



**RESEARCH PAPER**

**Nuclear Program of North Korea: Impact of US Economic Sanctions**

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**ABSTRACT**

This study examined the impacts of U.S. economic sanctions on North Korea's nuclear program, ballistic missile development, and humanitarian situation, with attention to regional power dynamics involving China, Japan, and South Korea. The major aim of the United States' sanctions access to restrict North Korea's international trade, finance, and technology to deter nuclear and ballistic missile development. However, unilateral restrictions have deepened the nation's economic isolation and dependence on China, complicating regional conditions. The Qualitative, descriptive, evolutionary, and case study methodology was used for the in-depth analysis of the DPRK. Sanctions do not limit the nuclear ambitions, but the state's dependence on China has increased. DPRK faces a humanitarian crisis; 60% of the population is absolutely poor. Regional tensions have intensified, affecting Japan and South Korea's security environment. Adoption of multilateral engagement, conditional economic incentives, and humanitarian exemptions is recommended to reduce suffering while encouraging diplomatic resolution.

**Keywords:**      North Korea, Nuclear program, US, Economic, Sanctions

**Introduction**

Democratic People's Republic of Korea DPRK, is one of the major examples of the limitations and challenges of economic sanctions. North Korea is the most heavily sanctioned state in the world because of its advanced nuclear development program. The nuclear program initiated in the 1980s became a major point of contention in an attempt to curb its development, and the international community imposed a number of sanctions. The United States has played a leading role in imposing economic sanctions with the aim of pressuring the regime to abandon its nuclear ambitions. Effectiveness of economic sanctions on the DPRK is a complicated and debatable issue. However, sanctions have imposed major economic costs on the regime, limited access to foreign currency, resources, or technology, and have had a limited impact on its programs. Sanctions have been imposed on DPRK to stagnate economic expansion and expand its dependence on China and giving a valuable leverage over the regime. On the other hand, the humanitarian outcome of sanctions, including food and medicine shortages, has disproportionately affected vulnerable populations. Economic sanctions have a major impact on DPRK's annual growth. From 2000 to 2013 rate of 1.4% and in 2016, GDP was estimated to be around 28.5 billion dollars. Sanctions also impact the agriculture, industrial sectors, with limited ability to import goods and services. The economic sanctions do not affect or limit the nuclear program of DPRK. North Korea has 50 nuclear warheads with the appropriate fissile material 70 to 90 nuclear program. North Korea's nuclear doctrine permits preventing nuclear strike in certain situations, and the state's leader, Kim Jong Un, has the authority to launch nuclear weapons.

## **Literature Review**

### **Sanctions and The DPRK Historical Review**

The relationship between the United States and DPRK has been marked by hostility and tension since the Korean War. From 1950 to 1953, the US led a coalition to defend South Korea against North Korea's attack, and the US also maintained a military program in South Korea, which kept tensions high. The war ended with the Armistice agreement in 1953, but a peace treaty was not signed between them. (Wit, 2001)

In the 1950s, DPRK actively pursued nuclear research programs. DPRK joined the IAEA in 1974. 1975 to 1979 nuclear scientist stationed at the IAEA's head office in Geneva with the intent of collecting information to learn how to design a nuclear reactor. DPRK built a reactor that could produce weapons-grade plutonium in the 1980s. Since the 1990s United States and North Korea have negotiated over the nuclear program and have had no success in halting the advance of DPRK's nuclear and missile program. Both states US and DPRK, signed the Agreed Framework in 1994, where the DPRK decided to freeze its nuclear program in exchange for safety and also normalization of relations. The trump administration pursued a maximum pressure strategy, increasing sanctions and isolation against DPRK.

From 2003 to 2009, the six-party talks, multilateral negotiations between the US, North Korea, South Korea, China, Japan, and Russia, started with the aim of resolving the nuclear issues, but they broke off in 2009. In 2009-2017, the Obama administration pursued a policy of Strategic patience to increase sanctions and isolate North Korea. In President Trump administration imposed tougher sanctions and increased pressure on North Korea. In 2018 the time of the Singapore summit, the two leaders signed a joint statement pledging to improve relations and work toward denuclearization. In recent years, the relations between states have remained tense, with little development toward a lasting peace and denuclearization (Mark, 2024).

