

Impacts of Science Technology and Innovation on National Sovereignty of Underdeveloped & Developing Countries

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ABSTRACT

This article explains the impacts of science, technology, and innovation on the national sovereignty of underdeveloped & developing countries. Science, technology and innovation are the root of informed decision-making in digital sovereignty matters. Technology and innovation have been changing rapidly in all industrial sectors. Economic productivity depends on technology, implying that a country needs an up-to-date, technologically skilled workforce to keep pace with other countries' productivity rates. In this digitalized era, economic and political power depends upon technological skills, especially on digital technology. Nowadays, sovereignty means maintaining control over technologies crucial to industrial transformation and competitiveness in the international market. Modern national sovereignty depends primarily on technological power and intellectual capacity, as well as on interdependence with other nations, while maintaining the phenomenon of independence. The loss of data sovereignty implies significant risks to national security and autonomy. The findings of this research are that education is a strategic instrument for a country's sovereignty to motivate intellectuals and human resources. Emphasise should be given on Science, Technology, Engineering, and Mathematics (STEM) education for increasing innovation capability, building a skilled workforce, reducing foreign dependency, and strengthening national sovereignty. Curriculum policy at every level of education should be updated to adjust the changing technology. Science, technology, and innovation are shaping the economic and political power of nations.

Key words: Science, technology, innovation, digital technology, national sovereignty, STEM, interdependence, independence.

INTRODUCTION

Science, Technology and innovation can be defined as the interrelated fields where science consists of various disciplines with objectives to understand the natural world, whereas Technology refers to the application of scientific knowledge among multiple domains, such as engineering, information technology, health science, agricultural science, food safety, etc., to improve the contemporary and future innovations. Innovation can be defined as the modification and development of previously invented technology that is more effective than the previous one.

The concept of sovereignty was first introduced by Jean Bodin in his book "Six Books of the Republic" (1576). He stated that a state's sovereignty means its faithful and unchangeable power to make and break law, derived from moral commitments upheld by its populace. Bodin reshaped political thought using the historical method

(Wikipedia). Hinsley (1986), a renowned author on sovereignty theory, explores the history, philosophy, and legal evolution of sovereignty and emphasises how modern sovereign countries emerged and survived amid changing political and economic conditions. According to Hinsley, if equilibrium is not maintained, sovereignty is missing.

A traditional definition of sovereignty is the state's supreme, exclusive authority over its territory, free from external interference (Krasner, 2001). It was based on military strength and territory. Sovereign countries can demonstrate legitimate leadership, control their markets and trade, enforce laws effectively, and function as independent states. The Montevideo Convention of 1933 on the Rights and Duties of States established the fundamental components of the sovereignty-based structure. Raghunath, Anant, and Mashelkar (2015) found in their study that science, technology, and innovation will determine the economic and political power of nations. They also found that information technology creates netizens from citizens as the nation moves from 'independence to interdependence'. Modern sovereignty depends overall on technological power and intellectual capacity (NDC Journal, 2025).

Sovereign equality and the right to self-determination are currently governed by the UN Charter and the International Covenant on Civil and Political Rights 2017. Jovan Kurbalija (March 2026) stated that only the United States, China, and North Korea can claim prevailing digital sovereignty so far. The other 190 member countries of the UN have been searching for a digital sovereignty formula that ensures participation in the internet ecosystem and the global economy while avoiding the dependency that could compromise vital national interests. He also stated that China has built its digital space the way it has built its economy: by using foreign technology, examining it, and then developing domestic alternatives. Zaman et al. (2024) studied "the impacts of technological innovations: a systemic review for smart Bangladesh"; they suggest that policymakers should take prompt action to ensure an efficient labour force through research and development, and to promote institutional excellence and environmental sustainability.

The present study finds, nowadays national sovereignty means maintaining control over technologies crucial to industrial transformation and competitiveness in international markets. Digital technology controls all financial, administrative, media and mass communication activities of the world. Digital sovereignty means a country's or organisation's ability to independently control, govern, and secure its digital infrastructure, data, and technologies. Curriculum policy at every level of education should be updated to adjust the changing technology. Fake news created using digital technology or AI by cyber criminals, it's a risk factor for sovereignty. Human resources should be conscious about misuse of AI or digital technology to create fake news. Strong fake news scanner software should be created to face the fake news in the electronic and print media. Emphasise should be given on Science, Technology, Engineering and Mathematics (STEM) education at every level of education to increase the innovation capability of human resources of the country.

