reshaping the job market, presenting both challenges and opportunities across various sectors. The impact of AI technologies adoption in different economic sectors is increasingly discussed in scientific literature. One strand of the literature highlights the positive impact of the widespread adoption of AI technologies. It is noted that AI technologies are enhancing productivity and efficiency in such industries as finance, healthcare, and manufacturing (Zhang & Lu, 2021). In the financial sector, AI has been instrumental in automating administrative tasks, thereby improving efficiency and reducing human error, which leads to optimized processes and cost reductions (Brynjolfsson et al., 2019). In healthcare, AI is used to improve diagnostic accuracy and treatment precision, contributing to safer and more effective patient care (Wu et al., 2021). The manufacturing industry has also seen substantial benefits from AI, particularly through the automation of production processes using robots, which reduces labour costs and increases production efficiency (Wang et al., 2024). Besides, by analyzing the impact of patented AI-related inventions across 3,500 companies Damioli et al. (2023) observe that AI patents have a positive and significant impact on employment, which suggests that AI innovation may be beneficial for the workforce. Furthermore, AI's ability to analyse big data allows for real-time monitoring and optimization of operations, which is crucial in maintaining high productivity levels (Fisher et al., 2023). However, while AI can enhance productivity and efficiency, it also requires careful strategic planning and investment in both technology and human resources to ensure successful implementation (Yang, 2022). Education and training programs are essential to bridge the skills gap and ensure that the workforce can adapt to new AI-driven job requirements (Sorensen et al., 2021). Moreover, the adoption of patent innovation in the field of AI also increases worker productivity (Alderucci et al., 2020; Damioli et al., 2021). Therefore, some occupations can experience transformation rather than complete automation, allowing workers to benefit from productivity gains by using AI technologies in their professional activities.

Another body of literature emphasizes that AI technologies may lead to job displacement, especially in positions that involve routine and manual tasks. AI can perform repetitive and predictable tasks, thus making some occupations more susceptible to automation (Zarifhonarvar et al., 2024). Automation of routine tasks is a common problem across industries, raising concerns about job stability and the potential for large-scale unemployment. However, the risks of substitution caused by technological innovation, especially the widespread adoption of artificial intelligence, vary in the type and functionality of occupations and sectoral specifics. Therewith, high-skilled occupations, such as those involving cognitive and analytical skills, can face pressure and be susceptible to substitute, compared to low-skill jobs that require manual labour (Zarifhonarvar, 2024). Besides, Pizzinelli et al. (2023) argue that high-skill jobs, while exposed to AI, often have a higher potential for complementarity, meaning AI can augment rather than replace these roles. Hence, Acemoglu & Restrepo (2019) argue that the effect of automation on the labour market can be represented through the productivity effect, which increases labour demand for non- automated tasks, and the displacement effect, resulting in a reduction of labour share. A number of economic sectors, e.g. healthcare and legal services, face significant risks of substitution due to AI's ability to perform complex tasks such as diagnostics and legal research (Qin et al., 2024). Contrary, industries involving routine manual tasks, such as manufacturing, are also at risk, but the nature of AI's impact may differ, focusing more on automation of repetitive tasks (Fisher et al., 2023)

However, while the adoption of AI may displace human labour it simultaneously creates new opportunities, particularly in fields that require specialized skills such as AI engineering, machine learning, data science, and AI regulation (Liu et al., 2024). Liu et al. (2024) also argue that the demand for AI-related skills is growing rapidly, with significant increases in job postings for job positions that integrate AI into habitual roles. Besides, the number of sectors characterised by low value added and high labour intensity is expected to decrease. Conversely, technology-intensive and knowledge-based sectors are expected to develop, leading to a shift in employment patterns (Liang & Tan, 2024). Tolan et al. (2021) argues that some occupations that had been less affected by previous waves of computerization and automation may now be in a risky position. However, the impact of AI does not necessarily mean automation, but rather a restructuring of some tasks (Tolan et al., 2021).

The most related to our study works also investigate the effects of the development of AI technology on the labour market in terms of online job vacancies (Acemoglu et al., 2022; Goldfarb et al., 2020; Lyu et al., 2021). These studies were conducted on the basis of the U.S. vacancy database provided by Burning Glass Technologies (BGT). The data set consists of job title, firm name, required level of education, work experience and skills. Lyu & Liu (2021) use BGT data to identify the most widely adopted digital technologies from 2010 to 2019 in the U.S. energy sector. Their results show that the share of jobs requiring AI and robotics skills is highest among new digital technologies. Goldfarb et al. (2020) classify posted vacancies in the field of artificial intelligence for hospital jobs between 2015 and 2018 to reveal the level of adoption of AI in healthcare. Acemoglu et al. (2022) report that the share of AI vacancies in the U.S. labour market has increased rapidly over the past decade across sectors, with an especially pronounced growth in sectors like information, professional services, finance, and manufacturing. Moreover, U.S. companies have significantly increased their AI-related postings, which indicates a strong link between AI exposure and the demand for AI skills. Nevertheless, despite the reduction in non-AI vacancies, the overall impact on labour force at the industry level remains undetectable, indicating that AI's effects might not be widespread across the whole labour market up to 2018.

Despite the diversity of existing literature, a precise answer on how AI has affected the labour market across sectors and how this impact has changed over time remains to be found. Furthermore, the previous literature has mainly focused on retrospective data in order to predict the impact of AI on the labour force. Therefore, our study extends the existing literature in several ways. For example, related studies mainly focus on the level of AI adoption by U.S. market and mainly discuss the susceptibility of occupations to the impact of the AI technologies by analyzing the functional characteristics of occupations, while a direct assessment of the impact of AI development on labour demand across different economic sectors has been overlooked. Our research aims to address this gap by conducting a comprehensive exploration of the role of AI in the sectoral marketing landscapes of the United States. We specifically aim to identify the suitability of AI applications for different job sectors using a meticulous and methodical approach. Since the global adoption of AI is still at an early stage, from this point of view we consider the analysis of the impact of AI technology on the labour market over the period of rapid widespread adoption of AI technologies from 2020 to 2024 by using high-frequency and up-to-date data. This allows us to make a more detailed assessment of the impact of AI over time and by level of AI development.

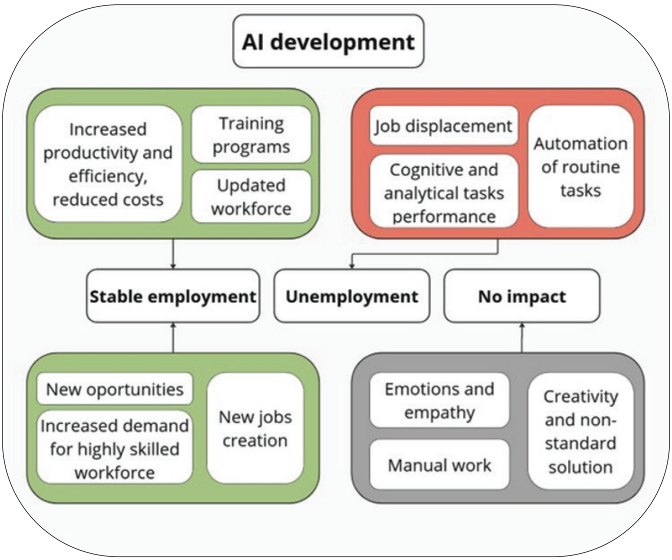
Tolan et al. (2021) ranked occupations in terms of their potential to be affected by AI. Although Tolan et al. (2021) present a ranked from 0 to 1 mathematically calculated values for specific occupation types according to their exposure to artificial intelligence, we specify their classification simplifying it to three groups according to ‘high’, ‘medium’ and ‘low’ degrees of exposure to artificial intelligence. We use the numerical values for different types of occupations reported in Tolan et al. (2021), grouping them according to their belonging to the industries represented in our study. Values less than 0.33 fall into the group of ‘low’ propensity to be affected by AI, between 0.33 and 0.66 into the group with ‘medium’ AI impact on sector performance, and finally between 0.66 and above into the group characterized by ‘high’ AI market pressure on the

U.S. labour market. Thus, Table 1 presents a classification of industries' exposure to artificial intelligence technologies development.

Industry category	Short code	Level of exposure (Tolan et al., 2021)	Expected direction of response
Information Design & Documentation	IDD	High	Negative
IT Operations and Helpdesk	ITOP	High	Negative
Software Development	SOFT	High	Positive
Accommodation and Food service	ACT	Medium	No response
Personal and other services	PERS	Medium	No response
Scientific Research and Development	SCI	Medium	Positive
Cultural and recreational services	CULT	Medium	No response
Finance and Banking	FIN	Medium	Positive
Administration	ADMA	Medium	Negative
Education and Instruction	EDUC	Low	Positive
Engineering/Technicians	ENGI	Low	Positive

Table 1. Industry ranking by exposure to AI

Figure 1 illustrates the theoretical framework of the response of economic sectors to the development of artificial intelligence technologies based on our review of previous studies on the impact of AI on the labour market and in accordance with AI Exposure Score for Occupations (Tolan et al., 2021). Figure 1. The comprehensive impact of AI technology development on the labour market



Hypothesis 1: High-tech industries including Software Development, Scientific Research and Development have a strong positive response to the development and widespread use of AI technologies due to increased demand for a highly skilled workforce.

Hypothesis 2: Industries such as Engineering/Technicians, Finance and Banking, and Education and Instruction have a positive response to the development of AI technologies due to the ability of AI to enhance productivity and efficiency.

Hypothesis 3: Industries that involve the use of cognitive skills and routine tasks, such as Information Design & Documentation, IT Operations and Helpdesk, and Administration have a strong negative reaction to the development and widespread use of AI technologies due to the displacement effect.

Hypothesis 4: The service industries, namely Cultural and recreational services, Personal and other services, and Accommodation and Food service do not respond to the development of AI technologies.

3. Methodology and data description

3.1 Artificial intelligence (AI) usage in the labour markets

Artificial intelligence (AI) has been integrated into various sectors of the labour market, each with its unique applications and impacts. First, in the information design, IT operations and helpdesk and public administration, AI is used to automate tasks, analyze large volumes of data, and improve decision-making processes. It also necessitates new skills to overcome the dynamic challenges posed by AI in these sectors (Kuziemski & Misuraca, 2020). Secondly, the healthcare, education, and social services sectors are less likely to be automated as they require more human interaction and empathy. AI in these sectors is used to enhance service delivery, such as AI-assisted diagnosis in healthcare or personalized learning in education (Kerasidou, 2020). Third, in the construction, engineering, and technicians' sectors, AI is used to address operational and productivity challenges, safety concerns, labour shortages, and cost and schedule overruns. For instance, AI can help in planning and designing construction projects, predicting potential structural issues, and automating routine tasks (Abioye et al., 2021). Fourth, the impact of AI in the trade sector can vary depending on market conditions. AI can help businesses optimize their operations and reduce costs. However, the integration of AI might lead to job displacement and other challenges (Ernst et al., 2019). Fifth, in the task-based roles, AI has a significant impact on task-based roles, where tasks can be automated or assisted by AI. This includes roles in manufacturing, logistics, and other sectors where routine tasks are prevalent (Cheng et al., 2019). Finally, in the entertainment industry, AI is becoming increasingly adept at imitating human work, raising questions about the rights and roles of human actors, writers, and other creators (Han, 2021). Moreover, the impact of AI on the labour market includes changes in employment and wages, transformation of jobs and skill needs, and alterations to the work environment. The adoption and integration of AI into the workplace can lead to increased productivity, new job creation, and economic growth, but it also presents challenges such as potential job losses and rising inequalities.

3.2 Data and Sources

This study employs high-frequency data (5 days a week) from February 2, 2020 to June 6, 2024 to evaluate the impact of artificial intelligence development on the U.S. labour market. Specifically, to capture the progress of AI technology we utilize AI-INDEX 15, which tracks the performance of U.S. companies operating in the artificial intelligence. The AI-INDEX 15 includes 15 companies that design, create, integrate or provide artificial intelligence (AI) in the form of products, software or systems and is calculated by assigning weights to shares of these companies. The rapid development of AI in the last few years may have diminished the creative and intellectual skills of the population, since AI is capable of data analysis, idea creation, problem solving, etc. Thus AI-INDEX 15 allows to account for the development of artificial intelligence and can serve as a proxy to capture the interest of population towards the AI technologies. Moreover, to represent the U.S. labour market, we rely on the Indeed Job Postings Index provided by the Indeed Hiring Lab. We focus on seasonally adjusted sector-level daily data specific to the United States. The analyzed period encompasses the last fourth years, which have witnessed significant advancements in artificial intelligence technology. Table 2 incorporates a detailed description of the variables used in our further analysis.

Variable	Description	Source
AI-INDEX 15	The AI-INDEX comprises 15 stocks of high-growth companies weighted by market capitalization. The companies whose value creation is based on the creation of artificial intelligence products and processes include Dynatrace, DocuSign, iFlytek, Palantir Technologies, Veeva Systems, Ansys, theTradeDesk, CrowdStrike, Fortinet, NICE Ltd. Cadence Design Systems, Synopsys, Palo Alto Networks, ServiceNow.	AI-Index.info
Indeed Job Postings Index	The index is started and set at 100 on 1 February 2020 and is constructed on the basis of a 7-day moving average of the number of vacancy announcements. The seasonal adjustments are made according to historical patterns in 2017-2019.	Indeed Hiring Lab (hiringlab.org)

Table 2. Data description

Our study aims to analyze the influence of AI on the labour market in the United States, by categorizing the different sectors represented by Indeed Hiring Lab into economic industries. Therefore, for a more sophisticated analysis, our study relies on the represented U.S. labour market industries by employing indices derived from the geometric mean. Table 3 presents a classification of sectors according to their affiliation to specific industries. Grouping into respective industries is conducted according to the Job and Industry Classifications List provided by Commonwealth Bank as well as personal considerations.

Short code	Industry category	Sectors
ACT	Accommodation and Food services	Food Preparation and Service
		Hospitality and Tourism
ADMA	Administration	Administrative Assistance
		Medical Information
		Installation and Maintenance
CULT	Cultural and recreational services	Arts and Entertainment
		Media and Communications
		Sports
ENGI	Engineering/Technicians	Civil Engineering
		Electrical Engineering
		Industrial Engineering
		Medical Technician
FIN	Finance and Banking	Accounting
		Banking and Finance
		Insurance
PERS	Personal and other services	Beauty and Wellness
		Cleaning and Sanitation
		Customer Service
		Legal
		Security and Public Safety
SRD	Scientific Research and Development	
EDUC	Education and Instruction	
IDD	Information Design & Documentation	
IT	IT Operations and Helpdesk	
SOFT	Software Development	

Table 3. Classification of U.S. labour market sectors by economic industries

3.2 Econometric methods

Our investigation utilizes two state-of-the-art econometric analysis procedures, namely the cross- quantilogram and TVP-VAR Model with stochastic volatility approaches. These are suitable for investigating the role of AI in the U.S. labour market due to their ability to capture dynamic relationships and directional predictability across different time horizons and market conditions.

3.2.1 Cross-quantilogram (CQ) dependency approach

The CQ approach is particularly adept at measuring the cross-quantile dependence across time series without any moment condition requirement. In this way, this technique is useful for identifying the dependence between AI development and labour market variables across different quantiles of each variable's distribution. The CQ approach proposed by Han et al. (2016) enables the assessment of a non-linear bivariate dependence between the development of AI technology and the U.S. labour market, considering different conditional levels of quantiles.

$$\rho^{\tau}(k) = \frac{\square[\psi_{\tau_1}(\square_{1\square} - q_{1\square}(\tau_1))\psi_{\tau_2}(\square_{2\square-k} - q_{2\square-k}(\tau_2))]}{\sqrt{\square[\psi_{\tau_1}(\square_{1\square} - q_{1\square}(\tau_1))]}\sqrt{\square[\psi_{\tau_2}(\square_{2\square} - q_{2\square}(\tau_2))]}}$$

To address the issue of heteroscedasticity and approximate the null distribution of the cross-

quantilogram in equation (3) and the Q-statistic in equation (2), we employ a stationary bootstrap technique. The results obtained through the cross-quantilogram approach are presented as matrices of heat maps, encompassing 66-day lags, which corresponds to quarterly memory lengths, respectively. Each heatmap consists of a 19x19 grid, totaling 361 cells, representing quantile combinations ranging from 0.05 to 0.95 with a step size of 0.05. The color scale employed in the heatmaps ranges from red to blue, indicating the degree and direction of dependence between the two variables under examination. Specifically, red signifies a positive relationship, blue indicates a negative relationship, and the saturation of the color reveals the intensity of the transmission.

3.2.2 Time-Varying Vector Autoregression model TVP-VAR Model with stochastic volatility

The TVP-VAR approach facilitates the examination of dynamic connections across an array of time horizons, encompassing short-, medium-, and long-term perspectives. This method is useful when investigating the impact of AI development volatility on the U.S. labour market. The Time- Varying Vector Autoregression model (TVP-VAR) devised by Nakajima et al. (2011) considers that the variance of a random process is itself randomly distributed, i.e., it has stochastic volatility distribution. Therefore, the TVP-VAR approach is enforced to measure the degree and sign of volatility transmission between two variables over time.

4. Empirical results

4.1 Descriptive statistics

Table 4 provides the descriptive statistics for demand on labour force among U.S. economic industries constructed using the Indeed Job Postings Index data as well as for Artificial intelligence index 15, which represents the state of AI development. We conduct Skewness (Skew), Kurtosis, and Jarque-Bera (J-B) tests to examine the statistical properties of our variables. The results indicate that all variables exhibit non-normal distributions, except for AI-INDEX 15. To ensure the stationarity of our variables, we employ Augmented Dickey-Fuller (ADF) Unit Root Tests and confirm that all variables are stationary in the first difference.

