The History of Nuclear Armament Technology as an Introduction to Understand the Dynamic of International Society

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Abstract. This paper contains a brief explanation about the history of nuclear weapon development during the end of the Second World War until the Cold War era between 1940–1968. This paper was constructed using the qualitative historical method. This paper is divided into three sections; (1) introduction, (2) discussion, and (3) conclusion. The introduction explains the importance to understand the history of nuclear weapon development, especially to also understand the dynamics in the technology and socio-politics issues in the present time. The discussion is divided into two parts; (1) the short history of nuclear weapon development and (2) how it affects the world and what can we learn. The writer concluded that four changes were caused by the discovery of nuclear weapons; (1) the change of opinion towards war, (2) the confrontation between superpower countries that shifted into proxy war and competition of power and influence, (3) shaping the modern geopolitical landscape, and (4) nuclear technologies could be applied in a peaceful means.

Keywords: Nuclear Armament · Cold War · Technology

1 Introduction

The pedagogy studies currently discussing one of the most common topics in education called the disruption era. This topic was brought up during the Covid-19 pandemic period, where distant learning becomes the new normal procedure in education. Both the teachers and the students were required to adapt to various technologies that seem unfamiliar to be used as a teaching method in Indonesia. When the pandemic hits, the conventional face-to-face teaching mechanism rapidly turns into digital/distant learning with the internet as the main backbone. Unintentionally, this rapid change also widens the awareness of modern communication technologies to the Indonesians.

The more advanced, edge-cutting technologies of the current era allow the schools and teachers to perform this whole distant learning mechanism. In the last several decades, various technologies were being developed such as the internet, nuclear, computer, and many others. These forms of development greatly affect our daily lives as well as the world in general. Various development in technologies leads to various new kind of

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jobs. For example, the constant evolution of computing and internet infrastructure resulting in unique, more specific types of jobs such as programmers, network management, streamers, and others.

This constant development does not happen instantly. It is a continual process [1]. It means that the current invention comes from another invention that was previously made. Such like there would be no internet if there is no computer being made, and there would be no computers if there is no electricity being developed. Things like technology in civilization would always grow along with discoveries and innovations, as long as humans with their resources are still capable, or willing to do so. Therefore, as far as the wisdom being passed through generations, technology will always improve.

Technologies will naturally grow over time. Though, the development itself may fluctuate depending on several factors. There are at least three variables that contribute to the speed of development in technology, such as (1) awareness and acceptance of new ideas, (2) interaction with another culture, and (3) rivalry or conflict [2]. Acceptance to a new idea is required because without it, innovation of the technologies would simply become harder to achieve. Interaction with other cultures is related to what is called 'cross-pollination' between cultures. For example, people living in rural areas will likely harder to comprehend the advanced technologies in contrast with the people from urban areas. Other than that, the rivalry between competing parties will also unintentionally advancing the development in the technology itself out of the desire to dominate over the other party. In this paper, the writer would like to focus more on the last factor.

During the First and Second World War periods in the 20th century, such major conflicts were managed to break and also advancing the development of technologies even further. Several technologies were invented or developed even further by these events. The First World War accelerated the development of fighter aircraft, tanks, and armored vehicles. Meanwhile, the Second World War makes the manufacture of rockets, radar, and atomic bombs grow even more. The conflict in WWII was later resulting in tension between the two major powers, the United States and the Soviet Union after the war ends. The competition between the two gigantic powers becoming a catalyst for the development of nuclear and space technologies afterward.

The rivalry between the United States and the Soviet Union was later known as the Cold War, where the two parties passively participating in wars using a diplomatic approach. Even though, the technology and arm wars were still ongoing in the forms of space domination and the possession of nuclear weapons. The interesting trait of this war is that neither of the parties was actively engaging in an open fight. The modern weaponry of WWII was enough to create massive casualties, but in the Cold War, it was even worse. The idea of using nuclear weapons in an open war is more than enough to bring destruction to both parties. And so instead, both the United States and the Soviet Union were more likely to engage in a power struggle and proxy war.

Among the various technologies that being invented or developed in the Cold War period, two of the most known as the product of this era were the technologies in space crafts and nuclear weapons. These two technologies were influential to the people in the 21st century. Space technology helps to improve communication and remote sensing capabilities, while nuclear weapons possess even more daunting power. Nuclear armaments becoming the main cause of the diplomatic tension in the Cold War period.

On the other hand, nuclear technology could also be used in other various fields such as agriculture, health, and energy. The technology that was once used to show dominance, can also be used to improve the lives of the people.