The US economic sanctions sometimes hardly or not impact North Korea's decision-making regarding its nuclear program. When North Korea faced the sanctions then they developed more and more nuclear and missile programs, for example, when the UN increased the sanctions on North Korea then the leader of North Korea Kim Jong-un regime sent a ballistic missile toward the northern Japanese island of Hokkaido. So, that means the sanctions are not going to work. The sanctions have an impact on the economy of North Korea because North Korea is banned from every state to trade and maintaining relation with every state. In the advancement of a sanctions strategy, China is the only state that works with North Korea. As we see from the economic perspective the China controls about 90% of its foreign trade. Those states that impose sanctions mean a stricter sanction regime that pushes the state into a corner, but North Korea is not one of them states because it developed the nuclear program after the bundle of sanctions. On the other hand, North Korea does not focus on conventional weapons; it focuses on nuclear weapons. Tighter sanctions increased the economic price that it pays for the nuclear program, also it potentially leading the regime collapses. If the regime collapse the China would face a refugee crisis, economic burden, and a lot of economic zones. (Huang, 2017)

### **Effectiveness of sanctions in the DPRK context**

There are some potential impacts of US economic sanctions on North Korea:

- The US sanctions pressure the DPRK regime regarding its nuclear program by cutting its access to the international market and financial institutions. It also plays a role in more difficult the DPRK's nuclear ambitions and this pressure engaged DPRK in negotiation such as the six-party talks and direct negotiations with the DPRK.

- Sanctions play a role in curbing nuclear proliferation by limiting the materials, technology and cutting down the nuclear aid.
- The economy of North Korea faced crises, and sanctions limited its ability to export goods, for example, coal, textiles, and seafood. These sanctions impact on industries and also weaken the regime's financial standing and reduce its ability to fund its nuclear program. According to the experts, the DPRK dropped 12.9% in imports and exports.
- The US sanctions impact on the DPRK's illicit activities, including drug trafficking, cyber-attacks, and arms smuggling. It also impacts the financial transactions and banking programs.
- Sanctions also limit the military growth of North Korea by controlling the military equipment. Because of this, the DPRK has limited ability to develop military capabilities.
- US sanctions strengthened DPRK resolve to pursue its nuclear program for national security and survival. These determinations are driven by deterrence, which means the DPRK sees the nuclear weapons and missile program as a deterrent against the military and other threats from the United States and its allies. In the face of external pressure, the DPRK perceived it as a regime survival.
- Economic sanctions limit the ability of negotiation on its nuclear program by increasing the reliance on China, reducing the economic leverage, and perceived weakness.
- DPRK nuclear capability is seen as a valuable asset in negotiations with the United States' which uses it as a secure concession from the sanctions.
- Because of the sanctions pressure, North Korea developed the nuclear program, as the sanctions are not enough to deter the DPRK. The regime is going to advance its nuclear capability.

Sanctions on DPRK have been one of the contentious tools used in international diplomacy. The sanctions imposed by the US on DPRK were limited in the deterring its nuclear ambitions and illicit activities. Sanctions damage the economic impact on nuclear weapons development. For example, in the time nuclear test 2016 and 2017 started a global Maximum Pressure campaign was started to maximize sanctions, and its major results are: economic downturn in North Korea, DPRK test most powerful weapon in 2017, developed the ICBM capability. The effectiveness of sanctions depends upon the balance of pressure and diplomacy for engagement and negotiation. In 2024 the all sanctions collapsed for the enforcement when Russia used a veto. The sanctions of enforcement are weakening day by day, and since 2018, no new sanctions on DPRK have been passed. Both China and Russia both states play a role in weakening the sanctions. After the collapse of sanctions, the DPRK's behavior totally changed because they are developed more and more ballistic missiles. (Hastings, 2024)

### **Role of Regional Actors and Multilateral Enforcement**

The role of regional actors in exacerbating and mitigating the impact of US economic sanctions on DPRK complex issue. The regional actors like China, Japan, South Korea, and Russia play a role in influencing North Korea and its nuclear program. The US and its allies play a role as exacerbating actors. The US's potential exacerbating actions, increased economic sanctions, and imposed strict sanctions on its allies support the strict sanctions on DPRK. On the other hand, China, the Republic of South Korea (ROK), Japan, ASEAN, and Russia play a role as mitigating actors. They provide humanitarian aid and reduce the economic pressure, engage in diplomatic efforts, supportive diplomatic efforts, promote regional dialogue, cooperation on NPT, reduce the economic pressure, and help in the nuclear program. The United States of America and its allies also placed the sanctions on North Korea. The main actors are South Korea, Japan, and organizations like the UN also imposed sanctions on North Korea; these states also create difficulties for North Korea in economic development and trade. These sanctions have an impact on North Korea's

economy and also impact on the state's behavior. But the effectiveness of these types of sanctions is often debated. (Team, 2019)