Statistics	Mean	Median	Max.	Min.	Std. Dev.	Skew	Kurtosis	J-B	ADF	Obs.
ACT	117.1	125.4	174.7	23.2	31.6	-0.9	3.1	139.7[a]	-12.6[a]	1134
ADMA	126.1	130.1	199.9	29.8	31.3	-0.9	3.8	188.1[a]	-10.7[a]	1134
CULT	101	106.7	152.3	25.6	27.2	-0.8	3.3	132.9[a]	-11.2[a]	1134
EDUC	127.8	136.8	185.3	41.3	34.5	-0.9	2.9	155.1[a]	-11.4[a]	1134
ENGI	136.2	148.8	186.4	48.8	35.8	-0.9	2.6	143.6[a]	-11.2[a]	1134
FIN	122.2	124.5	184.8	39.4	28.6	-0.7	3.5	108.7[a]	-11.3[a]	1134
IDD	106.4	102.4	182.4	44.4	34.7	0.4	2.3	56.6[a]	-11.2[a]	1134
IT	108.4	105.9	217.6	51.8	28.4	0.2	2.8	8.9[a]	-11.8[a]	1134
PERS	135.4	142.3	206.8	36.2	33.3	-0.8	3.3	138.1[a]	-15.4[a]	1134
SRD	129.1	130.2	195.1	49.4	30.3	-0.3	2.9	20.1[a]	-11.1[a]	1134
SOFT	123.8	110.2	234.8	53.6	46.8	0.6	2.2	98.1[a]	-11.6[a]	1134
AI-INDEX 15	2930.7	2889.3	4275.7	1326.9	627.1	-0.1	2.8	4.2	-11.7[a]	1134

Table 4. Descriptive statistics

Furthermore, we utilize the slope heterogeneity test proposed by Pesaran & Yamagata (2008) to assess the heterogeneity of slope coefficients. The results, represented in Appendix A, indicate that the null hypothesis (H0) can be rejected based on the p-value, suggesting that the sectors respond differently to AI in general. However, it should be noted that we assume homogeneity of the sector at low levels of AI adoption. In the case of high levels of AI adoption, the effect may be different. Figure 2 depicts the evolution of stock price index of companies engaged in the field of artificial intelligence technologies development, which can stand as an appropriate benchmark for assessing the development of artificial intelligence and the growing interest of the population towards AI. Given the weekly specificity of the data, the AI index experiences a number of prominent periods of ups and downs over the 4-year period, beginning with the Covid-19 pandemic.

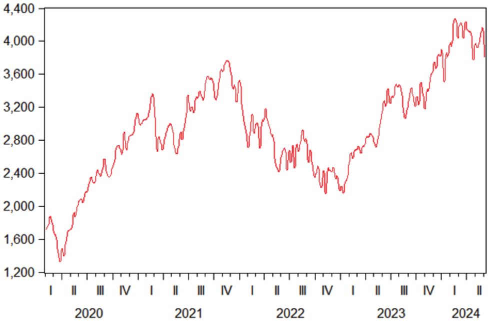


Figure 2. Evolution of the AI-INDEX 15

Thus, the stock prices of AI companies enjoyed rapid growth in 2020; the composite AI-INDEX reached a high of more than 3000 basis points. Although the index was more volatile in 2021 the consistent growth illustrates the undisputed leadership of AI companies in the stock market due to the potential of AI-driven business models. Amid heightened uncertainty in the global financial systems in 2022, the subsequent rise in inflation has led to higher key interest rates, which have particularly affected venture capital-dependent technology stocks and resulted in a sharp fall in the AI-INDEX 15. Having recovered from the blows of the coronavirus pandemic and geopolitical risks, markets have been able to recover on the back of a technological upswing and investor optimism regarding the development of AI systems and software applications, including for example ChatGpt. The explosive development of artificial intelligence technologies and its integration into routine and professional activities has made the potential of AI tangible for everyone.

The United States labour market is represented in our study through 11 specific economic sectors, which are differently exposed to the impact of artificial intelligence. Meanwhile, the demand for labour in these economic sectors varies due to distinct industry structures, the degree of labour intensity of production, the proficiency level of employees, the economic environment, the state tax policy, etc. Besides, the subject of artificial intelligence continues to dominate in the economy, revealing more and more frontiers for its widespread adoption. However, the question regarding the actual impact of artificial intelligence on the demand for labour resources in different sectors of the economy remains open.

Figure 3 illustrates the evolution of job posting indices in the U.S. labour market by economic sector. We observe a certain resemblance in the dynamics of indicators specifically in the period of labour constraints amid the coronavirus pandemic crisis and the subsequent surge in labour demand in 2021 post-crisis time. Interestingly, having reached a certain peak in job openings growth in late 2021 and early 2022, some of the sectoral indices experienced a strongly downward trend, another on the contrary a steady rise, while the performance of the rest almost returned to pre-crisis levels. For instance, Information Design & Documentation, IT Operations and Helpdesk, and Software Development show the sharpest decline during 2023-2024, which can be attributed to the promotion and application of artificial intelligence systems and reduction in labour intensity. Conversely, such economic industries as Engineering/Technicians, Education demonstrated a steady rise in labour demand in 2023-2024 compared to the pre-pandemic Covid-19 period. The remaining part of the sectors demonstrated more resistant to labour market turbulence dynamics, having returned to the pre-crisis level. However, without empirical evaluation we can only hypothesize sectoral differences in the response of U.S. labour market sectors to the development and adoption of AI technologies, according to their potential differences in susceptibility to substitution by AI technologies. Therefore, the following section presents a detailed assessment of the impact of artificial intelligence on the U.S. labour market across various sectors using econometric modeling.

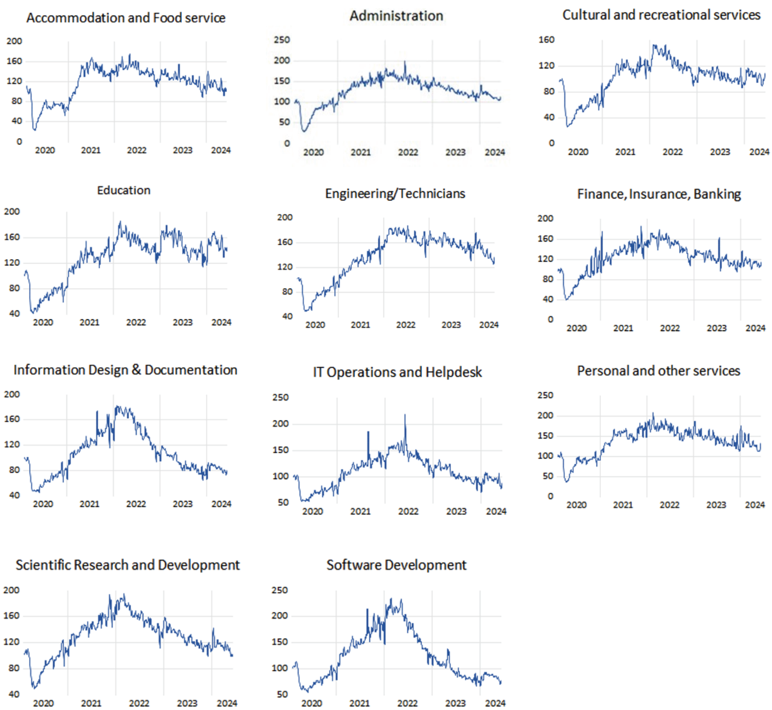


Figure 3. Evolution of economic industries indices calculated based on Indeed Job Postings

3.2 Quantile Response of U.S. sectoral labour market to the artificial intelligence (AI) development

This section explores the interconnection between the U.S. labour market and the development of the artificial intelligence market using the cross-quantilogram approach. The results obtained are visualized through heat map matrices displayed in Figures 4-5. In these heat maps, the vertical axis represents the values of the AI index, while the horizontal axis corresponds to the quantile distribution associated with each sector of the labour market. The color scale employed, ranging from blue to red, indicates the magnitude and direction of the response between the variables. Blue represents negative values of cross-quantile dependence, while red signifies positive values. We set the lag number at 66, which effectively captures the response of the U.S. labour market to changes in the artificial intelligence market after a single quarter. Results with fewer lags were found to be statistically insignificant, which is logical considering the labour market's limited ability to swiftly and noticeably react. Notably, positive reactions are observed across all sectors of the economy at the low quantiles of the AI-INDEX 15. However, the previously conducted slope heterogeneity test confirmed the variation in economic sectors' responses to artificial intelligence. Consequently, our focus primarily lies on reactions occurring at high levels of artificial intelligence, thus considering the impact of advanced technological development on different sectors of the U.S. labour market.

Figures 4-5 demonstrate the quantile response of labour market conditions to changes in the artificial intelligence industry. To provide a better perception of the results, the obtained heatmap matrices are organized according to the degree to which the labour market are related to the AI industry. Therefore, Figure 4 showcases the outcomes derived from the cross-quantilogram approach applied to the relevant job sectors. The findings reveal a critical landscape within the

U.S. job market, as it encompasses both positive and negative responses to AI technologies. We observe a strong positive reaction at low and middle quantiles (0.2-0.65 quantiles) of the AI index and IT-related sectors, including Software Development and Scientific Research and Development. This response is attributed to high interest in the labour force in this sector during the time of moderate development of AI, which required large recruitment of specialists for the development of IT, including the creation of AI-based applications and services, and the integration of AI into various areas of human activity. Conversely, our results reveal a slightly negative response in the context of IT Operations and Helpdesk and Scientific Research and Development. This discovery paints a critical picture of the U.S. sectoral landscape where the influence of AI applications is significant. Additionally, among such industries as Information Design & Documentation and Scientific Research and Development exhibit a strong negative reaction on the high quantiles of both indicators, implying that the development of AI has lessened the demand for human resources in these sectors. However, in the areas of information, design and documentation, and software development, AI

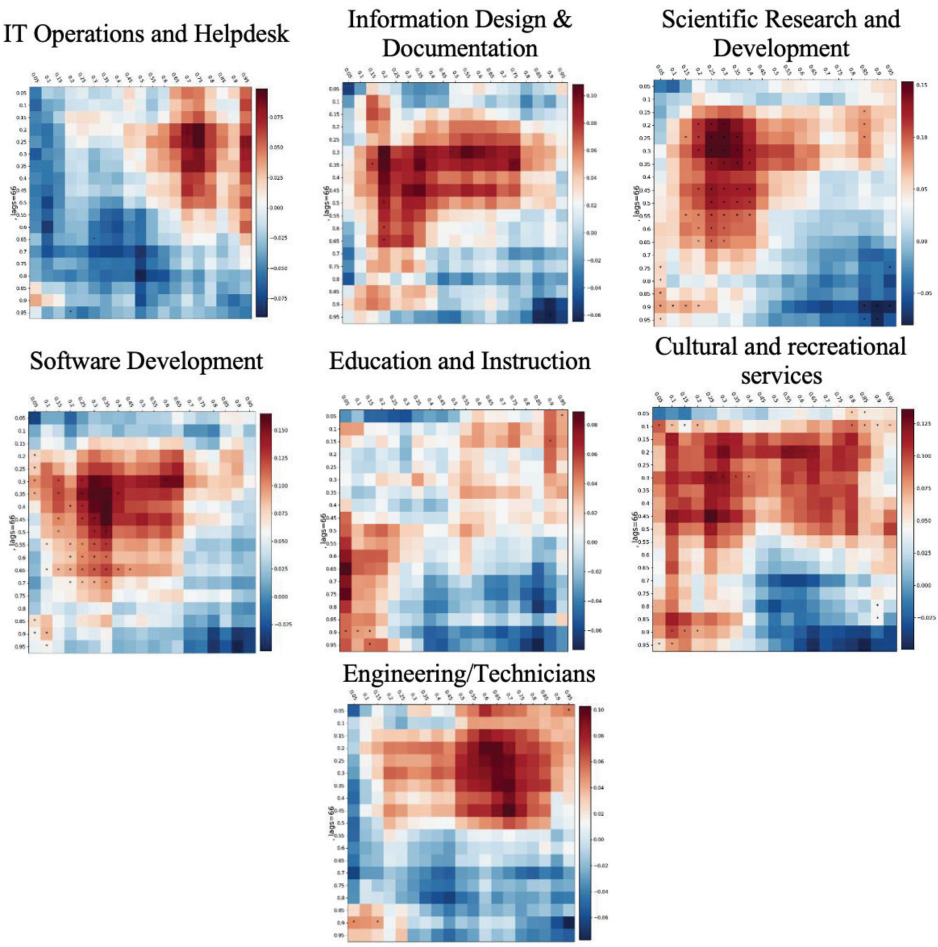


Figure 4. AI development and relevant job sector nexus

applications appear to foster a beneficial equilibrium between human labour and AI operations (Acemoglu & Restrepo, 2018), thereby contributing to the continued growth and development of U.S. tech industries.

Intriguingly, sectors with elevated communication requirements, such as Cultural and recreational services, Education and Instruction exhibit a modest positive response to the advancements in AI development. Consequently, these sectors, characterized by a lower level of exposure to AI, can be classified as having a higher positive impact of AI. Besides, a weak positive response to high values of the AI index is observed in such sectors as Engineering/Technicians, where the workflow requires a high level of professional skills in both cognitive and manual tasks. The rapid integration of AI into production and technological processes increases the demand for specialists capable of skillfully using AI technologies to automate work projects and increase productivity.

Figure 5 unveils the outcomes derived from the cross-quantile dependency analysis for sectors characterized by low relevance to AI. We observe that when the market for AI technologies is in a bearish condition (low quantiles), the sectors displayed in Figure 5 exhibit moderately positive reactions. Of particular significance is the notable negative response, denoted by a significance sign (*), observed in the Accommodation and Food services, Personal and other services. The adoption of artificial intelligence in daily life simplifies the process of using accommodation, food services and personal services, which determines the negative response of Accommodation and Food services and Personal and other services sectoral indices at high quantiles of the artificial intelligence index (0.8-0.95 quantiles). Interestingly, we find a lack of response in Administration and Finance and Banking of the U.S. labour market. Consequently, this sector can be classified as having a comparatively low impact of AI at the current stage. This could be due to the complex nature of these sectors, where human expertise and personal touch are still crucial and cannot be fully replaced by AI. It might also be a result of these sectors being in the early stages of AI adoption, with the full impact of AI yet to be realized. These findings underscore the multifaceted impact of AI across different sectors, highlighting the need for tailored strategies to harness the benefits of AI while mitigating its potential negative effects.

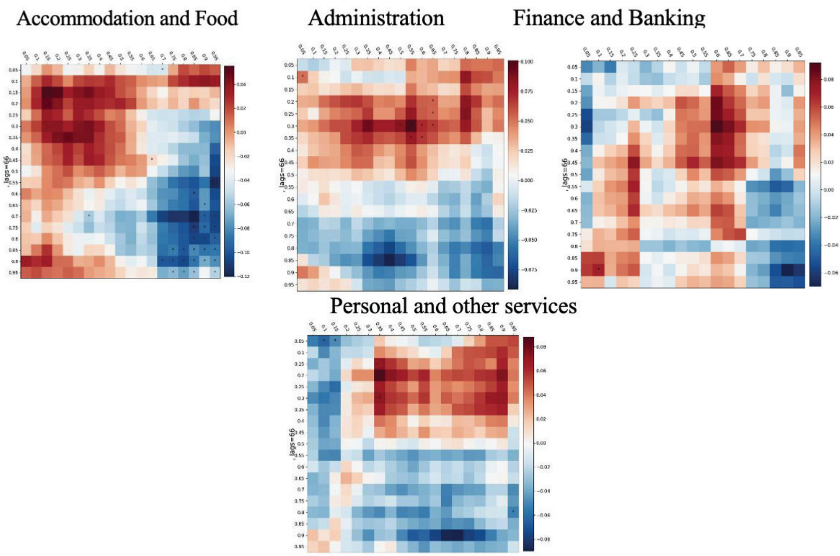


Figure 5. AI development and low-relevant job sector nexus

The impact of AI development on different sectors of the U.S. labour market at different quantiles can also be estimated by using cross-quantilogram based on rolling-window technique. Setting the size of the rolling window equal to 252 days (1 year) we study the time-varying linkage between the two timeseries to make a robustness check for our main results. The results of rolling- window cross-quantilogram are presented in Appendix B. We provide results on the dynamic impact of AI development on shifts in demand in the U.S. labour market by considering this relationship at the middle quartiles, i.e., given that Tau is equal to 0.5. The blue line indicates how the level online postings respond to the AI development over time, while the red lines mark the borders of the 90% confidence interval. Therefore, we observe a positive shift in labour demand in industries such as Scientific Research and Software Development and Education especially from 2022 amid the rapid development of AI technologies. Service-oriented industries exhibit a smooth decline in response to AI, highlighting their inability to be replaced at the current stage. The obtained results are consistent with prior findings.

3.3 Dynamic Response of U.S. sectoral labour market to the artificial intelligence (AI) development by using TVP-VAR Model with Stochastic Volatility

To estimate the impact of AI development on U.S. labour market sectors, considering different phases of AI market development and periods of high economic uncertainty, including the global lockdown during the COVID-19 pandemic, we apply a time-varying vector autoregression (TVP- VAR) model. This model uses rolling windows to capture the time dynamics and stochastic volatility of the parameters. A Markov Chain Monte Carlo (MCMC) simulation technique with 1,000 samples is employed to evaluate the model.

The results of quantile dependence provide a general overview of the labour market's exposure to AI, while the TVP-VAR approach measures the variation of this response over time. Figures 6-7 display the impulse response functions of sectoral new job posting indices in response to changes in the AI market. During the COVID-19 pandemic, although the demand for labour in all sectors of the U.S. labour market plunged, this may not be directly associated with the low level of AI market development. However, almost all economic sectors experienced relatively small declines in industry-specific new job postings indices, driven by the AI industry's development in early 2021.

The impulse response functions depicted in Figure 6 indicate a strong surge in labour demand in such AI related sectors as Information Design & Documentation and Software Development, where the creation of GhatGPT and enhancements to other machine learning algorithms appear to have boosted the demand for specialists capable of using AI algorithms in order to automate workflows, as well as being able to enhance existing technologies. Conversely, a reverse dynamic is evident in such sectors as IT Operations and Helpdesk and Scientific Research and Development, implying that the development of AI has lessened the demand for human resources in these sectors. Moreover, as for the Education and Instruction sector, we observe a negative response during the period of economic slowdown in the U.S. economy in 2022, while a positive response is evident during 2023-2024, indicating that AI stimulates new openings in the education market due to the integration of AI and machine learning technologies into the educational process. AI technologies like ChatGPT have also been used to facilitate automated conversations and generate human-like text, which has broad implications for teaching and learning (Jarrahi, 2018). Similar trends can be observed in the Engineering related market, where the rapid integration of AI into production and technological processes increases the demand for specialists capable of skillfully using AI technologies to automate work projects and increase productivity.