According to the writer, the development period of technology during the Cold War is important to be addressed as a subject. We can learn various things from these arm wars. Though, not all of the current technologies were derived from the arm wars in the Cold War era. But the most influential ones were coming from the aftermath of the conflict. Seeing from the socio-politics perspective, the Cold War itself still provide a great influence even though the conflict was already settled down for about three decades now. This event may also tell us about how this world will take turns, sometimes in the future.

On the other hand, our history curriculum does not explicitly consider technological warfare in the Cold War era as a subject. The subject matter that mentions the information about technological warfare was found to be limited. In the syllabus, this subject is included in the Attentive History (*Sejarah Peminatan*) in grade XII, precisely in Basic Competency (*Kompetensi Dasar*/KD) point 3.2 and 3.3 [1]. The information about the arms race was mentioned in point 3.2 which discusses the development of science and technology in general. The topic of technological warfare itself was included in the sub-discussion about space and weaponry technologies. On the other hand, the effect of the Cold War in socio-cultural aspects mostly discussed the international affairs and politics on the outside of Indonesia.

The writer assumes that this subject about science and Cold War possess a greater potential. This subject could be used to understand more about the development and constant advancement of current technologies. But the problem lies in the complexities of the subject about the Cold War itself—which was already complex by its nature—that the student seems to be quite difficult to understand the subject. Moreover, the subjects outside of Indonesian history were known to be infrequently being written. The teachers are more inclined to compose most common subjects like Islamic history or pre-independence history which the sources are pretty much more abundant. Therefore, the writer attempts to provide the subjects that are considered important to be addressed.

There were various kinds of innovation and development regarding technology during the Cold War era, thus resulting in a subject that has a wide coverage of topics. The technologies like outer space, commercial flights, nuclear, and the internet. On this occasion, the discussion will be focused on the development of nuclear armament technologies. The main reason is that nuclear technology is a legacy of the Cold War that possesses a greater impact on society. This massive power was driving the geo-political dynamics during the Cold War, and the influence is still present even decades after.

2 Discussion

This section of the paper is divided into two parts. The first part contains a brief explanation of the arms race during the Cold War. The discussion will cover the beginning of the conflict between eastern and western block, up to the diplomacy means to restrain the possession of nuclear weapons. The second part will focus on the effect caused by the development of weaponry, which also will be discussing its implications that may affect the future. The second part also emphasizes the importance of this subject.

2.1 Short History of the Development of Weaponry Technologies During the Cold War Period

The emergence of the Cold War is directly related to the aftermath of WWII. The widespread conflict has caused tremendous damage both in the economy and politics for more than 60 million people in the world. The eastern front had suffered more casualties in countries like the Soviet Union, Poland, and Yugoslavia which lost 10–20% of their population. Aside from the casualties, WWII also contributes to the damage of various infrastructures in the war-torn countries, while at the same time crumbled the Eurocentric world order [3]. The colonial countries like England, France, Netherlands, and Belgium were suffering so much damage that they cannot repress the independence movements from their colonized countries. New continental powers have emerged as the result of this event.

After WWII was ended, two countries emerged as new powers and replacing the domination of the European Union. The two strong countries are the United States and the Soviet Union. These countries provided an appreciable amount of contribution during the war that leads to the victory of the Allies. Their economies are more independent, on the contrary with the Allies which pretty much relies on their colonies. The United States has mostly survived the impact of the war and even managed to gain some profit for their industries. On the other side, the Soviet Union was listed among those countries that suffered the most damage from WWII, but not all regions enduring the same fate. Also, the victory of the Soviet Union in the eastern block has pushed up their reputation in the international.

The aftermath of WWII has brought discord between the two major powers. Unlike the previous conflicts, the two countries decided to not engage each other in open war. They prefer to use more diplomatic and harmless approaches, thus creating a new form of competition on influence and applied science. This harmless and diplomatic approach is what made this particular period called the Cold War. The struggle for influence was based on the economic ideological differences between the United States with their free-market economy and the Soviet Union with their communism. The competition on applied science was mainly about the space race and the possession of nuclear technologies. In this paper, we will be focusing more on the latter issue.

The research about nuclear technologies was initially conducted by German scientists. But after the persecution by the Nazis, some of the scientists (especially the Jewish ones) decided to flee either to the United States or to the Soviet Union. These political runaways then warned the US government about the development of nuclear weapons by the Nazis and suggests that the US had to arm itself with the same weapon. The US government considered this suggestion important that the US government, cooperating with England, immediately established the Manhattan Project [4]. The project was started in 1940 with all information kept classified from the Soviet Union.