Since 2006, the UNSC has imposed nine major sanctions resolutions on North Korea because of its nuclear and ballistic missiles. The major resolutions are based on North Korea's nuclear and missile activities; cease its illicit activities and rejoin the NPT; impose sanctions on the arms embargoes, goods bans, and asset freezes; seize its cargo; and call it to the six-party talks. In 2016, the Resolution (2270) was passed for the bans on coal, minerals, and financial activities. The other resolution in 2016 (2321) and in 2017 (2375) passed for the ban of capital oil exports, blocking joint ventures, and banning textile exports. South Korea imposed economic sanctions on North Korea at the most critical moments, including: In 2010 Cheonan warship incident, banning the most inter-Korean trade; In 2016 Suspension of the Kaesong Industrial Complex, symbolizing inter-Korean cooperation; restrictions on the humanitarian aid and tourism to reduce the economic inflows to the North. Japan also imposed economic sanctions on North Korea. Some most unilateral sanctions are: banning imports and exports; prohibition North Korean ships from entering Japanese ports; also limiting the financial transactions of ethnic Koreans in Japan. In 2006, Japan restricted the diplomatic exchange with the DPRK. In 2014, it also postponed all types of investigations. In 2016 and 2017 the Japan imposed new sanctions on DPRK nuclear missile extending and testing. It also creates hurdles in Chinese and North Korean assets and bans both bilateral trade, restrictions on the entry of DPRK citizens and ships on its territory. In 2006, the EU imposed sanctions on DPRK. It bans the nuclear program, training of nuclear program, export of oil, goods, and bans the EU investment across the DPRK, and in 2022 it expended the sanctions on North Korea by freezing its assets. (Seok, 2021). The China, Russia, ROK, Japan, and ASAEN played an important role in mitigating the impact of US sanctions on the DPRK nuclear program. The mitigation based on providing humanitarian aid and reducing the economic pressure, engaging in diplomatic efforts, Supportive diplomatic efforts, promoting regional dialogue, cooperation on NPT, and reducing the economic pressure and help in to the nuclear programs. The United States' major aim is to denuclearize the Korean peninsula and wants to engage in diplomatic efforts for regional stability. The United States works with China to the influence over the DPRK and avoid other issues. DPRK played a key role for China as a great power in East Asia in impacting regional stability and US-China competition. (Group, 2019) China also played a role in the trading and nuclear program. China and DPRK have ties for 75 or 76 years. States have bilateral relations because of the communist state, and both states were established after the WWII. China struggles to balance its relations with DPRK and help it into the nuclear program since the 2000s. China and DPRK, both states, have economic relations. Experts said that China keeps DPRK totally dependent upon it, and both states have had trading relations for over 2 decades. According to the report of 2023, the DPRK's 98% trade depends on China. China gives priority to DPRK for maintaining stability and influence, denuclearization, and limiting the migrant flows. (Fong, 2021)