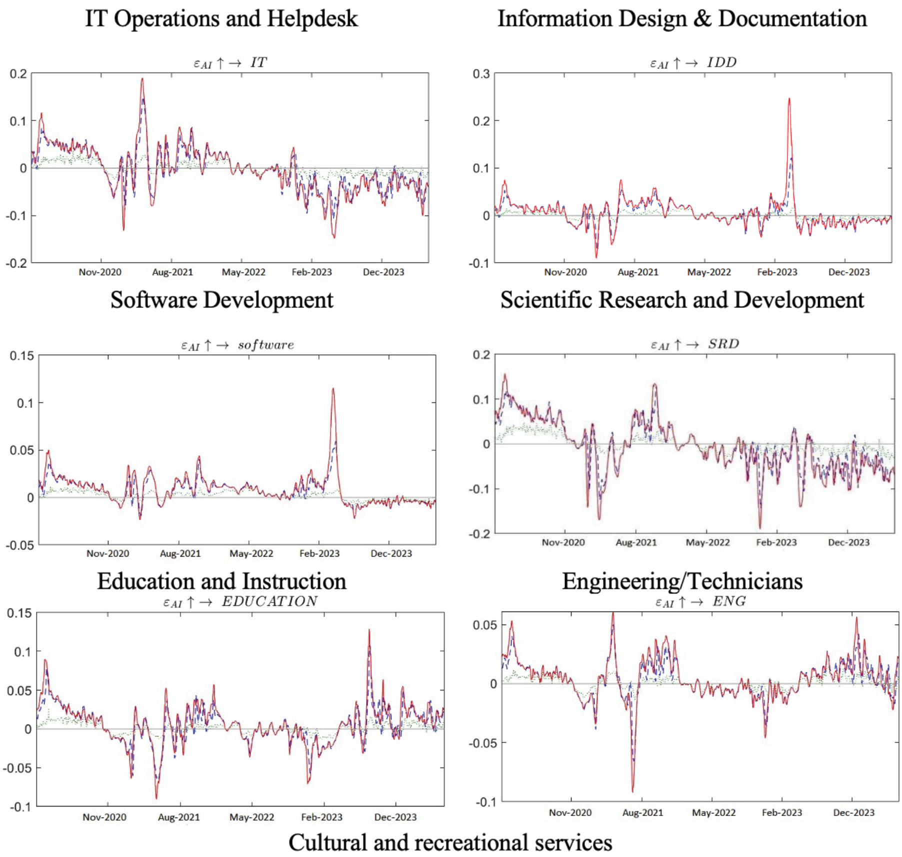


Figure 6. Time-varying impulse responses for relevant job sectors, 1-,5-,10-period ahead

Figure 7 illustrates the impulse responses of low relevant job sectors to changes in the AI market. Among sectors with potentially medium exposure to AI, including Accommodation and Food services, Administration, Finance and Personal and other services, a strong negative reaction is observed since early 2023, which corresponds to a period of rapid development and widespread use of AI technologies. Thus, these U.S. labour sectors, where the adoption of artificial intelligence greatly simplifies workflows, tend to have a negative trend of decreasing labour demand as a result of AI development.

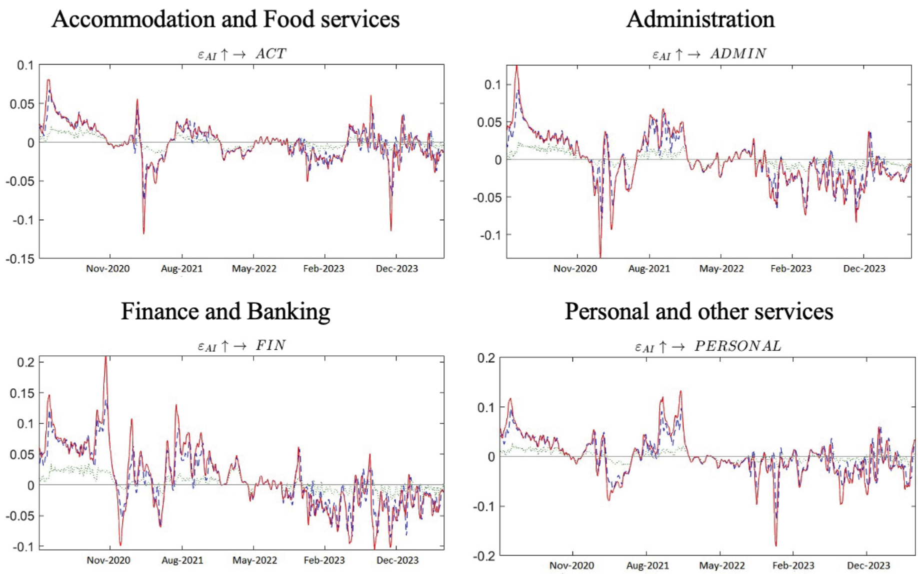


Figure 7. Time-varying impulse responses for low relevant job sectors, 1-,5-,10-period ahead

4. Discussion

Our research provides a comprehensive analysis of the impact of AI development on various sectors of the U.S. labour market, revealing several crucial insights that have significant implications for both policymakers and industry stakeholders. Therefore, our findings indicate that the integration of AI technologies can on the one hand yields a reduction in human employment levels, and on the other hand have the opposite effect, wherein positive influences of AI development are observed in enhancing labour potentials, irrespective of the market conditions. Based on obtained results, we introduce a classification of U.S. labour market sectors according to their empirically validated exposure to AI development (Table 5). We compare the findings on the impact of artificial intelligence on the U.S. labour market by sector, comparing with the classification presented in the study by Tolan et al. (2021). Our results suggest the varying degrees and directions of sectroral job indices exposure to the AI market, including both positive and negative reactions, as well as no meaningful response at all. Overall, our results are consistent with the findings of Tolan et al. (2021) but highlight the direction of AI's impact on the U.S. labour market.

Industry category	Short code	Level of exposure (Tolan et al., 2021)	Expected direction of response	Actual direction of response
Information Design & Documentation	IDD	High	Negative	Negative
IT Operations and Helpdesk	ITOP	High	Negative	Negative
Software Development	SOFT	High	Positive	Positive
Accommodation and Food service	ACT	Medium	No response	Negative
Personal and other services	PERS	Medium	No response	Negative
Scientific Research and Development	SCI	Medium	Positive	Positive
Cultural and recreational services	CULT	Medium	No response	Positive
Finance and Banking	FIN	Medium	Positive	No response
Administration	ADMA	Medium	Negative	No response
Education and Instruction	EDUC	Low	Positive	Positive
Engineering/Technicians	ENGI	Low	Positive	Positive

Table 5. Sector ranking by exposure to AI, expected and actual direction of response

This study builds on and extends the existing literature on the effects of AI and other technological developments on social and economic processes. For instance, Webb (2019) predicts the impact of AI technologies on occupations by analyzing job task descriptions and patents. Webb's assertion that AI handles tasks involving judgment and decision optimization, distinct from previous technologies, is consistent with our finding that AI significantly promotes job opportunities in sectors like Scientific Research and Development, Software Development, Education. These sectors benefit from AI's ability to enhance productivity and innovation, supporting the notion that AI complements rather than replaces human labour in these fields. The widespread incorporation of AI across industries has concurrently catalyzed new opportunities for human labour within various markets' production processes (Tschang & Almirall, 2021). From this perspective our findings are consistent with Liu et al. (2024) and Liang & Tan (2024) that AI development creates new opportunities in sectors that require specialized skills of AI engineering, machine learning, data science, and AI regulation. Thus, we confirm hypothesis 1 and state that Software Development and Scientific Research and Development industries respond positively to the AI development due to the increased demand for highly skilled labour force.

Our study also aligns with Alderucci et al. (2020) and Damioli et al. (2021), who found that AI-related patent innovations increase worker productivity. By using high-frequency data, our research captures the dynamic impact of AI over time, reinforcing the idea that AI can enhance job creation in certain sectors. Additionally, our research extends the seminal work of Autor et al. (2003) and Brynjolfsson & McAfee (2012), who distinguish between cognitive and manual tasks, and routine and non-routine tasks. While AI can substitute routine tasks, our findings show that sectors that require predominantly non-routine tasks, especially those requiring creativity and complex decision-making, benefit from AI augmentation. In particular, our results indicate the positive impact of AI development in education and engineering sectors by increasing efficiency and productivity, which is in line with Damioli et al. (2023). Moreover, in the education sector, AI technologies like ChatGPT have been used to facilitate automated conversations and generate human-like text, which has broad implications for teaching and learning (Jarrahi, 2018). Thus, we also confirm the second hypothesis. Hence, such industries as Engineering/Technicians and Education and Instruction tend to increase demand for labour force due to the ability of workers to use AI technologies to increase personal efficiency and labour productivity.

Our findings also reveal a negative response of a number of sectors to the AI development, indicating the probability of displacement, especially in such sectors as IT Operations and Helpdesk and Information Design & Documentation. This can be attributed to the pronounced role of AI in displacing human labour, where human workers face challenges in competing with the efficiency and capabilities offered by AI-powered operations, which is in line with Minevich (2023). Moreover, our findings on the negative impact on these sectors are consistent with Huang and Rust (2018), who argue that the disruption caused by AI might lead to job displacement. This highlights the need for targeted policies to support workforce transitions in these vulnerable sectors, as AI-driven automation may lead to job displacement without corresponding new job opportunities. Therefore, we also confirm the third hypothesis related to the negative impact of AI development on the industries that involve the use of cognitive skills and routine tasks.

Our results also highlight the positive response of demand for working force to AI development among service-related sector as Cultural and recreational services. Where the exposure to AI is relatively lower, the integration of AI technologies complements human labour by fostering collabouration and enhancing human skills, thereby establishing a working environment that synergistically combines the efforts of human labour and AI technologies in the United States (Tschang & Almirall, 2021). Based on this we can’t accept the fourth hypothesis and argue that service-related industries are also susceptible to the impact of AI development.

Our study is also closely related to the works of Acemoglu et al. (2022), Goldfarb et al. (2020), and Lyu et al. (2021), who investigate the effects of AI on the labour market through online job vacancies. Unlike these studies, which primarily focus on the level of AI adoption, our research directly assesses the impact of AI development on job creation across different sectors. By using high frequency and up-to-date data, our study provides a more detailed and timely assessment of AI's impact, addressing the gap in the literature regarding the sector-specific effects of AI over time. In general, our research contributes to the existing body of knowledge by providing a nuanced understanding of how AI development influences the U.S. labour market. By disaggregating job market sectors and using high-frequency data, we offer valuable insights into nonlinear impacts of AI in terms of the degree of development of technology and economic sectors. This is further supported by Nguyen & Vo (2022), who document a non-linear relationship between AI and unemployment, suggesting that AI's impact varies with economic conditions, which our analysis also confirms. Our findings can inform targeted policy interventions, promote economic equity, and support workforce resilience in the face of rapid technological change.

5. Conclusion and policy implications

The exponential rise in AI adoption within the labour market has ignited a profound and ongoing debate surrounding the implications of AI implementation for the human labour force. Some proponents argue that the integration of AI leads to a reduction in human labour, while others assert that it enhances their capabilities by seamlessly integrating advanced technological operations, especially within the realm of marketing. Amid this debate, this analysis delves into the relationship between AI and the U.S. sectoral job markets, employing a cross-quantilogram approach and utilizing daily data spanning from February 2, 2020, to June 6, 2024. The findings of this study remain robust across the TVP-VAR model with stochastic volatility.

Remarkably, the findings of this study shine light predominantly on the positive cross- quantilogram dependency between AI adoption and U.S. sectoral labour markets, particularly in sectors with higher, medium, and lower exposure to AI, regardless of prevailing market conditions. This suggests that the application of AI in these sectors is yet to complement human labour, resulting in the presence of collabourations between AI and human workers. Conversely, it is observed that all levels (higher, medium, and lower) of AI involvement in U.S. job markets contribute to a slight reduction in job opportunities for human labour, as demonstrated by the negative cross-quantilogram dependency between AI adoption and U.S. sectoral labour markets. This phenomenon can be attributed to the replacement of human workers by AI implementation in intricate technological processes that require sophisticated handling. Industries grappling with high-volume computational processes and complex algorithmic tasks often find human labour insufficient to cope with the demands, leading to the displacement of human workers in favour of AI systems. However, it is crucial to recognize that the impact of AI on employment is not solely determined by the technology itself. Rather, it is shaped by a multitude of factors including industry dynamics, workforce skills, and policy frameworks.

Based on these findings, this research provides some policy implications. First, policymakers should focus on increasing investments in sectors where AI development has been shown to significantly promote job opportunities, such as Scientific Research and Development, Software Development, Education, and Culture and Recreation. This could include funding for AI research, subsidies for companies innovating with AI, and training programs to prepare workers for jobs in these fields. Secondly, for sectors where AI development has a negative or negligible impact on job creation, such as Accommodation, Finance, and Personal Services, policymakers should implement support programs to aid workers transitioning to more AI-resilient jobs. This might include retraining initiatives, unemployment benefits, and incentives for companies to diversify their business models to integrate AI more effectively. Thirdly, reform educational curricula to include AI-related skills and promote lifelong learning programs to help workers continually adapt to technological changes. This includes integrating AI and data science courses in higher education and providing continuous professional development opportunities. Finally, ensure that AI development and implementation strategies are inclusive and consider the socio-economic disparities across different regions and communities. Policies should aim to mitigate the risks of job displacement and ensure that the benefits of AI are widely distributed, promoting economic equity.

6. Limitations and further research opportunities

Like any academic endeavour, this study is not without its limitations. Firstly, the primary analytical framework of the study hinges on a cross-quantilogram-based dependency analysis, which diverges from a causal inference approach. This methodological choice may limit the depth of conclusions drawn regarding cause-effect relationships between AI adoption and labour market outcomes. Secondly, the geographical scope of the study is confined to the United States, representing one of the high robot density countries. However, the study does not extend its analysis to other countries with significant robot density such as Singapore, Japan, and South Korea. While this focus allows for an in-depth exploration of the U.S. context, it may limit the applicability of the findings to other national contexts.

Given these limitations, there are several promising avenues for further research. Future studies could benefit from the implementation of causal inferential techniques to deepen our understanding of the causal relationships between AI adoption and labour market outcomes. Additionally, adopting a cross-sectional study design under a comparative analysis framework could enhance the generalizability of the findings. This would allow for a broader exploration of AI's impact on labour markets across different national contexts, further enriching the discourse on this critical topic.

References

1. Abioye, S. O., Oyedele, L. O., Akanbi, L., Ajayi, A., Delgado, J. M. D., Bilal, M., ... & Ahmed, A. (2021). Artificial intelligence in the construction industry: A review of present status, opportunities and future challenges. Journal of Building Engineering, 44, 103299.
2. Acemoglu, D., & Restrepo, P. (2018). Artificial intelligence, automation, and work. In The economics of artificial intelligence: An agenda (pp. 197-236). University of Chicago Press.
3. Acemoglu, D., & Restrepo, P. (2019). Automation and new tasks: How technology displaces and reinstates labor. Journal of Economic Perspectives, 33(2), 3-30.
4. Acemoglu, D., Autor, D., Hazell, J., & Restrepo, P. (2022). Artificial intelligence and jobs: Evidence from online vacancies. Journal of Labor Economics, 40(S1), S293-S340.
5. Ahmed, S., Alshater, M. M., El Ammari, A., & Hammami, H. (2022). Artificial intelligence and machine learning in finance: A bibliometric review. Research in International Business and Finance, 61, 101646.
6. Alderucci, D., Branstetter, L., Hovy, E., Runge, A. & Zolas, N. (2020). Quantifying the impact of AI on productivity and labor demand: Evidence from U.S. census microdata. In Paper presented at the Allied Social Science Associations—ASSA 2020 Annual Meeting.
7. Artificial Intelligence (AI). United States Department of State. URL: https://www.state.gov/artificial-intelligence/.
8. Autor, D. H., Levy, F., & Murnane, R. J. (2003). The skill content of recent technological change: An empirical exploration. The Quarterly journal of economics, 118(4), 1279-1333.
9. Beede, D., Brynjolfsson, E., Buffington, C., Dinlersoz, E., Foster, L., Goldschlag, N., & Zolas, N. (2020). Measuring Technology Adoption in Enterprise-Level Surveys: The Annual Business Survey. Washington, DC: US Census Bureau working paper.
10. Bessen, J. E., Impink, S. M., Reichensperger, L., & Seamans, R. (2018). The business of AI startups. Boston Univ. School of Law, Law and Economics Research Paper, (18-28).
11. Brynjolfsson, E., & McAfee, A. (2012). Race against the machine: How the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy. Brynjolfsson and McAfee.
12. Brynjolfsson, E., Rock, D., & Syverson, C. (2019). Artificial intelligence and the modern productivity paradox. The economics of artificial intelligence: An agenda, 23, 23-57.
13. Carbonero, F., Davies, J., Ernst, E., Fossen, F. M., Samaan, D., & Sorgner, A. (2023). The impact of artificial intelligence on labor markets in developing countries: a new method with an illustration for Lao PDR and urban Viet Nam. Journal of Evolutionary Economics, 33(3), 707-736.
14. Cheng, Y., Sun, F., Zhang, Y., & Tao, F. (2019). Task allocation in manufacturing: A review. Journal of Industrial Information Integration, 15, 207-218.
15. 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.
16. Damioli, G., Van Roy, V., & Vertesy, D. (2021). The impact of artificial intelligence on labor productivity. Eurasian Business Review, 11, 1-25.
17. Damioli, G., Van Roy, V., Vertesy, D., & Vivarelli, M. (2023). AI technologies and employment: micro evidence from the supply side. Applied Economics Letters, 30(6), 816-821.
18. Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., ... & Williams, M. D. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. International Journal of Information Management, 57, 101994.
19. Esmaeily, R., Razavi, M. A., & Razavi, S. H. (2024). A step forward in food science, technology and industry using artificial intelligence. Trends in Food Science & Technology, 143, 104286.
20. Fisher, E., Flynn, M. A., Pratap, P., & Vietas, J. A. (2023). Occupational safety and health equity

impacts of artificial intelligence: a scoping review. International journal of environmental research and public health, 20(13), 6221.
21. Goldfarb, A., Taska, B., & Teodoridis, F. (2020). Artificial intelligence in health care?
22. Evidence from online job postings. In AEA Papers and Proceedings (Vol. 110, pp. 400-404).
23. Han H., Linton O., Oka T., Whang, Y.-J. (2016). The cross-quantilogram: Measuring quantile dependence and testing directional predictability between time series. Journal of Econometrics, 193 (1), 251-270.
24. Han, S. (2021). AI, culture industries and entertainment. In The Routledge Social Science Handbook of AI (pp. 295-312). Routledge.
25. Huang, M. H., & Rust, R. T. (2018). Artificial intelligence in service. Journal of service research, 21(2), 155-172.
26. Hui, X., Reshef, O., & Zhou, L. (2024). The short-term effects of generative artificial intelligence on employment: Evidence from an online labor market. Organization Science, 35(6), 1977-1989.
27. Jarrahi, M. H. (2018). Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making. Business horizons, 61(4), 577-586.
28. Javaid, M., Haleem, A., Khan, I. H., & Suman, R. (2023). Understanding the potential applications of Artificial Intelligence in Agriculture Sector. Advanced Agrochem, 2(1), 15-30.
29. Kerasidou, A. (2020). Artificial intelligence and the ongoing need for empathy, compassion and trust in healthcare. Bulletin of the World Health Organization, 98(4), 245.
30. Kim, S. W., Kong, J. H., Lee, S. W., & Lee, S. (2022). Recent advances of artificial intelligence in manufacturing industrial sectors: A review. International Journal of Precision Engineering and Manufacturing, 1-19.
31. Kuziemski, M., & Misuraca, G. (2020). AI governance in the public sector: Three tales from the frontiers of automated decision-making in democratic settings. Telecommunications policy, 44(6), 101976.
32. Lane M., Saint-Martin A. (2021). The impact of Artificial Intelligence on the labour market: What do we know so far?. OECD Social, Employment and Migration Working Papers, 256.
33. Leigh, N. G., Kraft, B., & Lee, H. (2020). Robots, skill demand and manufacturing in US regional labour markets. Cambridge Journal of Regions, Economy and Society, 13(1), 77-97.
34. Liang, S., & Tan, Q. (2024). Can the digital economy accelerates China's export technology upgrading? Based on the perspective of export technology complexity. Technological Forecasting and Social Change, 199, 123052.
35. Liu, J., Chen, K., & Lyu, W. (2024). Embracing artificial intelligence in the labour market: the case of statistics. Humanities and Social Sciences Communications, 11(1), 1-14.
36. Lyu, W., & Liu, J. (2021). Artificial Intelligence and emerging digital technologies in the energy sector. Applied energy, 303, 117615.
37. Manyika, J., Lund, S., Chui, M., Bughin, J., Woetzel, J., Batra, P., Ko, R, Sanghvi, S. (2017). Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages. URL: https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the- future-of-work-will-mean-for-jobs-skills-and-wages#/.
38. McElheran, K., Li, J. F., Brynjolfsson, E., Kroff, Z., Dinlersoz, E., Foster, L., & Zolas, N. (2024). AI adoption in America: Who, what, and where. Journal of Economics & Management Strategy, 33(2), 375-415.
39. Minevich, M. (2023). Our Planet Powered by AI: How We Use Artificial Intelligence to Create a Sustainable Future for Humanity. John Wiley & Sons.
40. Muro, M., Maxim, R., & Whiton, J. (2019). Automation and artificial intelligence: How machines are affecting people and places. Brooking Institution. URL: https://www.brookings.edu/wp-content/uploads/2019/01/2019.01_BrookingsMetro_Automation- AI_Report_Muro-Maxim-Whiton-FINAL-version.pdf.
41. Mutascu, M. (2021). Artificial intelligence and unemployment: New insights. Economic Analysis and Policy, 69, 653-667.