RESEARCH METHOD

The analysis-synthesis method is used to obtain reliable results in this study. Secondary data from previously published papers and documents are used to analyze the present study, focusing on how the effects of science, technology, and innovation act on sovereignty. The authors have also used the systemic method to examine sovereignty within a broader system of global relations and processes. That means the authors did not consider sovereignty as an isolated phenomenon, but as part of an interconnected, interdependent complex system for nations, preserving their independence. This method is also used to analyze and highlight the legal and political challenges asserted by Transnational Corporations (TNCs) to national sovereignty. This study explored how international economic, political, social, and technological trends interact and affect state sovereignty, considering factors such as cyberspace, globalisation, international organisations, and TNCs.

NATIONAL SOVEREIGNTY ISSUES

Economic Strength

The inability of governments to govern national economies results in high unemployment or fiscal deficits. Developing & underdeveloped nations frequently face various conditions set by the IMF and the World Bank for their trade and financing. Economic efficiency and treaties overseen by bodies like the WTO restrict a nation's ability to implement independent economic strategies, e.g., protectionist measures. Productivity capability is a significant challenge to both income growth and a country's sovereignty. And the productivity capability depends upon the technological capacity and skilled workforce of a country. The nation-states and their sovereignty maintain a significant impact on the dynamics of power and trade among different nation-states (Tran Vang-Phu & Duong Anh Son, 2024). Obviously, capability of international trade depends on productivity capacity of a nation.

Digital and Cyber Crimes

In recent times, fake news on the internet poses a potential challenge to state sovereignty, enabled by the global network of computer systems and information technologies. The issue is not just the physical infrastructure of the internet, but also the virtual world where people interact, exchange information, conduct business, and where transactions, data processing, and data storage take place. Cyberspace comprises a wide range of components, including network hardware, software, databases, websites, and other resources that create the digital world (Garvey, 2021). This technology is a dynamic system that continuously evolves due to innovations in this field. In Western countries, approximately 90% of critical computer infrastructure is managed by the private sector (Dunn Cavelty 2010). Data breaches, cyber-attacks, and cyber warfare are the most significant security threats to countries. Using artificial intelligence, cybercriminals create fake news that can spark communal unrest in the country, and thus, break national bonds. The digital technology landscape is rapidly changing due to AI, the Internet of Things (IoT), and Quantum computing (Krishna Yadov, 2024). The ability to control, manage, and secure data within a nation's territory is becoming a potential component of national sovereignty in this age of AI and Data Science. AI is transforming workspace, changing how value is created and how decisions are made, at speed and at scale (ILO head, AFP, Geneva, 2026). Developing countries depend on foreign technology firms for communication infrastructure, cyber security, and digital services. These raise concerns about data privacy, surveillance, and the control of digital infrastructure. The dominant technology giants like Google, Meta, and Amazon have captured large amounts of user's data in developing and underdeveloped nations, which they can analyze and monetise outside national jurisdictions. Thus, loss of data sovereignty implies significant risks to national security and autonomy.

Internal non-state actors

Internal non-state actor's terrorism ignores borders, making it complex for the countries to control their territory. These non-state actors act as agents for other countries, undermining their country's sovereignty in exchange for instant or probable financial benefits from abroad. It's a major challenge to control non-state actors.

Globalisation Issue and Cultural Threat

In the modern age, Globalisation has become a powerful force redefining international relations, domestic governance, and economic activities on a global scale. Increased economic interconnectedness has spread globally, threatening to weaken national identities and cultural sovereignty. The spread of global media, consumer brands, and digital platforms has led to a trend of cultural behaviour homogenization. Western cultural norms, values, and lifestyles are increasingly shaping the social norms of developing countries, weakening local norms, values, traditions, languages, and nationalism. The dominance of English- language media, Western culture & films, fast-food chains, and Western fashion leads to a form of cultural imperialism and disrupts social coherence in the developing nations.