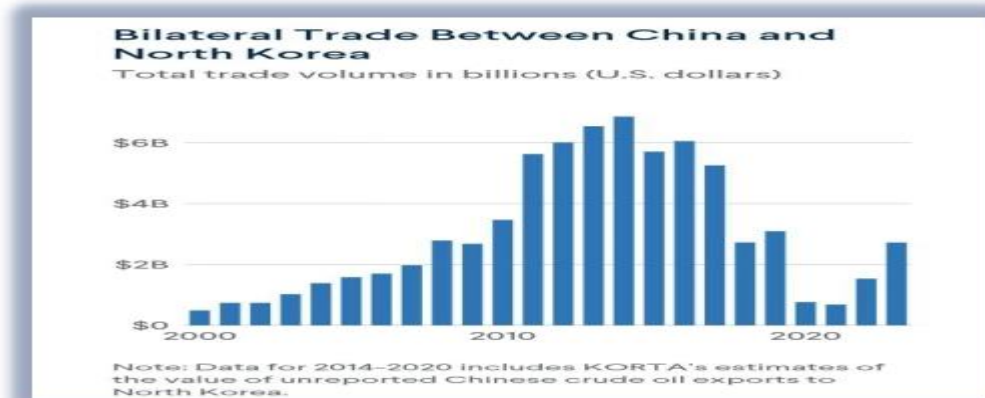


Figure:1 Trade of DPRK with China

Russia is one of the economic opportunities for the DPRK that aim to increase its influence in Asia for the multilateral solutions. The North Korea policy is also inspired by Russia, and in history, both states played an important role in the bilateral relations, as we see in the Cold War. Recently the both states have had economic and nuclear-based trade partnership. For the regional development, Russia plays an honest broker role in resolving the crisis, and plays a role in trilateral cooperation with Seoul and Pyongyang. However, both states, Russia and China, supported the lifting of sanctions on DPRK and their stance to counter the US unilateralism and promote the multipolar world order (Wishnick, 2019). On the other hand, Russia and the DPRK have military relations with each other. As we see in the past, both states' military relations started in 2001 when the DPRK defense minister visited Russia, and they signed defense and military equipment. In 2015, both states also signed the agreement that was based on the prevention of dangerous military activities. In 2022, experts say Russia was buying millions of artillery shells and rockets from DPRK and they also delivered an arms shipment from it during the time of the Ukraine war. In 2023, North Korea supplied 1 million artillery shells to Russia in the Russia-Ukraine war. Russia also used DPRK short-range ballistic missiles; that's why the US imposed sanctions on DPRK-supplied missiles. In 2024, Russia used its missiles in the Ukraine war, and both states signed the treaty on the Comprehensive Strategic Partnership between the Russian Federation and the Democratic People's Republic of Korea. To solidify military and economic ties, both states, Russia and DPRK have a high-level visit in 2024. (Kuo, 2018) ROK played a role in mitigating the impact of US economic sanctions on the DPRK based on a multifaceted approach, involving cooperation, diplomacy, and economic ties with the DPRK. ROK also supports the sanctions on North Korea that were imposed by the US. ROK plays an important role in the diplomacy and dialogue for the peace negotiation and has abandoned its nuclear program. South Korea also provides humanitarian aid to North Korea. Japan plays a role in mitigating the impact of US economic sanctions on the DPRK based on a multifaceted approach, involving cooperation, diplomacy, humanitarian consequences, and economic ties with the DPRK. Japan supports the bilateral and multilateral sanctions imposed by the UNSC. Japan plays an important role in the diplomacy and dialogue for the peace negotiation and abandoned its nuclear program. On the other hand, ASEAN plays a role in mitigating the impact of US economic sanctions on DPRK nuclear program. ASEAN played a role in indirect enforcement. Its commitment to a nuclear-weapon-free Southeast Asia supports the non-proliferation efforts. A nuclear weapons-free zone also played a role in regional stability and security. The ASEAN members maintain bilateral relations with the DPRK that can be leveraged to enhance engagement and communication. (Wertz, 2019)

### **Impact of Economic Sanction Regimes on North Korea**

The United States imposed a bundle of sanctions against the DPRK that target its nuclear weapons, illicit activities, and human rights abuses. The major aim of these sanctions is to counter the DPRK's nuclear weapons and ballistic missile development, which is generated through illicit activities. The current economic sanctions on DPRK are based on the complex and multifaceted impacts that affect its economy, humanitarian situation, and nuclear program for future policy. Sanctions are significant constraints on the DPRK economy, international trade, financial markets, and advanced technology. They have limited development assessment because they have no right to join the international level trade and partnership like the other states, so the DPRK maintains bilateral relations with Russia and China for nuclear and illicit activities to generate its revenue. Sanctions indirectly affect the humanitarian aid by creating challenges for international organizations in navigating customs procedures, transferring funds. The state increased the missile program for its own strategic goals. For future development state needs to intervene in comprehensive approaches such as the security grants, dialogues, and economic incentives that may help to achieve the resolution of nuclear issues. (Kim, 2023)

## **Economic Development**

The economic sanctions regime has significantly impacted DPRK economic development by banning its access to international trade, finance, economic growth, activities, and technology. So, North Korea has an isolated command economy, which means the economy is planned and coordinated by the government, which makes it a standard component for communist states. The government of DPRK determines the production, range of production, and price of goods that are offered for sale. The experts believed that these policies of the government began after the Korean War, which created hurdles to state economy development, and sanctions and trade restrictions also created problems for the economic prospects. DPRK developed its economy based on the industrial and military economy parallel development. DPRK firstly checks and balances the USSR model of governance that based on the socialist economy and reliance policy. This model emphasized the development of industry and its investment in steel, machine tools, iron, and cement. From 1995 to 1996, the DPRK faced a lot of economic crises because of the natural disasters. From 1990 to 1998, the state experienced an average annual growth rate that was a -4.1%. In 2002, it gave some relief in order to allow the private and semi-private market, and also launched a series of economic reforms. In the improvement of the previous decades, some measures are:

- Increased the wages and prices.
- Price fixing mechanism.
- Change the distribution system.
- Decentralizing the national planning.
- Starting the distribution market for productions.