42. National Artificial Intelligence Initiative Act of 2020, DIVISION E § 5001 (2020). URL: https://www.congress.gov/116/crpt/hrpt617/CRPT-116hrpt617.pdf#page=1213.
43. Nguyen, Q. P., & Vo, D. H. (2022). Artificial intelligence and unemployment: An international evidence. Structural Change and Economic Dynamics, 63, 40-55.
44. Nti, I. K., Adekoya, A. F., Weyori, B. A., & Nyarko-Boateng, O. (2022). Applications of artificial intelligence in engineering and manufacturing: a systematic review. Journal of Intelligent Manufacturing, 33(6), 1581-1601.
45. Oxford Economics (2019). How robots change the world. Retrieved from https://resources.oxfordeconomics.com/hubfs/
46. Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. Journal of econometrics, 142(1), 50-93.
47. Pizzinelli, C., Panton, A. J., Tavares, M. M. M., Cazzaniga, M., & Li, L. (2023). Labor market exposure to AI: Cross-country differences and distributional implications. International Monetary Fund.
48. Qin, M., Chang, H. L., Su, C. W., Răcătăian, R. I., & Crăciun, A. F. (2024). Substitution or creation? Identifying the role of artificial intelligence in employment. Technological and Economic Development of Economy, 1-22.
49. Rane, N., Choudhary, S. P., & Rane, J. (2024). Acceptance of artificial intelligence: key factors, challenges, and implementation strategies. Journal of Applied Artificial Intelligence, 5(2), 50-70.
50. Reddy, S. (2022). Explainability and artificial intelligence in medicine. The Lancet Digital Health, 4(4), e214-e215.
51. Rikap, C. (2024). Varieties of corporate innovation systems and their interplay with global and national systems: Amazon, Facebook, Google and Microsoft's strategies to produce and appropriate artificial intelligence. Review of International Political Economy, 1-29.
52. Sorensen, G., Dennerlein, J. T., Peters, S. E., Sabbath, E. L., Kelly, E. L., & Wagner, G.
53. R. (2021). The future of research on work, safety, health and wellbeing: A guiding conceptual framework. Social science & medicine, 269, 113593.
54. Tolan, S., Pesole, A., Martínez-Plumed, F., Fernández-Macías, E., Hernández-Orallo, J.,
55. & Gómez, E. (2021). Measuring the occupational impact of AI: tasks, cognitive abilities and AI benchmarks. Journal of Artificial Intelligence Research, 71, 191-236.
56. Tschang, F. T., & Almirall, E. (2021). Artificial intelligence as augmenting automation: Implications for employment. Academy of Management Perspectives, 35(4), 642-659.
57. U.S. Bureau of Labor Statistics. URL: https://www.usa.gov/federal-agencies/bureau-of- labor-statistics.
58. U.S. Department of Labor (2022). Retrieved from https://www.bls.gov/.
59. Wang, X., Chen, M., & Chen, N. (2024). How artificial intelligence affects the labour force employment structure from the perspective of industrial structure optimisation. Heliyon, 10(5).
60. Webb, M. (2019). The impact of artificial intelligence on the labor market. Available at SSRN 3482150.
61. Wu, E., Wu, K., Daneshjou, R., Ouyang, D., Ho, D. E., & Zou, J. (2021). How medical AI devices are evaluated: limitations and recommendations from an analysis of FDA approvals. Nature Medicine, 27(4), 582-584.
62. Wu, J., Wang, X., Dang, Y., & Lv, Z. (2022). Digital twins and artificial intelligence in transportation infrastructure: Classification, application, and future research directions. Computers and Electrical Engineering, 101, 107983.
63. Yang, C. H. (2022). How artificial intelligence technology affects productivity and employment: firm-level evidence from Taiwan. Research Policy, 51(6), 104536.
64. Zarifhonarvar, A. (2024). Economics of chatgpt: A labor market view on the occupational impact of artificial intelligence. Journal of Electronic Business & Digital Economics, 3(2), 100- 116.
65. Zhang, C., & Lu, Y. (2021). Study on artificial intelligence: The state of the art and future prospects. Journal of Industrial Information Integration, 23, 100224.

CHINA

Sun Yixuan
Master student

Shandong Normal University,
(SDNU)

How new technologies are transforming Chinese language learning: global practices and BRICS cooperation based on AI breakthroughs in 2025

[Abstract] Currently, artificial intelligence technologies allowed breakthrough development in education and are fundamentally reshaping the ecosystem of language education, and the field of Chinese language learning is undergoing personalized, immersive, and intelligent changes. This paper analyzes the experiences of BRICS countries in Chinese language teaching, integrates recent data and research examples, evaluates the potential and risks of AI tools, and proposes a synergistic development path balancing technological capabilities and humanistic values.

I. Three key AI breakthroughs in Chinese studies in 2025

Owing to the revolutionary innovations in AI technology, there are three key breakthroughs in Chinese language learning at present:

1. Personalized learning: from "unified teaching" to "precise adaptation"

AI is able to dynamically analyze students' language skills through natural language processing (NLP) and machine learning algorithms to create personalized learning programs. For example:

(1) Adaptive learning platforms (e. g., the Chinese version of Duolingo): based on recordings of student responses and voice data, course difficulty is adjusted in real time, which in turn improves learning efficiency by 30%.

(2) Smart grammar correction tools (e. g., Chinese version of Grammarly): provide instant feedback when errors are detected, support double parsing of grammar rules and cultural contexts, and reduce anxiety while learning a foreign language.

(3) Virtual AI conversationalists (e. g., Tandem AI): simulate real-life social scenarios and practice spoken Chinese to overcome the "dumb Chinese" dilemma.

Advantages: significant improvement of learning efficiency, adaptation to the needs of students with multilingual backgrounds; disadvantages: over-reliance on algorithms can weaken cultural understanding, e. g., contextual dependence of idiomatic allusions is difficult to fully understand with AI.

2. Immersive experiences: from "two-dimensional elements" to "multidimensional perception"

(1) Virtual cultural experiences (e. g., "VR class on Chinese history"): students can "visit" the Forbidden City or the Mogao Caves in Dunhuang and learn about the evolution of Chinese characters and history through interactive scenarios.

(2) AR-based real-time translation tools (e. g. Chinese version of Google Lens): scanning Chinese characters instantly displays the translation and pronunciation, expanding their practical applications.

(3) Data supports: the global VR/AR education market is 18 billion dollars with an annual growth rate of 40%; MIT research has shown that immersive learning increases language memorization by 45%.

3. Intelligent assessment: from "result-oriented" to "process optimization"

(1) Emotional monitoring systems (e. g., Goodville's Sara assistant): detecting student attention distraction and dynamically adjusting learning content. In addition, students are now wearing smart watches that have multiple monitoring functions, including psychological monitoring in addition to external security, e. g., there are Little Genius and Huawei Children's Watch in the Chinese market that have this function. In this way, a contribution is made to optimize the learning process.

(2) Multimodal assessment tools (e.g., KDDI Speaking Assessment): combining phonological, semantic, and intonation multidimensional criteria to identify pronunciation deficiencies.

2. The dual nature of technology: a dialectic of opportunities and risks.

On one hand, technological innovations can contribute to equal access to education and enhance teaching and learning.

1. Promoting equal access to education: students in remote areas have access to quality resources through AI platforms (e. g. the Chinese version of Khan Academy), thus bridging the gap in education between urban and rural areas.

2. Reducing teaching costs: AI assistants take care of basic Q&A and homework correction, thus helping teachers focus on teaching higher-order thinking.

On the other hand, the use of technology is inevitably at risk, and the potential for risk exists from both the developers' and users' perspectives.

1. Data breach: behavioral data during the learning process can be misused, so it is necessary to follow the BRICS Framework Agreement on Cooperation on Data Security.

2. Superficial cultural understanding: AI translation tools (e. g. DeepSeek) improve efficiency, but they struggle to convey the cultural meaning of idioms and proverbs.

The digital gap increases: unequal access to technology may lead to a gap in educational resources in BRICS countries.

III. Socio-economic aspects: the trend towards technology-based development

First of all, from an economic perspective, human capacity improvement and industrial innovation can effectively improve the competitiveness of workers, and AI-assisted Chinese language training accelerates the training of multilingual talents and helps BRICS companies enter the Chinese market. At the same time, it can create a new industrial chain, and the education technology market size is expected to reach 404 billion dollars in 2025, driving hardware development, content creation and other related industries.

In addition, in terms of national strategy, policy synergy and technical standards, the development of ethical guidelines for AI education, reference to China's AI development program, and the establishment of data privacy protection norms and algorithm transparency are conducive to the good development of the industry.

A cloud-based education platform for BRICS countries will be created. The integration of high-quality Chinese language courses and AI tools from member countries, such as Baidu Education in China and Yandex Education in Russia, is performed to integrate resources and promote resource sharing and technological assistance. A specific starting point can be identified in school to make the integration of "AI + Humanities" into curriculum projects, the use of AI pre-course to deal with the basics and focus in the classroom on the method of cultural discourse. There are also efforts to train teachers in digital literacy, such as the "AI Tools and Instructional Design" offered by Nanyang Technological University in Singapore to develop teachers' skills in technology.

IV. Prospects for implementation in BRICS countries: cooperation and challenges

1. Results orientation

Language compatibility deepens cooperation: AI tools help BRICS students to master Chinese, promote economic, trade, scientific, and humanitarian ties.

Synergistic development of technological innovation: collaborative research and development of multilingual AI models (e. g., BRICS) to reduce dependence on Western technology.

2. Challenges and recommendations for their solution

Adaptation of technology localization: Chinese language learning algorithms should be optimized to take into account the linguistic peculiarities of the participating countries (e. g. Russian, Hindi).

Co-creating ethical regulatory mechanisms: establishing a BRICS Committee on the Ethics of AI Education to prevent technological misuse and cultural hegemony.

V. Conclusion: Towards a “techno-humanistic” symbiotic future of education

AI technologies have given a new impetus to Chinese language learning, but their success depends on collaborative innovation and critical utilization by the BRICS countries. Only by balancing efficiency and ethics, tools and humanism, the Sustainable Development Goal of “facilitating communication through technology and building consensus through culture” can be achieved. In the future, we hope to practically improve language learning and use, strengthen the cooperation strategy and build mutually beneficial partnership in foreign language learning.

References

- [1] Peng Peihuang. Analyzing deep learning in intelligent educational environment and building models [J]. Informatization of education in China, 2021, (01):10-14.
- [2] Kai Kupferschmidt. AI Brain manipulation? WHO’s new chief scientist aims to anticipate global challenges, doi: 10.1126/science.adj4460

Author:

Sun Yixuan, female, Master of International Chinese Language Education (2023), Institute of Humanities, Shandong Normal University, Zibo, PRC.

CHINA

Tian Lu

Student

Shandong Normal University
(SDNU)

A Key Role of Technology Investment for Economic Growth and Quality of Life

I. Introduction

On 23 October 2024, the city of Kazan in Russia hosted the 16th BRICS Summit where the President of China Xi Jinping highlighted the need to turn BRICS into the primary mechanism for strengthening unity and cooperation between the countries of the Global South, as well as the leading force in reforming world governance. He also noted the importance of consolidating the position of developing nations in international governance institutions.

In the context of digitalization and globalization, technologies play a key role in creating a robust foundation for global growth. For developing countries, technological innovation becomes an important tool for bolstering their national capability, strengthening their international influence, and resolving economic and social issues. However, it is important to set priorities in advance as to what technologies need to be developed to make sure that they will not only bridge the technology gap of the Global South, but also drive economic growth and better quality of life for its communities.

II. Food Security

"Food is God", as a Chinese saying goes. It is certainly a key resource for human life as well as for the survival and development of any country. Food security plays a decisive role and is a priority objective for national economic development and social stability. Application of new technologies could help to optimize allocation of agricultural resources, enhance resilience to natural factors, increase food output, contribute to the sustainable development of agriculture and substantially strengthen food security.

The following technologies could be employed to ensure food security:

1. The Internet of Things (IoT) in agriculture. For example, farms could use IoT-based systems consisting of various field sensors to monitor soil humidity, salts and alkali levels, and ambient temperature, helping to adapt to changing conditions. Then, through IoT networks, sensor data would be collected and uploaded into cloud platforms for precision agriculture. IoT can be also used to control grain storage environment with solutions that generate alerts based on collected data on air humidity, pests, etc., which will ensure good management of grain storage facilities.
2. Satellite Remote Sensing. For example, farms can fly drones to take high definition images of crop fields, uploading them into cloud services to monitor crop growth, pest and disease status, while using satellite remote sensing for crop macro-monitoring and precision crop management.
3. Robots. Manual labor could be replaced with robots to perform sowing, weeding and other operations. With proper controls, robots could not only deliver workforce savings, but also work the fields more efficiently, leaving no missed spots.

III. New Technologies

New technologies contribute to the development of multiple sectors, providing a strong and stable foundation for the evolving world economy. Disruptive technology is an important part of technological innovation, which not only breaks through the original technological cycle and charts a new technological track, but can also replace the mainstream technology. Since it was first proposed by Clayton Christensen, a professor at Harvard Business School, the concept of disruptive technology has evolved and come to be widely used not only in business management, but in many sectors of the economy. Investment in various new technologies can promote industry specialization and standardization.

Today people's everyday lives are intertwined with technologies, especially in health services that are no longer confined to human interventions alone. Technologies are having an unprecedented impact, offering innovative solutions for better healthcare, such as artificial intelligence (AI), which is a key end-to-end technology. Deep-learning AI algorithms help doctors with accurate analysis of medical images and facilitate early diagnosis, boosting diagnostic efficiency and reducing misdiagnosis rates. Moreover, telemedicine helps to improve access to medical services in remote areas with inadequate health infrastructure, allowing local hospitals and patients to contact medical experts via video consultations and make sure they receive timely treatments. Patients can also wear lightweight medical devices that can monitor their physical parameters in real time and transmit this data to health service providers. Such systems enable remote health management and ensure timely disease prevention and treatment.

Natural disasters still heavily affect economies, societies and human lives, causing unavoidable damage. In today's technologically advanced age, solutions are available that help to prevent and minimize damage caused by natural disasters. Earthquake early warning systems are a case in point. Such systems consist of multiple seismometers installed in earthquake risk areas for real-time monitoring of seismic activity and the direction of seismic wave propagation. When an incipient earthquake is detected, the system broadcasts an alert signal several or dozens of seconds before seismic wave arrival, helping to avoid casualties and reduce damage. People can also use satellite remote sensing, radars and other technologies to monitor rivers, storms, rainfall, snowfall and other natural phenomena, continuously collecting relevant data and providing advance warnings to avoid or minimize damage.

Climate change has an impact on water resources, for example, by accelerating the melting of glaciers, so there is a clear case for utilizing advanced technology to respond to changes in water resources caused by climate change. For example, satellites and sensors can be used to monitor surface waters in real time and provide data on water quality, levels, distribution, etc. as inputs for water management. Other technology applications include hydrological models that can simulate precipitation, evaporation and other processes, helping hydrologists to develop science-based water resource management programs.

The era of big data brings not only more convenience, but also hidden cybersecurity hazards. Nowadays, with people facing huge risks as data breaches can be both disastrous for users and detrimental to social stability and security, data security has become a top priority issue. One of the effective cybersecurity tools to address it is blockchain, a decentralized system based on the distributed ledger technology (DLT) that supports secure and transparent data processing and transactions, playing an important role in finance, supply chain management, healthcare and other sectors. Stronger encryption is another measure that is critical for securing data transmission and processing and preventing data leaks and theft.

Economic development and increasing quality of life require a lot of energy, which is a limited resource on our planet. Therefore, humanity cannot progress without sustainable energy sources, for exploiting which people need efficient and affordable technology. One of them is photovoltaic technology for capturing solar energy, which is a highly promising sustainable energy source. Modern PV cells can offer high conversion efficiency at low cost, rivalling traditional energy sources. There are also wind power, bioenergy, geothermal power and other technologies that can effectively promote sustainable energy generation and development.