A case study show the results as (1) the impact of globalization on sovereignty is evident in multiple sectors in India e g India had to ban several mobile apps of China in 2020 due to risk on national sovereignty, (2) in Nigeria, dependency on oil exports and foreign investment has created vulnerabilities in 1980s, Nigeria had to devalue its currency, implied undermining domestic industries and increased socio-economic inequality, (3) but Brazil has accepted globalization by balancing regional cooperation using strategic autonomy and they gained from Trade and foreign investment, they have also resisted some mandates of WTO, it's a good example for

developing nations to follow. Khadizar & Siddique (2024) viewed the concept of sovereignty as closely linked to the country, but globalisation has exposed it to numerous challenges, such as increased dependency across fields such as the economy, trade, politics, the military, and culture.

Since the mid-20th century, the concept of state sovereignty has undergone a significant transformation, shaped by various international processes, such as the integration of many states into the global economic and political arena, resulting in the present situation. Nelia Makovetska et al. (2024) described the sovereignty crisis of national states at the end of the 20th and the beginning of the 21st centuries, which was sparked by the war events: Operation Desert Storm, the conflicts in Kosovo, Panama, and Afghanistan, and the accelerated development of the European Union.

Climate Change Affects

Climate change and its effects on natural resources have traditionally been treated as a soft security issue and challenge to be managed, rather than a disruptive factor in international security (Caitlin E. Werrell, 2016). The role of science & Technology (S&T) has received increased attention in the Sendai Framework for Disaster Risk Reduction (2015-2030) (SFDRR). An unrest of national security strategies, defence papers and intelligence assessments have suggested that climate change is a “threat multiplier”. Khalid Shafi et al. (2021) found in their research that there are fears in the underdeveloped world about the erosion of their sovereignty through climate change action and response mechanisms, and that remedial actions taken are not sufficient in practice.

Geopolitical Issue

Some large, powerful countries have geopolitical issues with other small and less powerful countries, which create threats to national sovereignty. The big power countries exert pressure on underdeveloped or developing countries to gain various advantages in competitive trade markets, fiscal issues, and other fields. In modern conditions, it is difficult to understand the nature of geopolitics and its interaction with various geo-strategies. Dubov (2014) described that various definitions of geopolitics given by scholars that reflect the depth and complexity of this discipline, both in the classical and modern scientific contexts.

RESULTS

Science & Technological Sovereignty

Science & Technology (S&T) is the foundation of informed decision-making in digital sovereignty matters. The role of S & T has received enhanced attention in the Development of science, technology and innovation. It plays a vital role in economic development and in the sovereignty of a country. The government of every country should consider developing its human resources to achieve the economic development and technological capabilities necessary for its development. The children and young people must be motivated in the proper way to realise their capabilities in science and technology, as well as in Military technology. The military force cannot imagine itself without technology. We know that network technology was developed in the military. Every country should have an updated policy on science, technology and innovation. Innovation in science and technology can drive continuous technological development. The latest technologies are also required for security and defence forces to protect the country's security and sovereignty. A strong software innovation team is required in every country to create independent software that protects digital sovereignty. Digital technology means programming and coding capability.

Science, Technology and Innovation Policy Update

Development in science, technology, and innovation is a continuous process; nowadays, technology changes every day. The governments should take care of modernising policies on education curricula, science, technology, and innovation to align with international communities in this regard. The Bangladesh government has adopted a policy to emphasise technical education from the secondary level to enhance the country's skilled workforce.

Research and Development (R & D)

Research and Development (R & D) acts as a critical foundation for modern sovereignty, shifting the focus from territorial control to technological self-reliance, economic competitiveness and data governance. Investment in R&D allows states to make independent decisions, reduce dependence on foreign technologies, and manage their own resources in an era defined by rapid digital transformation and globalisation. There should be coordination among the national security departments, the R&D and Science & Technology departments of the country. There is a gap between necessity and existing technology to face technological and digital sovereignty.