In June 1945, Germany conceded to the Allies, along with the completion of the nuclear bomb that was created by the Manhattan Project. The bomb was tested on 16 July 1945 at Alamogordo with a satisfying result. The outcome of the test was immediately reported to the US President, Harry Truman, who was attending the Postdam agreement with England and the Soviet Union at the time. The information about the test was also

disclosed to the Soviet Union. The response of the Soviet Union was rather superficial, and it turned out later that they were also having their nuclear research team.

Meanwhile, during the Pacific War, the Japanese were cornered but still managed to give much resistance to the US. Okinawa has fallen to the US and it should take one last step to invade Japan's mainland. However, the estimated cost was a bit too much, and the risk of losing soldiers is very high. The United States then decided to use the brand new bomb that was just invented and hoping that Japan will surrender right after. The first bomb was dropped on 6 August 1945 in Hiroshima, and the second bomb was dropped three days after in Nagasaki, destroying both cities completely.

The strategy was proven to be effective, the Japanese were immediately surrendered and thus avoiding the prolonged combat. However, the overpowering capabilities of the bomb, and the massive number of casualties especially the civilian has made the world criticizing the deployment of an atomic bomb in combat. As a record, the casualties of the civilians reached 140.000 victims in Hiroshima and 70.000 in Nagasaki. Furthermore, this event disrupted the relationship between the United States and the Soviet Union. As the developer of the atomic bomb, both the US and England have realized the destructive power and start to establish regulations regarding the usage of the weapon.

The first attempt to regulate the nuclear armaments was done not long after the bombs were dropped. On 15 November 1945, the United States, England, and Kanada were forming a pact of agreement which states that all scientific literature regarding nuclear weapons must be opened to the public for peace interests and control against nuclear technologies. The meeting was later followed by the United Nations Atomic Energy Commission (UNAEC) that was established on 24 January 1946 [5]. The committee was formed under the United Nations Security Council with the main purpose is to handle the issues regarding nuclear energy.

Unfortunately, the negotiation in UNEAC provides meaningless results. The United States submitted a proposal called the Baruch Plan which sole purpose is to form an international committee that regulates and monitors nuclear armaments. The proposal was rejected by the Soviet Union for a reason that the committee cannot be trusted because they assume the United Nations has been too dominated by the western block, especially with the absence of veto rights of the said committee. The Soviet Union tried several times to recommend their proposal to destroy all the remaining nuclear weapons, but this proposal was rejected by the United States. The negotiation goes stale and after numerous failed attempts to reach an agreement, the UNEAC was disbanded in 1949.

One of the biggest hurdles for the negotiation regarding nuclear weapons is the distrust between the Soviet Union and the United States. After the failed discussion in the UNEAC, the United States decided to monopolize the nuclear arsenal. The United States distributes the technology to its allies in NATO. Furthermore, the United States tried to monopolize the uranium market by issuing the Mc Mahon Act in July 1946 [6]. The US with Canada and England attempted to purchase all uranium stocks in Kongo, Australia, and South Africa. The different viewpoint between the Soviet Union and the United States became more profound, where the Soviet Union tried to eliminate all of the existing nuclear weapons, while the United States decided to do the opposite.

Even so, the United States slowly changed its stance after the Soviet Union succeeded their first nuclear bomb test in October 1952. Their development on the nuclear warhead

was vastly progressed, to the level that the Soviet Union can go toe-to-toe with the United States in terms of capability. On 12 August 1953, the USSR carried out a hydrogen bomb test that resulted in a bigger explosion than the one that dropped in Hiroshima and Nagasaki [7]. This means that the United States was no longer superior in monopolizing the nuclear warhead market because both USSR and the USA have the same possession of nuclear warheads. Later on, both countries realized the destructive capability of their nuclear weapons, and from this moment their discussion about the nuclear restriction shows more promising progress.

At this point, the two powerful countries were aware that the possibility of using the nuclear weapon and facing others in a nuclear war will bring them into a Mutually Assured Destruction (MAD) scenario. Both the USSR and the US tried to suppress the multiplication of nuclear weapons, but they don't trust each other. Instead, the number of their possession of nuclear weapons was increasing. During the end of the 1950s and early 1960s, the world was on the verge of nuclear warfare. This was caused by multiple diplomatic tensions between the two powerful countries. The Cuban Missile Crisis on 16–29 October 1962 was recorded as an important event in history when nuclear warfare is almost broke out but can be managed and solved democratically [8]. After this incident, the attempt to deal with the danger of nuclear weapons was at its firm.