In 2020, it also closed the border to prevent the spread of COVID-19. According to the Bank of Korea, the GDP of it grew 3% in 2023. (yemen, 2021) The gross national income GNI of DPRK was 1.59million dollars per capita in 2023. The state is still working and investing in the military for economic development. According to the report of 2022, the DPRK spends 33% of its GDP on defense programs. So, today, DPRK is working with China, which China one of the major trading partners of the DPRK. It relies on China for diplomatic assistance and the economy. The major exports are: electricity, silk, instruments, potato flour, and metallurgical products, and their worth is around 1.59 billion dollars. The major imports of DPRK are: rubber, polymers, tobacco, soybean oil, fertilizers, and medicines, and their worth is around 3.25 billion dollars. According to the US data, the DPRK's GDP grew slightly. In 2023, its GDP grew 3% after the long-term period, the exports rose by 104% and Export 71%. The history of the DPRK economy and the periods of stagnation and crises, with isolated phases of recovery and economic growth. The major goals of the regime are to make the defense economy, food production, human rights, and living standards. The major issues faced by North Korea are human trafficking, which means the number of citizens, including children and women, is forced labor and sex trafficking. North Korea labor one of the primary sources of China and Russia. In 2024 the all types of sanctions collapsed for the enforcement when Russia used a veto. The sanctions of enforcement are weakening day by day, and since 2018 the no new sanctions on DPRK have been passed. Both China and Russia both states play a role in weakening the sanctions. After the collapse of sanctions, the DPRK's behavior totally changed because they are developed more and more ballistic missiles. On the other hand, some experts say that the sanctions also affect nowadays because the sanctions weakened enforcement, but the UN sanctions remain in place. The multilateral sanctions monitoring team MSMT was launched in 2024. That team is based on the 11 states, such as China, the US, Japan, South Korea, and many others. The major aim of this team monitor the sanctions violations and develop accountability. In 2024, they shaped several initiatives, challenges that are:

- 20x10 policy for the regional development that aims to build up the local industries in 20 cities in 10 years. That aims to focus on the local economies.
- Financial development
- Devaluation the food prices, which means prices have increased 5000 won per kilogram to 9200 won by the year.
- Economic dependency on China

The sanctions regime creates major challenges for the DPRK economy, and it limits the development and access to the global markets. China and Russia play an important role in the development of their economy (Brown, 2024)

### Humanitarian Situation

In 1995, North Korea first appealed for international humanitarian aid, and the state received aid from the USSR, China, and Eastern Europe. DPRK founder Kim II-Sung first needed the aid after the Korean War, but they maintained or rebuilt the state for themselves. On the other hand, his son Kim Jong II and his grandson Kim Jong Un also developed the economy of DPRK by themselves. The socialist states' support ended when the USSR collapsed and China began its trade development. During this time, the economy also increased and natural disasters. From 1995 to 2000, famine killed 600,000 to 1 million people. So, the different organizations with 230 groups work in DPRK for the agricultural capacity, food security. DPRK humanitarian country team HCT struggles to provide health care, nutrition, disaster prevention, water, and many other things. (Nazanin Zadeh-Cummings, 2024). After the nuclear development of DPRK, the UNSC and the US also imposed unilateral sanctions on it for the peace and security of the region. The sanctions of DPRK significant impact on the human rights of North Korea. Sanctions' impact on humanitarian aid and the long-term effects of it. In 2018, according to the report of UNICEF, 200,000 children suffered from malnutrition, and 60,000 children faced the risk of starvation. US unilateral sanctions delay the humanitarian shipments to the DPRK people. According to one NGO, it is very difficult to provide the 16 boxes of beans to North Korea. The sanctions of 2017 create hurdles for the transport of any metal goods and ban the shipment of medical supplies. Because of this, it hinders the health care services, high rate of tuberculosis, diarrhea, and pneumonia. They also faced the water crisis, with over 9.75 million people lacking access to drinking water. (Nazanin Zadeh-Cummings, 2024). The sanctions impact on DPRK's civilian economy and harm the vulnerable members of the population. The current sanctions have a great impact on the elites. On the other hand, the working-class families that live in the remote areas have restricted access to medical supplies, fuel, and food. Sanctions on fishing, industries, and garments target the 50,000 North Koreans. According to the 2018 report, because of the delay and funding shortfalls, 3,968 people have died. (Group, 2019)