In the context of rapid development of science, technology and digitalization as well as accelerated global urbanization, smart cities has become a major trend, with governments showing a keen interest in related construction methods and advanced technologies that can be deployed to improve the quality of life for city dwellers, optimize city management, and efficiently deal with urban development problems. One of the most prominent technologies for various urban applications is the Digital Twin (DT), a high-precision simulation model that mirrors the state of the physical world in real time, supporting deep integration between physical and virtual reality. These models can be combined with big data, AI, IoT, cloud computing and other emerging technologies, to accurately forecast trends and predict the behavior of physical objects, boosting the efficiency of urban management, resource allocation, decision-making and risk mitigation.

Platform economy as an emerging economic model has profoundly influenced global economic development, contributing both to economic growth and better quality of life.

Platform economy relies heavily on big data for collecting and analyzing consumer data in order to accurately assess consumer needs and preferences, allowing companies to quickly adjust their business models and maximize customer satisfaction, using extensive Internet coverage. Note that such data collection and analysis require a strong focus on user data protection to prevent data breaches and ensure the security of user transactions. The could be achieved, for instance, through the use of blockchain technology, which is a powerful tool for securing cross-border payments and building transactional trust.

IV. Conclusions

Developing nations, especially the countries of the Global South, are gradually strengthening their position on the international arena. However, opportunities offered by the global economy come hand in hand with challenges that require a systemic approach to technology investments. Therefore, it is critical to support emerging technologies to provide food security, enhance healthcare quality, promote sustainable energy, minimize the impact of natural disasters, build smart cities and create sustainable economic models.

Technological progress should aim to improve the quality of life as well as create a favorable environment for sustainable development of the global community.

Tun Myat Aung
Vice Rector

University of Computer Studies, Hinthada

From Digital Transformation to the Goal of Sustainable Development of the National Economy

Introduction

It is necessary to increase the productivity of the country in order to achieve sustainable development of the economy of the country. In order to increase the productivity of the country, it is necessary to train the human resources in the country to invest and use modern technologies. Among modern technologies in today, digital technology calculates a lot of data accurately and quickly and it is the technology that allows perform precise actions. It will be observed in both developing and developed countries that the growth of Industry 4.0 is raising the productivity of the country in tandem with the advancement of information and communication technology (ICT) technologies such as programming technology, artificial intelligence (AI), internet of thing (IoT), embedded technology, database technology, data communication and network technology.

Human Resource Development

The human resources in the country must be capable of using digital technologies in order to enhance its economic development. The human resources in the country, including those at universities, colleges, institutes, vocational schools, and basic education schools, must be trained, produced, and nurtured using modern teaching aids (software & hardware tools) using digital technologies in order to improve the economic growth of the country. This will also help the growth of Industry 4.0 by providing the human resources produced with practical skills in their respective fields. Therefore, the state needs to invest modern technologies for the human resource development in the country in line with the growth of Industry 4.0 by providing universities, colleges, institutes, vocational schools, and basic education schools with modern teaching aids (software & hardware tools) using digital technologies as well as providing necessary technical trainings. It will only have competent human resources, reduce unemployment, and increase productivity when the nation has the manpower needed to support the growth of Industry 4.0, which plays an essential role to the economic growth of the country.

Agriculture, Livestock and Fisheries Development

The agriculture, livestock and fisheries sector that is main economic sector is important for food security in an agricultural-based country. Developing and developed countries are transitioning from mechanized farming to smart farming systems using IoT technology, automation technology, and AI technology. The livestock and fisheries industry has also entered the Industry 4.0 era, where IoT technology, automation technology, and AI technologies are being used. In developing and developed countries, the use of IoT technology, automation technology, and AI technology in the agriculture, livestock and fisheries sector, along with the ability to perform scientific data analysis, can enable sustainable development in the agriculture, livestock and fisheries sector, increase productivity, and achieve food security. They are already experiencing economic growth due to the ability to export goods abroad. Therefore, the state must strive to develop the necessary human resources and invest and use modern technologies such as IoT technology, automation technology, and AI technology in the agriculture, livestock and fisheries sector. Only then will the state be able to boost the productivity of the country and attain sustainable development in the fields of agriculture, livestock and fisheries.

Micro, Small and Medium Enterprises (MSME) Development

The growth of Micro, Small & Medium Enterprises (MSME) is essential for the economic progress of the country. The growth of MSMEs in the country requires modern technologies, capital, and human resources. Therefore, it is essential for

MSMEs to invest and use modern technologies, and it is important to use modern equipment using digital technologies. Nowadays, with the use of Computer Numerical Control (CNC) machines, humans can create computer- aided designs with the precision they desire and produce high-quality products in large quantities in a short time, resulting in higher productivity than non- computerized machines, as well as the production of high-value products. For example, instead of using traditional hand looms in the weaving industry, computer-aided machine looms allow users to create new designs at will and produce high-quality fabrics in large quantities in a short time. As a result, MSMEs are able to manufacture and sell affordable and high-quality goods that are well-liked by domestic consumers and may take the place of imports from overseas. Products can be marketed overseas if domestic demand surpasses that of the country. This will increase export earnings and support economic growth because of the high export rate.

Banking Development

Mobile phones have developed into smart phones with digital technologies as a result of the advancement of ICT technology, which enables banks to employ mobile banking and internet banking systems. By enabling the simple and quick execution of banking activities like payments and transactions, the development of banking systems utilizing ICT technology has not only aided in the growth of enterprises and commerce, but it has also assisted in the management of inflation by reducing cash holdings. Consequently, the development of banking systems that use ICT technology in banking is very important for the economic development of the country. Banking needs to widely invest and use Internet Banking, Mobile Banking, and Automated Teller Machine (ATM). Only then can the banking system operate well, the people gain confidence in it, and investment, manufacturing, trade, urban development, and financial management can operate well, contributing to the economic development of the country.

E-commerce Development

An e-commerce platform, which is a software platform for trading goods and services and conducting transactions over the Internet, has emerged with the development of internet banking and mobile banking. The development of e-commerce platforms has led to the development of online shopping, where goods and services are sold directly to consumers through websites and mobile apps. With the development of online shopping, consumers can quickly find and purchase the goods and services they need, regardless of region or country. Domestic manufacturers can also market their goods and services online through digital marketing, penetrate the global market, and try to obtain more exports. The investment and use of e-commerce platforms has increased the rate of exports and greatly contributed to the national economy. If the e-commerce platform can be implemented well in the country, it will not only prevent customs duties and taxes from being lost through trade and online shopping, but it will also support the growth of the national economy.

Implementation of Development Plans and Policies

A nation needs good development plans and policies in several areas in order to grow its economy. It is necessary to have accurate and high-quality data in order to formulate sound development plans and policies. In order to obtain accurate and high-quality data, departments and organizations in various sectors need to invest and use database and cloud technologies to build digital platforms to systematically store their relevant data, and to constantly update data with related departments and organizations through data communication networks. Only then can we obtain accurate, high-quality data, and based on that data, programming technology can be used to perform the necessary scientific calculations, extract accurate information, and conduct research. Based on the research, sound development plans and policies can be established for several areas and work towards achieving sustainable development for the national economy.

Conclusion

In short, in order to develop the national economy, all departments and organizations in various sectors of the country must fully invest and utilize ICT technologies in line with the development of Industry 4.0, thereby increasing the national productivity, manufacturing, trade, and export rates through digitization, digitalization, and digital transformation. In addition, all departments and organizations in various sectors will be able to establish accurate and sound development plans and policies for the development of the national economy. By accurately implementing the national Sustainable Development Strategic Plan, the country will be able to achieve the goal of sustainable economic development.

RUSSIA

Usenko Nikita

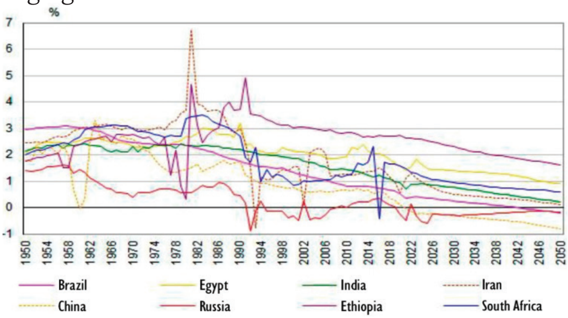
Student

Belgorod National Research University

Smart Cities in BRICS Countries and Development Trends in Russia. Investments in Technology, Application of Technology

Today's world is rapidly urbanizing. Cities as centers of economic activity, innovation, and social life are facing challenges related to population growth, increasing strain on infrastructure, and environmental degradation. At the same time, there are growing expectations of cities in terms of quality of life, convenience, and logistics. Smart cities in the conditions described above are no longer just a fanciful idea from the works of sci-fi writers of the last century, and not a modern trend that would demonstrate the technological advancement of a country, but a prerequisite for ensuring sustainable development of a state.

This topic is specifically relevant for BRICS countries, as these countries show high growth rates:



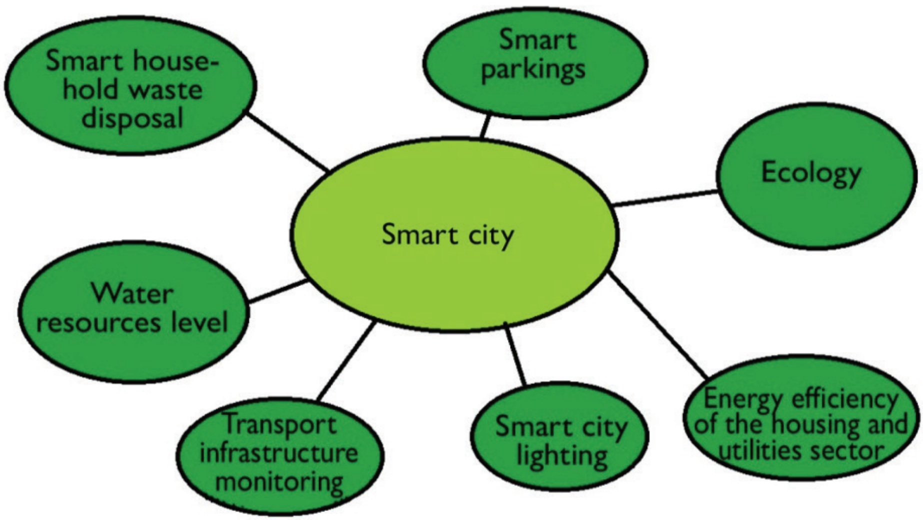
Source: United Nations, Department of Economic and Social Affairs, Population Division (2024). World Population Prospects 2024, Online Edition. POP/DB/WPP/Rev.2022/GEN/F01/Rev.1.

The figure demonstrates that the population of all BRICS countries, except Russia and China, is growing rapidly, and therefore these countries are facing the challenge of urbanization and increased infrastructure strain.

This essay provides an analysis of the current state of smart cities in Russia and BRICS countries, as well as the prospects for their development, considering the introduction of smart technologies as a strategic response to the challenges of urbanization and a tool for achieving sustainable economic and social progress.

The hypothesis states that the application and successful implementation of the innovative smart city concept in BRICS countries will improve their ability to cope with the above-mentioned challenges associated with population growth, as well as strengthen their position on the global stage.

First, it is necessary to introduce the concept of a smart city. “Smart city is a place where traditional networks and services become more efficient due to the digital solutions for the benefit of its residents and businesses. Smart city means not only the use of digital technology to improve resource utilization and reduce emissions, it also means more intelligent urban transport networks, upgraded water and waste management facilities, and more efficient ways of lighting and heating of buildings.” [1]



Next, we will consider the current state of implementation of the concept of smart cities in BRICS countries:

According to the Worldwide Smart Cities Spending Guide study from IDC (International Data Corporation), global expenses for Smart City solutions wil reach 422.9 billion dollars in 2024, which is 17.6 per cent more than in 2023. BRICS countries, especially China, account for a significant part of these expenditures. According to Deloitte, as early as 2022, smart cities in China accounted for about 50% of the country's GDP, and this amount will continue to grow.

China is actively implementing advanced technologies such as artificial intelligence, big data, and cloud technologies in its smart cities. Wuhan can serve as an illustrative example of such a city; the introduction of such initiatives started back in 2010, and according to foreign experts, this city has developed one of the best smart healthcare systems, which showed its effectiveness during the COVID-19 pandemic.

India keeps apace with China, although the goals of implementation of the smart city concept are slightly different; in China it is mainly to increase the level of health care, industrial production, and improvement of infrastructure, while in India the deployment of smart cities is aimed at poverty alleviation and accessibility of services. India is implementing its ambitious Smart Cities Mission program covering 100 cities.

As of January, 2025, 7,479 out of 8,058 tendered projects have been completed and involved 150,002 crore rupees out of the total tender amount of 164,368 crore rupees.

It is also important to note the experience in Brazil where, according to the Brazil Smart Cities Market Report 2023 by Research and Markets, the smart cities market in Brazil was valued at 4.5 billion dollars in 2022 and is expected to reach 8.2 billion dollars by 2028.

The Brazilian smart city concept emphasizes security, infrastructure, and transport. The most promising areas are video surveillance systems, smart lighting, and transport management solutions.

Here we will consider the trends in the development of smart cities in Russia. For example, in 2024, was approved the Executive Order No. 309 "On Russia's Development Goals through 2030 and for the Future until 2036", stipulating the following goals:

1. Preservation of population, promotion of health and well-being, family support;
2. Realization of everyone's potential, development of the talents, education of patriotic and socially responsible personality;
3. Comfortable and safe environment for living;
4. Environmental well-being;
5. Technological leadership;

6. Digital transformation of state and municipal administration, economy and social sphere.

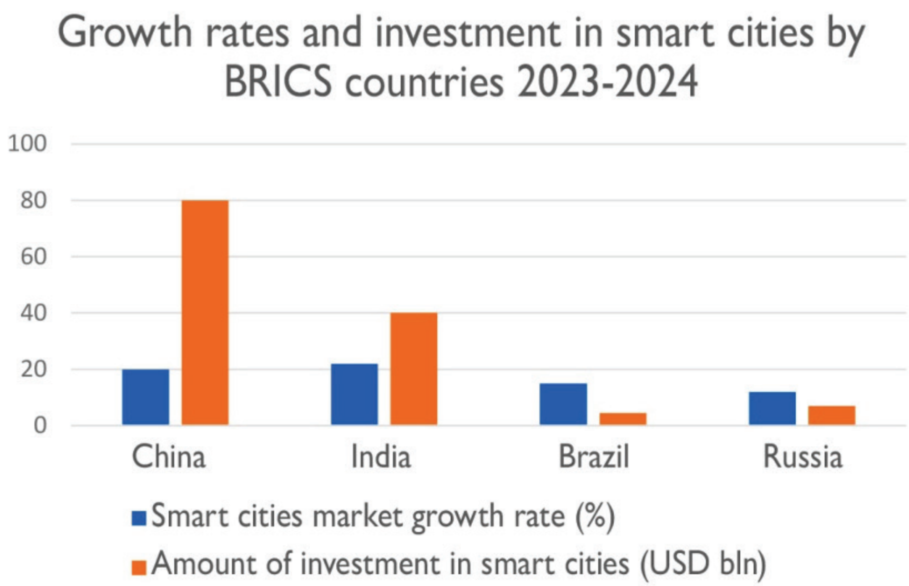
In terms of digitalization, the decree outlines such priorities as the deployment of big data processing technologies, machine learning, and artificial intelligence, as well as the development of digital platforms and robotization.

For example, in Moscow, which is the capital and the largest city in Russia, technologies based on artificial intelligence are being introduced everywhere. Back in 2014, the first such technology was introduced, namely the voice assistant of the citywide contact center, which has processed more than 115 million calls during its operation, which significantly reduced the workload of specialists. There have been improvements to the voice assistant in 2020 and 2022, and, currently, it supports the chat communication as well as better recognizes voice instructions.

But Moscow is not alone; for example, in early 2024, in Nizhny Novgorod and Khabarovsk, a system for monitoring the condition of waste containers was introduced (yet in test mode), which in the future may significantly reduce the workload of operators.

Furthermore, the development of cloud services technology will continue in Russia; according to experts, in 2024, the market for cloud technologies will grow by almost 30%.

Let us compare the growth rates of the smart cities market in China, India, Brazil, and Russia:



According to the above diagram, India is the leader in terms of growth rate with 22%, next to China with 20%, while Brazil and Russia are behind in terms of growth rate of 15% and 12%, respectively.

The above statistics demonstrate the growing interest and investment in smart city technologies in the BRICS countries. These investments are intended to address different urban challenges such as traffic congestion, pollution, inefficient resource management, and security.

Different BRICS countries have their own priorities and approaches to the development of smart cities, but all of them are focused on the application of innovative technologies to improve the quality of life of citizens and promote economic growth.

In my opinion, we should expect further growth of interest in this field in our country. This analysis suggests that Russia needs to pay more attention to the development of smart city technologies in order to keep up with its BRICS partners and respond to emerging challenges in a timely manner.

TADJIKISTAN

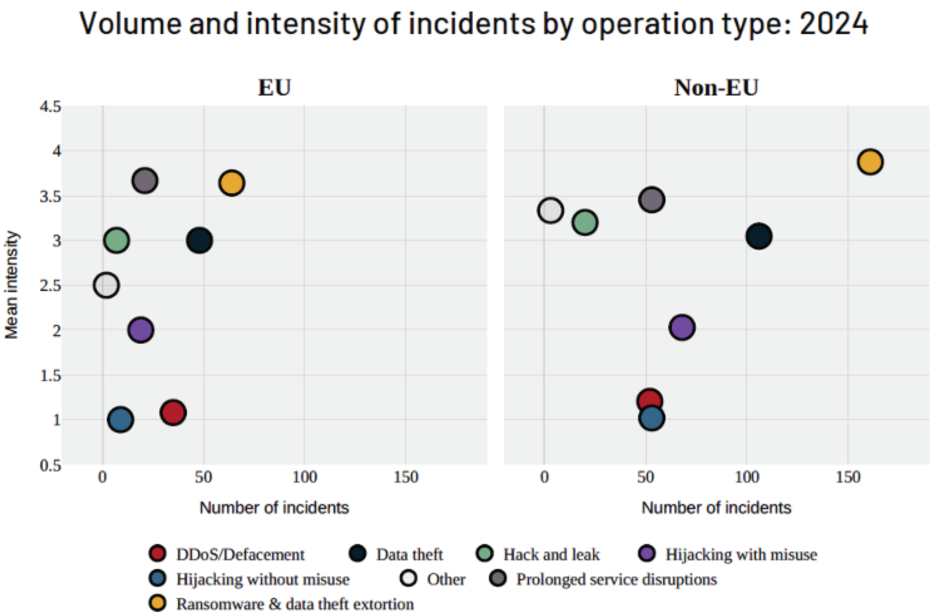
Vakhidov Azim
Doctoral student

Russian-Tajik (Slavonic) University

Cybersecurity in the era of the big Data economy

Rapid technological development and advent made available a breakthrough since nuclear weapons invention. Humanity entered in digital era after post-nuclear age. Digitalization is ubiquitous phenomenon. Homodigitus i.e. human being that is 24/7 attached to his/her smartphone or gadget such as smartwatch or else. He/she keeps all his/her data in this small technology as giant corporations, governmental institutes, etc. Banks, big companies and citizens became a desirable target for malicious actors. A critical data to include bank account login and passwords, social ID, biometrics and other private information is their ultimate goal to reach. Now these issues became a problem of a national security. The damage that can be done in cyberspace by state actors and non-state actors in some cases may have a devastating effect. Cybersecurity have become a very important in this regard.