Science, Technology, Engineering and Mathematics (STEM)

Education is a strategic instrument for a country's sovereignty to motivate intellectuals and human resources. In this regard, Science, Technology, Engineering and Mathematics (STEM) education is most important for building a skilled workforce, reducing foreign dependency, and increasing innovation capacity. So, STEM education is potentially important for national sovereignty. Akther Hossan (2025) found in his study that STEM education and formalised military-academic partnerships can play a vital role in the sovereignty of a country like Bangladesh. He also emphasises that education is not just a social service but an indispensable pillar of modern statecraft and national security. So, emphasis should be placed on STEM education to improve skills in science, technology, and innovation, as well as in digital technology.

National Bonding

National bonding is defined as the strengthening of cohesion, shared identity and political unity within the country, which serves as a crucial mechanism for protecting and reasserting national sovereignty in the face of globalisation, international pressure and transnational challenges. There should be equal rights for all classes of citizens of the country, such that no one can revolt against any policy of the country.

Case study on Bangladesh

Bangladesh is a South Asian country situated north of the Bay of Bengal, which is the northeastern part of the Indian Ocean and still is a member of LDCs. Independent Bangladesh emerged in 1971 through a bloody war with the then West Pakistan. The main causes of the war were the inequalities between the then West Pakistan and East Pakistan in governance of administration, development facilities, and overall facilities for citizens. The Constitution of Bangladesh was written in 1972. In Bangladesh, all citizens have equal rights, including the hill and small tribal peoples, and enjoy multiculturalism and religious harmony.

Science, Technology and Innovation (STI) can enhance Bangladesh's national sovereignty by driving economic independence, strengthening security, and advancing digital governance. Through initiatives such as 'Smart Bangladesh' and Bangladesh Satellite-1, Bangladesh has been reducing its dependence on foreign technology, strengthening cyber-security, and increasing industrial productivity. Now, Bangladesh is using AI supported technology in some sector, such as AI supported Closed Circuit Camera are using trafficking vehicles, security purpose. Bangladesh is shifting its role from a passive user to an active, resilient player in the world economy. Strategic investment in digital technology, nuclear energy and AI reduced dependency on external aid and strengthened critical infrastructure. Since Bangladesh is in the era of digital transformation, the launch of SpaceX's Starlink satellite-based internet constellation has sparked the youth's immense promise and mounting concern. Alam (2026) emphasises the urgent need to establish a robust regulatory framework before opening the country's skies to foreign satellite internet providers such as Starlink. The government should emphasize on Science Technology Engineering and Mathematics (STEM) education to increase the capability of innovation in science and technology as well as generating skilled workforce.

Comments:

The world's observation is a significant change in global trading assumptions. The USA's recent economic policy is challenging in international trade and geopolitics. Developing and underdeveloped countries are trying to align with the superpower, the USA, for economic interests. To address these challenges, developing countries

have to increase skilled workforce and industrial productivity by leveraging skilled manpower with technological knowledge.

There is a gap between current necessity and existing own technology to face technological and digital sovereignty. The government should appoint appropriate, efficient professionals with adequate remuneration and oversight to achieve the necessary output to protect the country's national sovereignty and economic strength using digital technology. Digital sovereignty technology means the ability to innovate independent program and code for digital security purposes of the nation.

CONCLUSION

In the new era of dynamic technologies and issues, every country must consider its sovereignty and adopt updated policies in education, science, technology, and innovation to meet the challenges. So, the government should update the education curriculum at every level of schooling to align with the dynamic technology of the world. In the recent situation, economic strength is now geopolitical influence, and so every country should protect their sovereignty unitedly in an unstable world. Underdeveloped & Developing nations should emphasise for building strong institutions by mobilising action nationwide.

To sustain the flow of skilled workers in a changing world, countries would emphasise education in science, technology, innovation, and research and development (R&D). For this, governments must emphasise STEM education at every level of education to increase innovation in science and technology. There should be a research and development section in every potential Department of the country to update the necessary policy to address the issues.

This study suggests that policymakers in underdeveloped & developing countries should emphasise systematic, pragmatic, and long-term strategic thinking in designing digital sovereignty through institutional performance for success. Policymakers should take prompt action to ensure an efficient labour force through research and development, and may follow institutional excellence and environmental sustainability. The government needs to establish powerful regulatory Frameworks before opening the country's sky to foreign satellite internet providers like Starlink. A strong software innovation team is required in every country to create independent software that protects digital sovereignty. Because digital technology means programming and coding capability.

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