**Preventable deaths attributable to delays and funding shortfalls**  
UN agencies had to reduce their 2018 programming due to delays and funding shortfalls, resulting in an estimated 3968 deaths.

	Targeted Population	Unreached Population	Preventable Deaths		Deaths Due to delays*			
			M	F	M	F		
Severe Acute Malnutrition	60,000	5,000 (8%)	1,650	825	825	223	112	112
Vitamin A	1,600,000	83,565 (5%)	343	172	172	46	23	23
WASH	356,891	91,891 (26%)	703	352	352	95	48	48
Emergency Reproductive Health Kits	341,500	337,750 (99%)	1,272	600	672	172	81	91
<b>TOTAL</b>	<b>2,358,391</b>	<b>518,206</b>	<b>3,968</b>	<b>1,948</b>	<b>2,020</b>	<b>535</b>	<b>264</b>	<b>271</b>

\*Deaths due to delays are a subset of all preventable deaths. Calculated by applying the average proportion of the year spent waiting for exemption (99.35%) to the total amount of preventable deaths, assuming a 50% reduction in operating capacity.

Figure 2: Death Rate in 2018

DPRK is facing a food crisis caused by the long-term border closures, weather, and economic sanctions. From 2019 to 2021, approximately 42% of the DPRK population faced malnutrition, and 11 to 16 million which means 40 to 60% population faced the food crisis. In 2022, the agricultural output declined 3.8% with the crops and rice productions. So, currently humanitarian situation of DPRK is very serious, with food, human rights abuses, and basic necessities. The natural disasters, sanctions, and government policy create a dire situation for the North Korean citizens. The people of DPRK have no right to expression because they have strict media control, and they face punishment when they engage with other media. They face torture and forced labor-type punishments. They also do not have the freedom of movement, and they do not have good health. (Hassan, 2023)

### **Nuclear Program**

The United States and allies' sanctions have created economic challenges for the DPRK and made it hard for the regime to get access to certain goods. The sanctions have minimal impact on the DPRK economy, and also limit the access to certain goods and technologies. The sanctions declined trade and economic growth in 2016. But North Korea is not limited to the development and testing of nuclear weapons and ballistic missiles. The major focus of DPRK is to develop itself by developing its own industries and technologies related to the nuclear program. The leadership under the Kims considers nuclear weapons a major component for survival. It is because the US and its allies are ready for war at any time, and they pose a threat to the DPRK. The state joined the NPT in 1985 and withdrew from it in 2003, and faced US aggression. DPRK developed its nuclear program three years later, in 2006. Number of bilateral and multilateral negotiations on denuclearization, but that are all failed. The number of sanctions imposed on North Korea by the US for its nuclear activities are:

- In 2006 US imposed sanctions on Banco Delta Asia for money laundering and financing of weapons of mass destruction, and also, the US prohibited its financial institutions.
- In 2009 US enforced the UNSC resolution of 1874 for expanding the arms embargo and its cargo inspection.
- In 2013 US froze the assets of DPRK and also entities that are involved in WMD proliferation.
- In 2016 North Korea Sanctions Policy Enhancement Act was passed by the US. It is based on mandatory sanctions on any person who provides aid for the nuclear program of the DPRK.
- In 2017, start the maximum pressure campaign and freeze the assets.
- Sanctions on DPRK hacking group related to Cyber.

The US and UN damage or limit the nuclear and missile program, but the leader rejects the denuclearization talks. According to the North Korea regime, they developed their nuclear program for self-defense and deterrence against the threatening state, particularly the US. So, they see nuclear development as a tool for stability, deterring, survival, and security. The DPRK develops a lot of nuclear and ballistic missiles. The nuclear arsenal is: Hwasan 31 tactical nuclear bomb, miniaturized nuclear warheads, and thermonuclear or hydrogen bomb. The ballistic missiles are based on short-range ballistic missiles SRBMs, medium-range ballistic missiles MRBMs, intermediate-range ballistic missiles IRBMs, and intercontinental ballistic missiles ICBMs.