In the research conducted by European Repository of Cyber Incidents [1] in 2024 amongst EU and Non-EU members as shown below significant position holds Ransomware. Ransomware attacks continued to be a significant threat in 2024, with the LockBit group leading in the number of incidents. Despite international efforts to dismantle their infrastructure early in the year, LockBit was responsible for 10% of the tracked cyber activities. Next what’s been highlighted is Sector-Specific Threats. The health sector within the EU's critical infrastructure was the most frequently targeted. Organizations in this sector, which handle sensitive data and have low disruption tolerance, faced numerous ransomware attacks and data theft extortion attempts. Unfortunately, the report underscores the persistent and evolving nature of cyber threats within the European Union, emphasizing the need for continuous vigilance and adaptive cybersecurity strategies. The nature of cybercrimes is fairly uncommon for most people's perception. The general problem is that it's not obvious if a crime took place. In some cases, it takes a while to detect an attack or malware breach into the system. One of the infamous cyberrobbery was conducted by the group of hackers called "Carbanak" between 2013-2018. The estimated damage could be "up to one billion American dollars was stolen in about two years from financial institutions worldwide", the report of KasperskyLab states [2].



Fraudsters stole money in following way:

1. When the time came to cash in on their activities, the fraudsters used online banking or international e-payment systems to transfer money from the banks' accounts to their own. In the second case the stolen money was deposited with banks in China or America. The experts do not rule out the possibility that other banks in other countries were used as receivers.
2. In other cases, cybercriminals penetrated right into the very heart of the accounting systems, inflating account balances before pocketing the extra funds via a fraudulent transaction. For example: if an account has 1,000

dollars, the criminals change its value so it has 10,000 dollars and then transfer 9,000 to themselves. The account holder doesn't suspect a problem because the original 1,000 dollars are still there.

3. In addition, the cyberthieves seized control of banks' ATMs and ordered them to dispense cash at a pre-determined time. When the payment was due, one of the gang's henchmen was waiting beside the machine to collect the 'voluntary' payment [2].

How did a theft stay hidden? First, attackers used social engineering and malware2 to gain access to bank networks. Second, they manipulated internal banking systems, altering balances and making fraudulent transfers. Third, the criminals covered their tracks by mimicking legitimate transactions.

Another serious incident happened in 2017. This time criminals targeted Equifax. One of the largest credit reporting agencies, suffered a data breach exposing 147 million people's personal and financial data. "Founded in the 19th century as a retail credit company, Equifax had over the years morphed into one of the largest repositories of Americans' most sensitive financial data, which the company sliced and diced and sold to banks and hedge funds. In short, the viability of Equifax and the security of its data were one and the same" [3]. According to Blumberg Business investigation the breach occurred due to an unpatched software vulnerability in a web application. Attackers had access to the system for 76 days before being detected.

Space of cyber operations is huge. According to Solar [4], in the previous year there were monitoring Solar JSOC detected more than 31 thousand cyberattacks in Russian Federation. The attacks were mostly directed on the critical government sector [5].

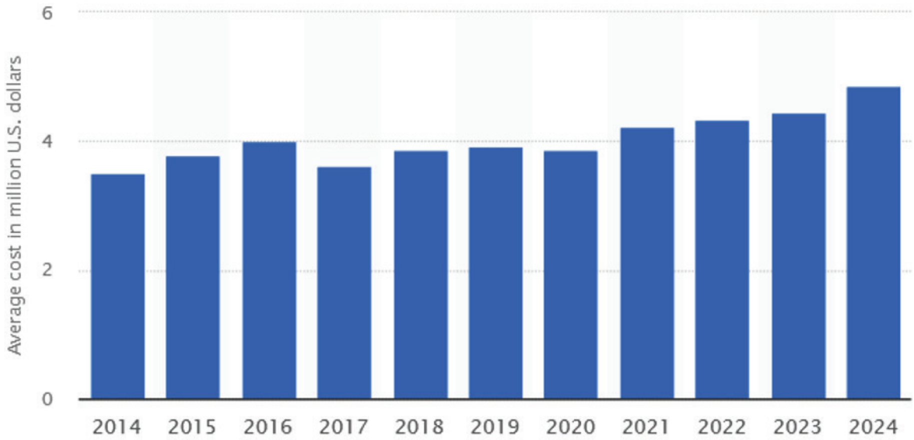
The damage suffered by Russians from telephone fraud in 2024 amounted to at least 295 billion rubles, said Stanislav Kuznetsov, Deputy Chairman of the Board of Sberbank (MOEX: SBER). He announced these data at a meeting of the Council for the Development of the digital economy and the Council for the development of the financial market at the Federation Council [6].

The document prepared by the Information Security Department of the Bank of Russia contains a detailed analysis of cyberattacks on the financial sector in 2024. The main topics include new attack methods, threat vectors, post-incident analysis, international cooperation, and recommendations for 2025 [7]. Here is tablet that shows types of cyberattacks.

If we look at the following statistics, the amount of money which is stolen annual looks appalling [8]. Statistics has been taken from statista.com

Now there is a question whether there are any solutions to this issue? The is positive. We can look, for example how the USA addresses this problem. The U.S. National Cybersecurity Strategy [9] outlines the federal government's approach to securing cyberspace, protecting national interests, and countering cyber threats.

Average cost of a data breach worldwide from 2014 to 2024 (in million U.S. dollars)



The most recent version, released in March 2023 under the Biden administration, emphasizes a shift toward a more aggressive and collaborative cybersecurity posture. After analyzing this official document, it becomes apparent that there are 5 key elements of U.S. strategy which are as follows: first is to defend critical infrastructure by strengthening public-private partnerships to enhance cybersecurity resilience; establish minimum security standards for critical sectors (energy, transportation, healthcare, etc.); expand the role of the Cybersecurity and Infrastructure Security Agency (CISA) in coordinating national efforts. Second is to disrupt and dismantle threat actors – use offensive cyber operations to target cybercriminals and nation-state adversaries; enhance cooperation between law enforcement, intelligence agencies, and international allies; increase the use of sanctions and legal actions against cybercriminal groups and state-sponsored hackers. Third is to promote security by design which includes to push software and hardware companies to adopt secure development practices; encourage liability for software vendors that release insecure products; advocate for secure cloud computing and zero-trust architectures. Fourth is to invest in a resilient future i.e. expand funding for cybersecurity research and workforce development; develop new technologies like quantum-resistant encryption and AI-driven security; support cybersecurity education and training programs. Fifths is to forge international partnerships through strengthening cooperation with NATO, the EU, and other allies to combat cyber threats; promote global norms for responsible state behavior in cyberspace; help allies and developing nations build cybersecurity capacity.

As for the Russian Federation, the official document "Russian Federation Cybersecurity Strategic Concept" (draft) [10], [11] outlines the concept for developing Russia's National Cybersecurity Strategy, emphasizing the need for a structured, systematic approach to cybersecurity threats at both the national and international levels. Below is a detailed analysis of its key elements. In brief it states that the rapid development of Information and Communication Technologies (ICTs) is seen as both an opportunity and a threat. Key cyber risks identified include: threats to individual rights, government institutions, and businesses through cyber espionage, hacking, and data breaches. Cyberattacks by criminals and cyberterrorists targeting protected information systems. Use of cyberweapons in cyber warfare and hybrid military conflicts.

In brief the proposed Russian Cybersecurity Strategy follows a state-centric approach with emphasis on national sovereignty, infrastructure protection, and controlled international engagement. The strategy prioritizes cyber defense, regulatory control, and domestic technology development, while recognizing the need for international cooperation in cybercrime enforcement. Russia's approach is more robust as we can see

To summarize my essay, in my humble opinion in such volatile time to securing economic and financial infrastructure from cyberattacks requires a multi-layered approach that involves both state-led initiatives and private-sector best practices. State Approach (Government-Level Measures) should look like in Russian Cybersecurity Strategic Concept. Regarding private or business sector some serious measures might be adopted such as: Adopt zero-trust architecture to limit unauthorized access. Implement multi-factor authentication (MFA) and encryption for financial transactions. Continuous Monitoring & Threat Detection deploy AI-driven security analytics to detect anomalies in financial systems. Use Security Operations Centers (SOC) to monitor transactions in real-time. Employee training & awareness, for instance, conduct regular cybersecurity awareness training to prevent phishing and social engineering attacks. Also establish clear incident response protocols for staff. Third-party risk management which would mean to ensure vendors and partners comply with cybersecurity best practices, and conduct periodic security audits of third-party services.

Both governments and private financial entities must work together to build a resilient cybersecurity ecosystem. The state provides regulatory oversight, intelligence sharing, and law enforcement, while financial institutions must focus on technology, training, and proactive threat mitigation. Only a coordinated approach can ensure the long-term security of economic and financial infrastructure.

Reference:

1. 2024 Cyber activity balance
2. https://www.kaspersky.es/about/press-releases/the-great-bank-robbery-carbanak-cybergang-steals-1bn-from-100-financial-institutions-worldwide?srsltid=AfmBOopwVIgiZdSwigqTBrGm3S0PXDwjB2hOoEINK2hNt-YkS2VfzHC8].
3. https://www.bloomberg.com/news/features/2017-09-29/the-equifax-hack-has-all-the-hallmarks-of-state-sponsored-pros
4. https://rt-solar.ru/analytics/reports/5320/?ysclid=m7yivttsgr860699835
5. https://tass.ru/ekonomika/23264859
6. https://www.kommersant.ru/doc/7551712
7. Обзор основных типов компьютерных атак в финансовой сфере в 2024 году. p.4.
8. https://www.statista.com/markets/424/topic/1065/cyber-crime-security/#statistic2
9. National Cybersecurity Strategy March 2023. p. 1-34.
10. Russian Federation Cybersecurity Strategy Concept (draft).
11. https://tass.ru/politika/878279?ysclid=m7ymwqynji229129219

Vasquez Patricio Carmen Analy
Student

National Autonomous University of Mexico

Race against cancer: Russia and the development of vaccines and immunomodulatory drugs

Cancer is one of the most devastating diseases of the 21st century, claiming millions of lives worldwide every year. According to a World Health Organisation analysis report based on data from the International Agency for Research on Cancer (IARC), there were 20 million new cancer cases and 9.7 million cancer deaths worldwide in 2022. WHO's predictive models suggest that approximately one in five people will be diagnosed with cancer in their lifetime, and the disease will kill one in nine men and one in twelve women (Filloy, F., 2025).

In the context of this epidemiological situation, the Russian government understands the need for a comprehensive approach to the cancer problem – not only as a medical problem but also as a factor directly affecting labour productivity, social stability and, in strategic terms, national security. The loss of working-age human resources due to cancer has a direct devastating impact on the nation's economic potential and its ability to sustain technological and defence development. By investing in advanced medical technologies, Russia seeks not only to save human lives but also to increase the productivity of its population while also reducing budget expenditures related to the treatment of chronic diseases.

Addressing the Future Technologies Forum about a year ago (on 14 February 2024), Russian President Vladimir Putin made a resonant statement: "We are close to creating so-called oncovaccines (cancer vaccines) and new-generation immunomodulatory drugs. And I expect that very soon they will be effectively used as individual therapy methods" (Putin, V., 2024). This announcement provoked a strong international response and attracted the attention of millions of people. Although cancer vaccines, or oncovaccines, already exist and are available in the medical armoury, it is the intensity of scientific research and dynamic progress demonstrated by Russia in this field that aroused the keen interest of the global community.

It is important to emphasise that the vaccine that is being developed is not a universal drug and must be adapted to the individual treatment protocol of each specific patient. Russian scientists are working intensively, applying advanced biotechnology techniques, and this is a potential breakthrough in the therapy of patients already diagnosed with cancer. During the research for this paper, it was found that although there are preventive vaccines in use against certain types of cancer, in particular hepatitis B and human papillomavirus (HPV) vaccines, Russian research has focused on personalised therapeutic approaches and specific types of oncology, including melanoma, lung cancer, a range of gastrointestinal oncopathologies and, with a high probability, kidney cancer (Kosorukov, 2024).

It should be pointed out that the development of such a class of vaccines is not exclusively Russian know-how – British and American pharmaceutical corporations are also actively working in this area. However, the fundamental difference in the Russian concept is the intention to provide free access to vaccination as part of the government's policy of universal health coverage. "Creating a Russian mRNA vaccine to treat cancer will cost the state 300,000 roubles per person, but it should be free for the patient," said Andrey Kaprin, chief oncologist at the Russian Ministry of Health. This approach correlates with one of the most important demographic problems faced by Russia today – the persistently low birth rate.

The military conflict in which Russia is engaged (and which, according to some analysts, is approaching its final phase) has had a significant negative impact on the country's demographic indicators. Another pressing factor affecting the demographic situation is the widespread practice of abortion, which further exacerbates problems related to the reproduction of the population. A systematic decline in population poses a strategic threat to national security since, in the absence of sufficient demographic potential, the social basis for the economic, defence and socio-cultural development of the state inevitably shrinks. In this regard, the development and implementation of advanced technologies to combat cancer and significantly improve the quality of life of the population has become a strategic priority for the Russian government.

National security issues are traditionally high on the domestic and foreign policy agenda of any country. However, as leading security analysts rightly point out, the conceptual content of this notion is highly subjective and varies depending on specific national conditions (Buzan, B., y Weaver, O., 1998). Demographic degradation poses no less significant, albeit implicit, hidden threat to Russia's national security than traditional military challenges from the Western bloc countries. The reduction of the economically active population directly leads to a decline in the country's production potential. Possessing a vast territory and significant reserves of natural resources, Russia is largely dependent on a sufficient working-age population, without which it is impossible to ensure sustainable economic development.

Vadim Bezverbny, a leading Russian expert in demography, pointed out the disappointing character of long-term forecasts that suggest that Russia's population may decline by 6.2 million people by 2050. In an interview with the Eurasian Information Agency, Bezverbny said: "Based on the data collected from January to October this year, we have to recognise that we are close to a historic low in birth rates. It is highly probable that the birth rate in 2024 will be the lowest in the last 30 years" (La República, 2024).

It is worth noting that Russia's aspirations in this area go beyond a purely national context. The country is actively developing international cooperation with Nicaragua[1] and Cuba,[2] with which it has concluded interstate agreements to jointly develop nuclear medicine and exchange medical specialists. Such partnership initiatives not only strengthen Russia's international standing but also provide access to additional scientific and technological competences that synergistically enhance Russia's potential in the prevention and treatment of oncology.

The robust government support that has stimulated research breakthroughs and scientific achievements in recent months also deserves objective recognition. According to the media, this work will continue throughout the current calendar year, focusing on perfecting the vaccine and ensuring its maximum clinical efficacy. All this will make it possible to improve the life of the Russian people and increase their average life expectancy to 60 or more years.

The development of this innovative vaccine is not only a significant medical breakthrough but also part of a comprehensive strategy to cope with the demographic and national security challenges faced by Russia today. Therefore, this approach clearly demonstrates the fundamental importance of technological innovations and strategic investments in public health as fundamental elements needed to ensure the country's sustainable development. Moreover, this initiative not only meets the current health needs of the population, but also perfectly fits

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1 In March 2024, Russia and Nicaragua signed a memorandum of understanding to establish a nuclear medicine centre in the Republic of Nicaragua. In the future, the centre will be able to diagnose and treat oncological diseases, as well as educate and train specialists in this and related fields.

2 The project "Russia and Cuba together for the benefit of health," organised by the Federal Agency for the Commonwealth of Independent States, Compatriots Living Abroad, and International Humanitarian Cooperation (Rossotrudnichestvo), is part of the New Generation presidential programme. The goal is to create a platform for international dialogue in the field of medicine with a special focus on cancer prevention and treatment.

into the architecture of a multilevel strategy to strengthen national security and improve the quality of life.

Development in this high-tech area is of paramount importance not only for Russian society but also for the global medical community as a whole. Although a number of other countries are already implementing parallel research programmes in this sphere, diversified scientific approaches and increased investment in this area can dramatically expand the therapeutic potential of cancer vaccines. Emerging scientific and technological competition between nations and research centres is creating opportunities to consistently reduce the cost of innovative treatments and make them more affordable to patients. Moreover, the involvement of a wide range of countries in this process will facilitate the creation of a global specialised infrastructure and a pool of highly qualified professionals, which together will ensure easier access to advanced medical technologies.

A cross-sectoral, collaborative approach to this challenge has the potential to significantly accelerate the development of vaccines against different types of cancer, optimise treatment protocols and reduce critical waiting times for patients. In today's world, where cancer remains one of the leading causes of death, consolidating research and resources will not only be a significant scientific breakthrough but will also bring hope to the millions of people battling cancer. Notably, international competition and cross-border cooperation in this area are not mutually exclusive processes; on the contrary, they can effectively complement each other to accelerate meaningful results on a global scale.