Date	Estimated Yield (kt)	Official Information on the Type Tested
October 2006	Less than 1.0	Contained 2 kg of plutonium, but never verified.
May 2009	2-5	
February 2013	6-16	
January 2016	7-15	Thermonuclear
September 2016	15-25	Warhead able to be mounted on a rocket*
September 2017	70-280	Thermonuclear, hydrogen bomb

Figure 3: Information About Tested

The DPRK conducted the test in 2017, which tested the hydro bomb or a stage of thermonuclear warhead. In 2018, they did not develop their nuclear program. This year the North Korea, the IAEA said that DPRK began restoring the test tunnel in 2022. In 2023, the leader said they are now working on the mass production and development of the nuclear weapons program. In 2021, the leader announced the five-year defense plan. They said the submarine is developed with nuclear power, and a number of warheads, improving the ICBM's range, and launch the ground or sea-based solid-fueled ICBMs. The state develops its nuclear program with the production of plutonium and uranium (HEU) for nuclear weapons. The state developed nuclear capability, which includes the plutonium production with a gas graphite 5 MWe experimental nuclear reactor and a plutonium stockpile with a range of 20 to 60 kg. The nuclear stockpile is enough for 10 to 30 nuclear weapons. The following table summarizes the range of nuclear weapons of DPRK that were produced in 2022.

Type(s) of Nuclear Weapon in a Possible Arsenal	Median	Range of Number of Nuclear Weapons	Constraints
All simple fission weapons	72	55 to 96	Uranium and plutonium stock
All composite-core fission weapons	20	17 to 23	Plutonium stock
Mix of one-stage thermonuclear weapons and simple fission and/or composite-core	49	31 to 74	Uranium and plutonium stock
Combination of three estimates	46	35 to 63	Averaging

Figure 4: Nuclear Weapons of DPRK

The UNSC bans ballistic missile tests, but that does not limit North Korea's nuclear and missile program. "The ballistic missile projectile with the rocket engine continues until it reaches the apogee of its trajectory, at which point it falls back to Earth using Earth's gravity. Ballistic missiles can deliver nuclear and large conventional payloads at high speed and over great distances". The range of ballistic missiles increased year after year, and they developed new missiles and technological programs. In recent years, the DPRK and Russia have both expanded their cooperation with the WMD program. North Korea improved its ICBMs through a series of tests. The test was launched in 2017, 2022, 2023, and 2024. In 2017, DPRK launched the Hwasong-14 or Hwasong-15, that based on liquid propellant and road mobile. In 2020, display the Hwasong-17, but it launched in 2022 and also in 2023, test a solid fuel ICBM that is a Hwasong-18. In 2024 Hawasong-19 test will have the capability of a military independently targetable reentry vehicle MRIV. The state has SRBMs KN-23,

KN-24, KN-25, and MRBMs KN-15 capability. North Korea has also made progress in submarine-launched ballistic missiles SLBMs. In 2019, they successfully launched the Pukgugsong-3 SLBM. In 2022, also developed the long-range SLBM that are Pukgugsong-4,-5, 6. The missiles of DPRK are growing very successfully, and they deter the regional threat by their missile and nuclear development. (Nikitin, 2025) DPRK developed its nuclear program and the advancement in missile program and cyber capability under the supreme leader Kim Jong Un.

Technological Advancement	
Cyber Espionage	North Korea has developed ICBM technology likely through cyber espionage, and it's probable that they're hacking institutions with key technologies, such as light water reactors
Missile Development	The country's missile development has gone through several stages, from acquiring basic technology to successful development.
Military Mobilization	Kim Jong-Un is deploying military personnel to various industries, including construction and manufacturing, to improve productivity.

Figure 5: Technological Advancement of DPRK

## Material and Methods

The research is based on the Qualitative, descriptive, evolutionary, and case study methodology used for the in-depth analysis of the DPRK nuclear program and examines the impact of US economic sanctions on North Korea.

## Results and Discussion

North Korea is one of the world's most sanctioned states, with international restrictions primarily because of its advanced nuclear program and ballistic missile developments. These sanctions, enforced by the US and its allies, aim to limit North Korea's access to resources and funding for its nuclear and missile programs. They restricted financial activities, trade embargo, and were against the individual or entities that were involved in the nuclear and ballistic missile program. North Korea possessing the nuclear weapons, ballistic missiles and military strength for the several bases, such as national security and protect the state's sovereignty in a region marked by historical conflict or ongoing tensions, for the regime survival to protect the state form the external threat, create the deter for the US and other potential states from launching a preemptive strike and attack on the state, and also development of North Korea nuclear, ballistic, and military capability based on the symbol of power and prestige. North Korea's nuclear program started in the 1950s with the assistance of the USSR. Nuclear program accelerated in the 1970s and in the 1980s developed the first nuclear reactor or produced weapon-grade plutonium.

In 2006 first nuclear test was conducted by North Korea, and now they also continue to develop their nuclear capability under international pressure and sanctions. The nuclear program is one of the major sources of tensions between the US and North Korea. Both states signed the agreed framework that major aim to freeze North Korea's nuclear program in exchange for energy assistance, but North Korea has continued nuclear activities instead. The US policy towards North Korea is based on pressure, sanctions, engagement, and diplomacy to reduce the nuclear program. According to the survey, 61% Americans said that the economic sanctions are better than the increased diplomatic ties with North Korea.

The US imposed multiple sanctions on North Korea, the economic sanctions majorly impact on DPRK's economy, limiting its access to international trade, financial. The US imposed sanctions on illicit trade, finance transactions, and banking programs. Sanctions also limit ability to develop the military capability. On the other hand, the sanctions have little impact on the North Korean economy, but the North Korea depends upon China 90% for its economic survival, and the effectiveness of sanctions is debated, because they do not necessarily lead to a reduction in North Korea's nuclear ambitions. The development of the nuclear program is a major threat to the East Asian states, mainly South Korea and Japan. In 2017, it launched a missile over the Sea of Japan, and it also tested a missile that landed in South Korean water or airspace that escalating tensions between the two states. The regional actors played an important role in exacerbating and mitigating the impact of US economic sanctions on the North Korea nuclear program. Japan, South Korea, and the UNSC imposed individual sanctions on DPRK and also involved or supported the US sanctions imposed on it. China, Russia, South Korea, Japan, and ASEAN are the potential mitigating factors that provide humanitarian aid, reduce economic pressure, and help to devolve the nuclear program, support diplomatic efforts, and promote regional dialogues or cooperation. The current economic sanctions focus on freezing assets, export and import restrictions, nonproliferation, and humanitarian concerns. Nevertheless the North Korea develops its economy on the reliance of China and Russia for international trade and aid. North Korea also the shift toward a cabinet-centered economic system for strengthening state control. In 2024, the GDP of North Korea is estimated to be between \$16 billion and \$30 billion. The DPRK also faces the humanitarian crises because of the sanctions and strict regime, such as food insecurity, limiting access to essential services, medicines, and 40% of the population is potentially undernourished. The number of states provided the humanitarian aid to North Korea. However, the current sanctions regime has not impacted on DPRK, and the state has continually developed its nuclear or missile program and has an ICBM capability for reaching the US mainland. North Korea has 50-strong strategic arsenal and also produces fissile material, plutonium and highly enriched uranium, with an estimate 70 to 90 warheads. The DPRK have a technological advancement such as cyber espionage, missile development, and military mobilization under the supreme leader Kim Jong Un. The DPRK also resolved economic sanctions and improved its relations at the regional and international levels via nuclear disarmament, missile moratorium, cooperation, and dialogue.

## **Conclusion**

The impact of US economic sanctions on DPRK nuclear program is a complex issue, with limited success in achieving its intended goals. The sanctions have had a significant impact on DPRK economy and have not deterred the regime from pursuing its nuclear ambitions.

## **Recommendations**

The recommendations of this article are; region the six-party talks with the US, North Korea, South Korea, and China for the peaceful resolutions, denuclearization, and for the security structure in Northeast Asia. Provided the humanitarian aid for the food assistance, medicine, also offering nutritional support to prevent malnutrition, provide support for sustainable agriculture, and offering protection and support to the population. Developed confidence-building measures between the US and DPRK. Providing them a new economic development projects and also working on the regional cooperation and developing peace and security talks between the ROK, DPRK, China, and Japan. The US should develop more and more effective policy strategies that collaborate with the US and its allies to manage any situation on the peninsula. The UN and the United States should use the negotiation policy with Kim Jong Un the improve relations. So, before any cooperation and agreement is established, a robust verification and monitoring mechanism for build trust and verify their compliance.

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