Bibliography

1. Buzan, B., & Wæver, O. (1998). Security: A new framework for analysis. Lynne Rienner Publishers.
2. El Heraldo de México. (14 de febrero de 2024). ¿Una vacuna contra el cáncer? Vladímir Putin asegura que Rusia está a nada de logralo. [Video] YouTube. https://www.youtube.com/watch?v=Xj7wnpe6I04
3. El Heraldo de México. (19 de diciembre de 2024). ¿Llegará a México? Rusia lanzará vacuna gratuita contra el cáncer. [Video]. YouTube. https://www.youtube.com/watch?v=qvwjFgx5eHs
4. Guio, L., (10 de febrero de 2025). Rusia desarrolla una vacuna contra el cáncer que se podría distribuir gratis en 2025. Medicina y Salud Pública. https://medicinaysaludpublica.com/noticias/oncologia/rusia-desarrolla-una-vacuna-contra-el-cancer-que-se-podria-distribuir-gratis-en-2025/26131
5. Imagen Noticias. (29 de enero de 2025). Desarrollan una vacuna personalizada contra el cáncer en Rusia | Noticias con Francisco Zea. [Video]. YouTube. https://www.youtube.com/watch?v=XAkmFaUhYJI
6. JP+. (13 de junio de 2024). Rusia muy cerca de encontrar la cura contra el cáncer. [Video]. YouTube. https://www.youtube.com/watch?v=7BbyXQ18oBg
7. RT. (22 de junio de 2024). Ponen fecha a las pruebas clínicas de la vacuna rusa contra el cáncer. RT. https://actualidad.rt.com/actualidad/513625-pruebas-vacuna-cancer-rusia
8. RT. (26 de diciembre de 2024). ¿Qué se sabe sobre la vacuna rusa capaz de combatir el

cáncer? RT. https://actualidad.rt.com/actualidad/535177-sabe-vacuna-rusa-capaz-combatir
9. RT. (27 de marzo de 2024). Nicaragua construirá un centro de medicina nuclear con el apoyo de Rusia. RT. https://actualidad.rt.com/actualidad/503898-nicaragua-construira-centro-medicina-nuclear
10. RT. (29 de febrero de 2024). Putin anuncia proyecto para fomentar el deporte y mejorar el sistema de salud. RT. https://actualidad.rt.com/actualidad/500728-putin-anuncia-proyecto-fomentar-deporte
11. RT. (4 de enero de 2025). Este año podría ser decisivo para la creación de vacunas contra el cáncer. RT. https://actualidad.rt.com/actualidad/535990-ano-decisivo-creacion-vacuna-cancer
12. RT., (27 de septiembre de 2024). Médicos cubanos llegan a una clínica especializada rusa como parte del intercambio de experiencias. RT. https://actualidad.rt.com/video/524450-medicos-cubanos-visitan-clinica-oncologica-rusia
13. Runwal, P., (22 de diciembre de 2022). El prometedor futuro de las vacunas contra el cáncer: así funcionan. National Geographic. https://www.nationalgeographic.es/ciencia/2025/02/manifestacion-origen-causas-resurgimiento
14. Vallejo, P., (16 de febrero de 2024). ¿Rusia vs. Cáncer? ¿Hola oncovacunas? Esto es lo que debes saber. Ecoosfera. https://ecoosfera.com/sci-innovacion/cancer-rusia-oncovacunas-vacunas/

ARGENTINA

Vidal Otegui Ignacio

UNIX system administrator

Independent Consultant

A New Model of Technological Ownership

Abstract

After decades of very fast technological development we are at a critical point where - due to new technologies - more power than ever has been concentrated in fewer hands than ever, causing very serious problems that hinder the proper deployment of new technologies and threaten the future of our society.

This situation calls for a “technological reform” where a convenient part of the control and management of tech- nology shifts to new power structures based in communal ownership by the users and technicians involved in each particular technology.

Hypothesis Core

Today a few people control most of the new technological achievements, using them in questionable ways that erode public trust in new technologies, hindering their optimal use in such a way that our future as a successful technological society is jeopardized.

This situation calls for new “power structures” that manage technology in a better way, so:

- Public trust in current and future technologies is restored, so people can feel they own the technolo- gies they use and have a say in its management, deployment and development.
- Efficient and transparent management of current technologies is warranted, avoiding abuses and “dark spots” in key areas like search engine results, massively deployed devices or widely used mes- sage systems, among many others.
- Creation and development of new technologies are encouraged because their creators have their profits assured in case the technology is successful.

1.1 Examples of current technological abuse

Just to name a few related to the IT sector:

- Heavily censored search engine results where independent web sites with valuable information and services are ignored and just results to “dominant” sites like Facebook, Amazon, Twitter (now X) and Wikipedia are shown.
- False and imposed technological requirements, such as needing a cell phone to rent a bike, a Google account to register in a public library, scanning a QR instead of typing a URL, a WhatsAPP account to get a refund, or enabling JavaScript to read a few lines of text.
- Imposed use of unsafe devices like current smartphones6, which lack the source code of key compo- nents and proper means to replace its software (OS) with other provided or modified by the user; too much often they also lack full technical specs required to confirm their safety.
- Imposed arbitrary hardware decisions, for example, the use of led lighted screens instead of much healthier technology like color e-ink or Pixel-Qi displays, which have been available for a long time.
- Cyber attacks by “mysterious agents” that never get caught and sabotage basic independent infras- tructure like email, telephony and web servers.
- Imposed, unsafe and unnecessary technical complexity, Chromium browser being perhaps the best example of this.

This list could be endless and cover most sectors, not just IT.

But the key point is that you need some technical knowledge of any given sector to be able to detect the technological abuses in that area, so the more our technological society develops, the more common people is unable to realize consciously that they are being abused.

This paves the way for opportunistic people with too much power to try to take over society by complex technological means.

These attempts - so far half successful - can only lead to general disaster in the long term.

But even today, if we think how our world should be thanks to our technology, and how it really is, we can see that the damage already done by these selfish interests is far too big.

1.2 Negative eff of technological abuse

A few examples of the nefarious effects of these abuses:

- Credibility lost in public institutions, which are seen as either tolerating or being part of this "take over" of public power by technological corporations and wealthy individuals.
- Growing apathy and mental health problems: psychotic drugs consumption has soared in those countries where "life digitalization" has been imposed more strongly.
- Decreasing productivity11 due to the growing feeling of being just an insignificant piece of machin- ery that will be treated as "obsolete" sooner than later.
- General distrust in new technologies, for example AI or robotics, which instead of being seen with hope are seen as new dangerous weapons in the wrong hands.
- Soft, silent, and often unconscious sabotage of society by common people.
- Increasing concentration of real power in fewer hands, which just worsens the current situation, usually creating new technologies that produce bigger abuses that concentrate still more power in fewer hands.

The way out of this must be redistribution of a convenient part of this technological power between enough wise hands, and it makes all the sense that these hands are those of the users and technicians involved with each particular technology or technical service.

1.3 Proposed solutions

My proposal is to adapt the communal ownership model of the past13 to our technological reality, so each technology or related service belongs and is managed by their users and technicians to such a degree that an optimal balance of power is reached with current financial and political power structures.

This new ownership model would work like this:

- Ownership is defined just by a fact: being a user or a technician involved in a particular technology or service. For example: using an email service once every few days.
- Owning a technology or service imply rights and obligations:
  - The right to use it.
  - The obligation to contribute to its proper management.
  - The obligation to participate in related decision making processes.
  - Others to be defined, the fewer and simpler the better.
- In the case of hardware devices, a smartphone for example, ownership and daily use of one device would imply owning all the technology inside it, and so getting involved with new software updates and having access to all the source code and full technical specifications among other things.
- Of course, to participate in this "ownership model" some kind of online platform will be needed, and this must be owned by their users and technicians

following this very same model.

To put this in practice some kind of new "technological law" will be needed that guarantees:

- Communal ownership of technology as explained above.
- Right to technology for basic needs, for example, owners could refuse access to the technology for a fancy video game, but not for a water making device or a vital medicine.
- Right to be paid for technological services, so people is motivated to create, manage and improve technology.
- Obligation to ensure that any technology one is involved with isn't used for unlawful purposes.
- Data generated by any technology belongs to its users and technicians..
- Obligation to transparency: any technological device must have full technical documentation and full source code freely available to their users (owners).
- No abuse by technological ignorance: people using any technology must have enough knowledge of it so they can't be easily abused while using that technology.
- Preference for small and efficient technological structures.
- "People first" policy: technology must be at the service of people, not the other way around.

In short, there should be rules to avoid excessive power concentration and abuses while at the same time promoting efficiency, dynamism and the empowerment of people through people controlled technology.

In other words, people must keep in mind that: either they own the technology they use, or they will be owned by those who own that technology.

People must understand that living in a technological society implies technical involvement, in the same way that living in an old agricultural society implied responsibilities such as ploughing the land, storing seeds, cleaning forests and so on.

Economic and social eff

The best effect of implementing this "technological reform" would be that the whole society will count with new strong foundations upon which to build the new technological society of the future.

Apart from that, other positive effects would be:

- People will feel to be an active part of new technologies and society at large, not their victims and/or passive users, this will make much easier and faster to implement new technologies, and so economic development will increase.
- Productivity will grow because people will have hope in a future where technology controlled by themselves will make their lives better, instead of fear of a future where they are substituted by robots and AIs.
- Public institutions will gain credibility and support, as they will be perceived as

successfully man- aging the current technological challenges and being able to stay above opportunistic and selfish oligarchs.
- Birth rates will grow as people regain their faith in society while hoping for a future where their children will use technology for their own well-being instead of being used by technology as if they were some kind of "disposable biological tool".
- A new culture based in hard work and personal responsibility will emerge, bringing economic and social development in many different and positive ways.

Relevant statistics

Regarding the ever accelerating technological development: https://www.weforum.org/stories/2023/02/this-timeline-charts-the-fast-pace-of-tech-transformation-across- centuries/

About who are the real owners of big technological corporations: https://hcss.nl/report/power-and-influence-in-a-globalized-world/

Other relevant statistics are incorporated in foot notes 2, 3, 4, 8, 10, 11 and 12.

Predictive study

Given that too many variables are still undefined at this early stage, a predictive study would be premature.

Conclusions, proposals and expected results

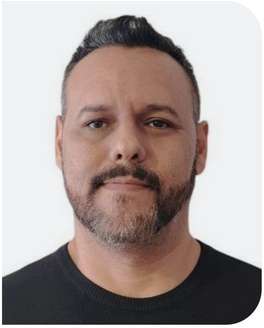
A transfer of a fair share of "real technological power" from their current owners to common people must be made in order to balance the technological society we all live in.

For this to success, the power transfer must be real, and of course well planned and managed.

The countries that better do this power transfer will develop and prosper in a much solid way because their people will believe in themselves as a group, and they will be as a light in the dark for those who are unable to make this transition.

So apart from social and economic gains, these pioneering countries will earn prestige and respect from everybody, and will pave the way to a new world where mankind has learnt to manage technology in a wise way.

VENEZUELA



Vielma Soler Francisco
Senior Analyst

Misión Verdad. Research and Analysis Group

The potential and challenges of artificial intelligence in the context of venezuela's oil and gaz industry in the context of the energy transition

Rationale

AI is defined as a set of "systems that combine sophisticated hardware and software with extensive databases and knowledge-based information processing models to mimic the characteristics of effective human decision-making."[1] It is a rapidly evolving technology that is being actively adopted by industry and has significant innovation and economic potential. The development of AI technologies is fuelling progress, efficiency and economic growth, and hence, their adaptation to key economic processes is becoming vital for developing countries.

It is also necessary to keep in mind the current and future trends in the hydrocarbon industry, which is of strategic importance for Venezuela. According to OPEC World Oil Outlook 2024 report,[2] by 2050 global oil consumption could

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1 Ganascia, Jean-Gabriel. Artificial intelligence: between myth and reality. UNESCO, 29 June 2018. https://courier.unesco.org/en/articles/artificial-intelligence-between-myth-and-reality
2 OPEC. (25 de Septiembre de 2024) 2024 World Oil Outlook 2050. https://publications.opec.org/woo.

reach 120 million barrels per day and gas consumption could rise to 96 million barrels of oil equivalent per day. Such production would meet additional primary energy demand, which would increase by 24% from current levels.

As for investment, OPEC estimates that the oil sector will require USD 17.4 trillion in investment between now and 2050. The Gas Exporting Countries Forum (GECF), in its Global Gas Outlook 2050 report published in 2024, predicts that USD 9 trillion in investment will be needed to meet gas production targets. Although new renewable energy sources will be developed actively, oil and gas will continue to account for more than 50% of the global energy mix, with an increasing share of green energy likely to negatively affect hydrocarbon prices.

For countries like Venezuela, investing in the hydrocarbon industry will be a challenging environment. This Caribbean country faces sanctions imposed without the approval of the UN Security Council, which makes them illegal. Similar measures also affect Russia, Iran and other major oil and gas exporters. The list of countries subject to sanctions is much longer. According to the Global Sanctions Database, as of 2023, 83 countries were under US sanctions, accounting for 35% of global GDP[3] The sanctions limit development opportunities for the countries hit by them, while also jeopardising investment plans in the hydrocarbon sector until 2050.

The impending energy transition and sanctions restrictions are forcing oil-producing countries such as Venezuela to transform their production processes. As long as sanctions remain in place, the country will have to cope with low hydrocarbon prices and limited foreign investment. These circumstances require Venezuela to improve its operational efficiency and reduce the cost of producing each barrel of oil and each cubic metre of gas. In this context, AI represents an optimal technological solution that can be adapted to address these challenges and ensure better management of oil and gas resources.

Prospects and impact of ai on the oil and gas industry

Advanced AI algorithms, trained on extensive and useful datasets and regularly updated, drive the value creation process. However, recent research[4] suggests the use of more advanced neural networks, such as large language models, to model fields and predict their performance.

A market research study by Mordor Intelligence[5] estimates the oil and gas AI

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3 GSDB. (2024) On the heterogeneous effects of sanctions on trade. Global Santions DataBase. https://www.globalsanctionsdatabase.com/#Research.

4 XUE, L. DOU, H. LI, D. (07 de Octubre de 2023). Artificial intelligence methods for oil and gas reservoir development: Current progresses and perspectives. Sciopen. https://www.sciopen.com/article/10.46690/ager.2023.10.07.

5 MORDOR INTELLIGENCE. (2023). AI in Oil and Gas Market Analysis - Industry Report, Size & Forecast 2025 — 2030. Mordor Intelligence. (5 de Febrero de 2025). AI in Oil and Gas Industry- Benefits, Use Cases, and Examples. Oyelabs. https://www.mordorintelligence.com/industry-reports/ai-market-in-oil-and-gas.

market to reach USD 3.54 billion in 2025, expecting it to grow at a CAGR of 12.61% during the forecast period (2025-2030) to hit USD 6.4 billion by 2030.

AI can significantly reduce production costs (expected to decrease by up to USD 5 per barrel) and increase productivity by 25%.[6] In addition, by improving recovery techniques, AI could boost oil reserves by 8-20%.[7]

Major oil and gas companies can now access all of their field data, allowing them to remotely manage and control all of their facilities. Thus, they can make more informed decisions and optimise operations with maximum efficiency. In addition, the digitalisation and verification of data logs before using them are of critical importance, as incomplete records can be a serious problem.

Usefulness as part of production cycle of the hydrocarbon industry

Table 1 compiled by Koroteev и Tekic (2021)[8] provides an overview of some AI solutions for all phases of upstream operations: geological assessment, drilling, reservoir engineering and production optimisation.

Table 1. Non-confidential summary of projects performed with the direct involvement of the authors

Upstream activity	Developed tool	AI approach	Main effect	
			Acceleration	De-risking
Geological assessment	Tool for automated mapping of reservoir rock properties over an oil region	None gradient optimization + interp olation techniques	Speeded up the manual mapping procedure from several weeks to several seconds	Removing human errors causing wrong mapping = making a more accurate definition of right hydrocarbon targets
	Tool for extracting the geological information from well logs	Gradient boosting	100+ times speedup	
	Tool for rock typing based on images of rock samples extracted from the wells	Deep neural networks	~1.000.000+ times speedup	
Drilling	Tool for detecting the drilled rock type and potential failure using real-time drilling telemetry	Combination of machine learning algorithms	Up to 20% time saving and up to 15% money savings at well construction	Maximizing the contact between the wellbore and the pay zone
Reservoir engineering	Tool for accelerating the conventional reservoir simulations	Deep neural networks	Accelerating by a factor of 200 to 2000	Making it possible to screen through much more field development scenarios for selecting the most optimal one
Production optimisation	Data-driven tool for an objective forecast of efficiency of well treatment campaigns	Gradient boosting + expert based feature selection	100+ times faster estimation of the well treatment effect	Up to 20% growth of marginality of the investments to the campaigns

6 JAIN, A. https://oyelabs.com/ai-in-oil-and-gas-industry-use-cases-and-examples/.
7 REUTERS. (3 de Septiembre de 2024). AI likely to weigh on oil prices over the next decade, Goldman says. Reuters. https://www.reuters.com/technology/artificial-intelligence/ai-likely-weigh-oil-prices-over-next-decade-goldman-says-2024-09-03/.
8 KOROTEEV, D. TEKIC, Z. Artificial intelligence in oil and gas upstream: Trends, challenges, and scenarios for the future. SicenceDirect. https://www.sciencedirect.com/science/article/pii/S2666546820300410.

Table 1. Non-confidential summary of projects performed with the direct involvement of the authors

According to Vadim Struk of Relevant Software, although the development of these technologies is still in the early stages, they are already demonstrating a number of benefits for the hydrocarbon industry.[9]

Supply chain optimisation: AI in oil and gas market can analyse vast amounts of production, transportation, and storage data to optimise the supply chain as well as identify and reduce financial and operational risks. This leads to reduced costs, improved delivery times, and better inventory management.

Predictive Maintenance: Refineries rely on complex tools that require regular maintenance. This oil and gas artificial intelligence equipment can analyse sensor data to predict failures before they occur, avoid expensive shutdowns and ensure smooth operations. Also, such technology as digital twins (data-driven virtual replica of a physical asset or process) enhances predictive maintenance by simulating complex drilling operations.

Energy Efficiency: AI oil and gas software can analyze data from refineries and pipelines to identify areas for energy waste reduction. This not only saves costs but also minimises the industry's environmental footprint.

Venezuela's successes and challenge

The use of AI in Venezuela's oil industry can bring a number of benefits, including maximising hydrocarbon recovery. Technologies such as machine learning and deep neural networks (DNNs)[10] can improve the process of extracting oil and gas from existing fields, which is particularly important for countries with mature fields.

With the right business connections and investment, these technologies can propel Venezuela into the region's technology hub, attracting investment and enhancing its global competitiveness. In addition, the introduction and support of AI systems can stimulate the training of professionals in high-tech fields and the development of homegrown applications.

Nevertheless, Venezuela faces certain challenges. Implementing these technologies will require significant investment in infrastructure, software development, specialised equipment and training. The lack of local capacity to develop and maintain such systems could lead to dependence on foreign suppliers, which is a serious problem, especially in the face of illegal sanctions.

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9 STRUCK, V. (15 de Marzo de 2024). The Energy Transformation: Implications of AI in Oil and Gas Operations. Relevant Software. https://relevant.software/blog/ai-in-oil-and-gas/.

10 XUE, L. DOU, H. LI, D. (07 de Octubre de 2023). Artificial intelligence methods for oil and gas reservoir development: Current progresses and perspectives. Sciopen. https://www.sciopen.com/article/10.46690/ager.2023.10.07.

Venezuela will find itself on an unequal footing with other countries. While investments by US and Chinese corporations may exceed the combined GDP of several Latin American countries, Venezuela and other countries in the global South will depend on alliances and cooperation with various global players as this is the only way to access the most advanced tools and platforms. In addition, the lack of its own infrastructure for high-performance computing and limited access to key components put the country at a disadvantage, reinforcing the need to develop local competences and infrastructure.

On the other hand, critical processes in the oil and gas industry, which are crucial to Venezuela's economic stability, could become vulnerable to cyber threats due to the use of interconnected AI systems. To protect against these threats, the country will need robust cybersecurity measures, including the development of domestic encryption technologies, multi-factor authentication, regular audits, incident response plans, and training for employees to use the technologies safely.

To successfully implement AI, Venezuela will need skilled professionals with expertise in artificial intelligence and data science, as well as specific knowledge of the oil and gas industry. In this regard, the country will benefit from the expertise of consultants from friendly countries such as China and Russia.

Venezuela's state-owned oil and gas company PDVSA must develop effective data practices, ensure continuous auditing of information, develop a culture of data sharing, and fill its systems with reliable information to improve the efficiency of AI-related processes.

Concluding observations

Recently, Venezuela's Vice President and Minister of Hydrocarbons Delcy Rodriguez has announced the signing of agreements with the Republic of India to collaborate on digital technology, open source software development and technology applications using artificial intelligence. Rodriguez said that the cooperation agreement signed between Venezuela's Ministry of Science and Technology and India's Ministry of Electronics and Information Technology will promote "exchange in key sectors such as health, education and public administration."

The minister stressed that the agreement also includes the exchange of professionals and experts, as well as training in technology, which will help build local capacity and create a more favourable environment for technological development in the country. Venezuela has begun to create new conditions for the development of these areas and in the near future will be able to integrate them with the hydrocarbon industry to unlock its potential and bring new opportunities to incorporate these technologies into its core economic activities.

To ensure the development and efficient utilisation of Venezuela's hydrocarbon deposits, the state oil company PDVSA will need to fully exploit its capabilities. This company has a division dedicated to automation, information technology and telecommunications and has sufficient resources to meet new challenges. The country will have to extract and sell resources in a difficult environment related to illegal sanctions and the possible fall in hydrocarbon prices in the context of the energy transition.

Venezuela needs to start adapting to future conditions right now in order to maintain its position as an important energy player and contribute to global energy stability and security in the coming years.

Wang Jun
Associate professor

School of Physical Education,
Shandong Normal University

Radical Changes and Opportunities on the Labor Market in the Age of AI

Summary: Artificial Intelligence (AI) is developing with astonishing pace and is causing profound effect on various industries. In the age of AI, the labor market will face unprecedented changes, but there will be new opportunities as well. The article considers the impact of artificial intelligence on the labor market, emergence of new professions, and transformation of staff training models, as well as forecasts labor market development trends.

Key words: artificial intelligence; labor market; changes; opportunities; staff training.

Introduction

In recent years, technology of artificial intelligence (AI) has been developing rapidly. From the AlphaGo's victory over the world champion in Go to the emergence of ChatGPT artificial intelligence keeps exceeding our expectations. AI is no longer a matter of science fiction, it has actually entered our life and is profoundly changing the world. As an important driver of social development, the labor market inevitably faces the wave raised by artificial intelligence. On one hand, there is a risk of traditional job replacement; on the other hand, new professions and opportunities are emerging. The article considers changes and opportunities on the labor market in the age of artificial intelligence and suggests response strategies.

1. Changes on the labor market under the impact of artificial intelligence

(1) Adjustment of the employment structure

Reduction in the number of low skilled jobs. Along with the spread of artificial intelligence technology, low skilled routine jobs are being gradually replaced with automated systems. Workers on production lines, call center operators in the service sector, as well as junior data analysts are facing the risk of being replaced. According to McKinsey Global Institute, approximately 50% of professions will be gradually replaced with artificial intelligence from 2030 to 2060. Demand for high skilled jobs is likely to increase. AI technology development will soar the demand for high skilled creative labor. The future labor market will value unique human characteristics, such as innovative thinking, critical thinking, and interpersonal communication skills.

(2) Emergence of new professions

Along with the development of artificial intelligence technology, there will emerge multiple new professions, especially in the area of AI and at the intersection of different industries. Popular technical specialties will include such professions as

AI-trainer, data scientist, and algorithmic engineer. These positions require not only profound technical knowledge, but also understanding of human needs and social problems. AI-trainers ensure data markup and analysis in order to optimize operations of artificial intelligence systems and improve user experience. Data scientists are focused on extracting valuable information from large amounts of data and they provide support for decision making. Besides, deep integration of AI in various industries promotes the emergence of interdisciplinary professions. Medical data analysts use AI to process medical images and patients' data and to help doctors with diagnostics; intelligent investment consultants apply AI algorithms to provide clients with accurate investment recommendations; ethical AI auditors assess artificial intelligence systems in terms of ethical risks to ensure compliance with regulatory requirements. These professions require broad knowledge and skills in different fields, as well as the ability to combine AI technology with the needs of particular industries.

Development of artificial intelligence also promotes transformation of traditional professions. For example, the service sector is facing a shift from call center operators to intelligent chatbot trainers. Such experts as accountants and legal assistants also use AI tools to improve their performance. This trend suggests that the future of the labor market will feature closer integration of technology and humanitarian skills. Experts will require continuous training and adaptation in order to successfully exploit the opportunities provided by AI and to solve new challenges.

(3) Human-machine cooperation is becoming the main trend

Regardless of the impressive abilities of artificial intelligence in many areas, it is still not a universal solution. In essence, AI is a tool meant to support humans in their activities, and not to replace them. Human-AI cooperation is likely to become the main trend on the future labor market.

For example, consider design industry. AI can quickly generate preliminary design sketches and offer various styles and variants for revision. However, AI generated content often lacks unique emotional and creative expression, and final design solutions and creative enrichment shall be still provided by human designers. Such mode of cooperation not only improves efficiency of the work, but also allows designers to focus on more creative tasks. In medical industry, AI can analyze enormous amounts of medical images and data on disease cases and provide doctors with diagnostic recommendations, however, the final decision on treatment still has to be made by a doctor based on their clinical experience and needs of the patient. Such model of human-machine cooperation improves diagnostics efficiency, as well as

maintains "human warmth" and professionalism in medical service. AI development resulted in the emergence of multiple new professions, such as AI training expert, AI ethics consultant, algorithm maintenance engineer, etc. These positions are focusing on AI model optimization, ethical control, and data management and they provide people with more opportunities for work in creative, managerial, and high skilled areas.

In future, human-AI relations will gradually develop from mere use of the tools towards more profound symbiotic cooperation. AI will become an intelligent helper for people helping them to optimize time management and task fulfilment. In financial sector, AI will be able to analyze market trends and provide investors with accurate recommendations for decision making. In education, AI will be able to create customized educational programs for students, while professors will focus on development of their creative abilities and critical thinking. AI is not a competitor for humans, but their powerful partner. Through reasonable management of AI development people will use it as a tool to reveal their own potential and improve performance, while retaining indispensable advantages in the area of creativity and ethical judgment. Joint human-AI work will become the key model to promote social development and technological progress.

2. Opportunities offered by artificial intelligence

(1) New professions and opportunities in high paying industries

In modern digital era, demand for artificial intelligence technology in high paying industries is continuously growing. Financial sector, public healthcare, and production become the leading platforms for AI implementation. For example, consider financial sector. AI technology is widely used in such areas as risk assessment, automated investment consulting, and fraud combating. This doesn't only ensure significant operational cost reduction, but also speeds up the decision-making process due to accurate data analysis. In medicine, diagnostic systems with AI support can quickly analyze medical images and help doctors to detect pathologies earlier, which improves efficiency of diagnostics. In production sector AI is used to implement smart production, optimize production processes, and improve product quality.

The eco-system based on large models of artificial intelligence is actively developing and creates over 200 new professions. These new professions cover not only traditional technical positions, such as technology development and data analysis, but also new professions, such as AI ethics consultant and AI training expert. These professions feature not only high wage levels, but also vast opportunities for career growth. Along with increase in the popularity of AI technology, the skill of human-machine interaction becomes a new job requirement, and experts able to flexibly use AI tools will be more competitive.

(2) Higher qualification and professional transformation

Importance of continuous training is associated with continuous progress of technology, as many traditional skills can become obsolete, while the demand for new skills will continue to grow. Thus, continuous training will become obligatory for everyone. Studies in such knowledge areas as programming, data analysis, and AI application will become an important future trend. Development of interdisciplinary competences is required as the future labor market will be more oriented on universal capabilities, and not particular skills. For example, successful AI engineer shall not only possess technical knowledge, but also understand needs of the industry and social problems. It underscores the importance of interdisciplinary approach and ability to adapt to various conditions.

(3) Transformation of enterprises and industries

Increased competitiveness of enterprises is associated with the application of artificial intelligence technology that can significantly improve operational performance, optimize production processes, and reduce costs. For example, in the processing industry smart equipment and systems use data analysis and machine learning to optimize production processes. Promotion of industrial innovations will result in deep AI integration into various industries, which will not only improve performance, but will also create multiple new jobs that were previously unimaginable. This provides new opportunities for industry development and transformation and promotes emergence of innovative solutions and business models.

3. Response strategy

(1) At the personal level

Improved technical skills are necessary for everyone. In this connection, people shall actively study technology associated with artificial intelligence, such as programming, data analysis, and machine learning. They shall develop their interdisciplinary competences, widen their knowledge, and join their professional experience with new areas. Development of flexible skills, such as innovative thinking, critical thinking, and interpersonal communication skills will become more and more important on the future labor market. People shall improve these skills through practice and training in order to increase their competitiveness. To stay

open-minded, as the spread of AI will bring a lot of uncertainty and new tasks, but will also provide vast opportunities. People shall stay open-minded, actively embrace changes and adapt themselves to the new methods of work.

(2) At the company level

In the age of artificial intelligence, companies shall adjust their hiring strategies in order to adapt to the new requirements resulting from technological changes. Special attention shall be paid to attracting diverse specialists having both interdisciplinary skills and innovative abilities. With the spread of AI it is no longer enough to master only one narrow specialization for a successful career. The trend is shifting towards

multidisciplinary professional paths and cross-industry development. For example, companies may search for engineers, whose technical knowledge is supplemented with skills in the area of artistic design, as this will help to improve interaction with the users. Besides, companies shall invest more resources in staff training and development and create flexible and adaptive training programs. Along with AI development, requirements for employees' skills are continuously increasing, thus organizations shall provide target training programs in order to help their employees to gain necessary knowledge related to AI. Besides, companies shall also actively implement models of human-machine cooperation using advantages of AI as a supplementary tool, while maintaining unique human abilities. Artificial intelligence can fulfil routine and recurrent tasks, thus freeing up employees to solve complex problems. For example, in public healthcare AI can analyze medical images and quickly detect possible mistakes in diagnostics, while doctors can focus on more difficult clinical cases. Such an approach not only improves efficiency of the work, but also provides employees with more time to focus on fulfilment of high value tasks.

By adjustment of their hiring strategies, developing talents, and promoting

human-machine cooperation companies will be able to better deal with the challenges and opportunities of the AI age. This will make it possible for them to achieve profound interaction between technology and human resources, thus strengthening their competitiveness on the market.

(3) At the social level

At the social level it is necessary to promote wide application of the artificial intelligence technology. Government and enterprises shall cooperate to develop ethical norms and legal framework for AI in order to guaranty legal and proper use of the technology. For example, in case of AI implementation in medicine for diagnostics it is important to develop standards of personal data protection and risk management. This will ensure patients' safety and prevent potential threats. Society shall also intensify information and education in the AI area and improve awareness of the population on its opportunities and risks, thus establishing favorable environment for development of the technology.

The education system and social learning mechanisms shall be adapted to the requirements of the AI age. At the level of general education, it is necessary to introduce training in AI and programming in order to improve digital literacy of the population. Besides, it is important to create platforms for continuous training in order to motivate employees to adapt to the changes in their professions resulting from new technology, as well as to develop skills of the experts in order for them to be able to master both technical knowledge and ethical approach. Society shall support

cross-industry cooperation and development of innovative eco-systems, promote cooperation between companies, scientific and research institutions, and the government in order to promote cross-industry innovative applications. Besides, it is

necessary to focus on reduction of the digital gap by way of introduction of translation technology and support at the international level in order to ensure global prosperity and equal access to new technology.

Society shall take into account the impact of AI on the employment structure. With wide spread of artificial intelligence some routine jobs can be replaced, but new professional opportunities will also be created. The government and enterprises shall cooperate to develop professional and advanced training programs, which will promote the switch of labor force to positions associated with AI. Due to such measures, society will be able to better deal with possible challenges pertaining to AI and to ensure harmonious development of technology and society.

Conclusion

Development of the artificial intelligence technology results in the emergence of new professions, especially that associated with AI and interdisciplinary areas. These professions require not only profound technical knowledge, but also the ability to understand human needs and social problems. For example, data scientists focus on extracting valuable information from large amounts of data to support decision making. These professions require experts to have vast interdisciplinary knowledge and skills enabling them to integrate IT-technology with the needs of particular industries.

AI development is also promoting transformation of traditional professions. This trend indicates that the future labor market will mostly focus on integration of technology and humanitarian skills, and employees will have to undergo continuous training and adaptation in order to deal with the opportunities and challenges pertaining to AI.

References

- [1] Hu Jingjing, Cheng Chengping. Impact of the new generation of artificial intelligence on employment and response strategies [J]. Journal of Humanities, 2025, (01): 40-52. DOI: 10.15895/j.cnki.rwzz.20250117.001.
- [2] Kong Weiwei, Xie Meiting. Research on the impact of artificial intelligence on employment quality: overview and prospects [J]. Education and Researches, 2024, (07): 134-141.
- [3] Zhu Peng, Su Jun, Han Zhihong et al. Smart future: social impact of generative artificial intelligence and standardized management [J]. Electronic Management, 2025, (01): 2-14. DOI: 10.16582/j.cnki.dzzw.2025.01.001.
- [4] Li Nan, Li Qinghong. New forms, problems, and paths of normative development of the labor market in the age of artificial intelligence [J]. Fujian Forum (Humanities and Social Sciences), 2024, (11): 48-62.
- [5] Jia Peng, Du Yang. Impact of artificial intelligence on the labor market [J]. Financial Intelligence Center, 2024, 9(05): 29-46+144-145. DOI: 10.20032/j.cnki.cn10-1359/f.2024.05.002.
- [6] Feng Xueying. Impact of artificial intelligence technology on the labor market and response strategies [J]. Weekly Internet Publication, 2024, (13): 37-39.
- [7] Chen Nan, Liu Xiangli, Fan Weiguo et al. Multiaspect impact and mechanisms of artificial intelligence impact on employment: overview and prospects [J]. China Human Resource Development, 2021, 38(11): 125-139. DOI: 10.16471/j.cnki.11-2822/c.2021.11.008.

RUSSIA

Yarygina Irina
Head of the Economics and Banking Business Department, Dr., Professor

MGIMO University

A New Model of Technological Ownership

Abstract:
Current global industrial development depends on successful energy production and sensible consumption management. One of the reliable source of energy is hydrogen that helps us to forget about exhaust gases, oilrigs and gasoline dependence forever. There is no denying the fact that hydrogen becomes a new energy carrier and plays an important role in contemporary hydrogen economy, which, in its turn, depends on research and development infrastructure, as well as on the ways of extracting hydrogen, harmonization of rules of fuel operating procedures and application of reasonable financial mechanisms. In its turn, safe hydrogen production solution contributes to better and safe living existence.

Hydrogen helps to reduce the level of carbon emission of manufacturing industries due to the type of its energy production and the usage of low-carbon technologies. Such kind of an approach is considered to be the future of power industry. For this purpose, it is possible to use technologies for carbon dioxide capture and storage, as well as water electrolysis, primarily using the energy of nuclear, hydro, wind and solar energy facilities where possible. The contemporary projects of hydrogen production suggest a justified solution of innovative international initiatives in its financing. The results of the research, which will be presented, are

of an applied nature, aimed at environment protection and safe development of global economy.

Management of ecology risks and secure energy production depend on mutual activity and partnership of relevant actors (international public and private institutions).

The key mechanisms of activity in this area are planned to be introduced as a part of the presentation.

Background:

Hydrogen can become a new energy carrier and play an important role in the global hydrogen economy. Risks of innovative green energy development projects depend on mutual activity and partnership. Hydrogen economy depends on R&D infrastructure, ways of extracting hydrogen, harmonization of rules of fuel operating procedures and application of reasonable financial mechanisms. Solving the innovative problems of safe hydrogen production, taking into consideration peculiarities of contemporary development, contribute to the global safe living.

Objective:

According to the research, the public and private sectors, for example, in Russia invest yearly about 6 trillion rubles in infrastructure development, including environment protection. However, insurance companies and pension funds have little experience of participating in such kind of projects. As a result, the share in capital investments leaves much to be desired. Investments in infrastructure remain attractive for private funds, but their money is getting into the industry rather slowly. We consider that one of the reasons is the lack of projects, structured under infrastructure bonds, which may secure also hydrogen energy production. Currently, there are about 60 private pension funds, operating in Russia and 36 of them carry out mandatory pension insurance. Private funds in any country may expand the usage of their financial resources in ensuring environmental protection, which is directly related to the development of hydrogen economy.

Methods:

The research is based on the methods of comparative analysis, content analysis and complex analysis. The method of comparative analysis is also used to determine the influence of secure energy production on contemporary economy and identify the role of the environment protection on the global background.

Results:

The research proves that allocation of pension reserves and investments are based on the following principles: ensurence the safety, securitization of profitability, divercification of investment portfolios, defining an investment strategy, based on objective criteria that can be quantified, information openness of the process, professional management of the investments. Thus, pension funds may contribute greatly to the the environment protection policy by developing financial instruments for sustainable development.

Conclusion:

Within the process of secure hydrogen energy production, there are challenges for public institutions to develop non-bank financial intermediaries and help to transform savings to investments. It is important to take the following measures: improve taxation of insurance companies as well as requirements for the structure of the investment portfolio and legislation by creating a unified code of responsible investments in hydrogen production. It is also important to promote cooperation between insurance and management companies, increase information transparency, clarify the rights of depositors and participants of private investment funds while participating in pension programs. The above mentioned measures contribute to the global sustainable economic growth, environment protection and develop cooperation of the Russian Federation with its economic partners.

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