Among many treaties that were made to restrict nuclear weapons, the Treaty of the Non-Proliferation of Nuclear Weapons (NPT) became the most important measure. This treaty was signed on July 1st, 1968 which its main purpose is to limit the expansion of nuclear weapons. Signatory countries of this treaty were obliged to; (1) for the countries who own nuclear weapons to not share their blueprint/technology with other countries, and (2) the countries who do not own nuclear weapons are prohibited to develop it. This treaty was later followed by other conventions for decommissioning nuclear warheads such as the Strategic Arms Limitation Talks Agreement (SALT I) on 26 May 1972 and Intermediate-Range Nuclear Forces Treaty (INF) on June 1st, 1988 [9]. To date, some countries still have nuclear warheads such as the United States, Russia, England, and China. But the further development of the weapon itself is no longer exists and the remaining warheads have started to be diminished.

Not every single nuclear technology ends up as a weapon. The implementation of nuclear energy in other scientific fields has now fallen under the regulation of the United Nation's International Atomic Energy Agency (IAEA) that was established on 29 July 1957. The Agency was founded by the notion of US president, Dwight Eisenhower to regulate nuclear armaments. The function of the agency was later expanding into several branches such as knowledge sharing, radioactive waste management, radioactive mining regulations, new energy development, farming, and medical purposes [10]. This agency is still active to this date and working on the development of scientific-based nuclear technology.

2.2 What We Can Learn from the Armament Technology Development During the Cold War

The various development of armament technologies during the Cold War affected the way we lived today. As we discussed in the introduction, the Cold War changed the world in terms of socio-politics and technology aspects. There were some recent events that

we can understand if we were aware of the historical aspects of armament development. North Korea, for example, got punished for testing their nuclear weapons while other countries that were part of the United Nations' security council were allowed to do nuclear tests without any problems.

Our curriculum that covers the topic of modern history is mainly focusing on globalization, oftentimes on the negative side. The discussion of this topic revolves on limited scopes such as international cooperation, consumerism, and cultural imperialism. The important events during the last decades often became subtopics in our curriculum. It should be the opposite if we want to understand more about our current world's issues, especially those related to developments in technology. The Cold War was merely seen as an ideological rivalry between the West and the Eastern Block.

One of the major changes in the modern era is our mindset about war. Conflicts between countries were rarely occurred compared to the previous centuries. War with various casus belli such as the conquest of new land, liberation, unification, and succession are more common before 20th century than it is today. It is mostly attributed to the development of international law and the global community that made the sovereignty of a nation more respected. The viewpoint that war is immoral and the fact that weapons are becoming more destructive is the main reason that caused this transformation.

The two mentioned factors were related to each other because basically, the utterly destructive weapon technology is the reason causing the resentment towards the war. Weapons technology was growing rapidly when the industrial revolution starts in the 19th century. In the previous era, war is considered a form of grand adventure and prestigious movement. The public opinion was also different from the recent time where usually, war is embraced with surging emotion of joy and patriotism. But this mindset takes a sharp turn during the First World War. More advanced weapons were used to cause huge casualties and material loss. No more glory and honor comes after a war, only carnage. The bombing of Hiroshima and Nagasaki during the Second World War is the culmination of the war in modern history. This weapon of mass destruction has taught us that waging a war with this weapon so dangerous will leads mankind into extinction.

This transition was later formed the political landscape of today's world. An open war is unlikely found during these days. But that does not mean that there is no competition or conflict between powerful countries. The Cold War between the USSR and the US not long after WWII clearly stated that the struggle between those countries will occur naturally. The difference is that the conflict will happen in other forms. Both the USSR and the US acknowledge the catastrophic capability of nuclear weapons that they both hesitate to use in the real combat scenario. Therefore, they resorted to using more of their influence rather than their power during the Cold War. This developed into a proxy war, where the two countries do not directly confront each other.

There is a Latin proverb that goes 'si vis Pacem para Bellum that means 'if you want peace, prepare for war.' The principle of this adage is that we are less likely to be attacked if we were preparing ourselves for an oncoming war because it is harder to siege a country that is always on a high alert rather than the unprepared one. This is what actually would happen nowadays. Both the Soviet Union and the United States refrain from engaging in an open fight because both are aware that their opponent has a nuclear warhead that can be launched at any given time. The existence of nuclear weapons has

changed into a bargaining chip that is used to hold the status quo. This principle holds to this day that no matter the state of the diplomatic relationship between the major countries, they will push themselves to maintain the status quo. Contradictory to the previous era where even a small problem could spark a war.

Speaking about the status quo, we also need to cover the important topic about nuclear weapons: their expansion. We have discussed the various treaty to limit the possession of nuclear weapons. The most influential of all of those is the Non-proliferation Treaty (NPT). This treaty was signed by almost all the countries in the world (including Indonesia) and renewed every five years. Therefore, the development of North Korea's nuclear weapons has received condemnation because they violate the consensus. Similar cases regarding the possession and development of nuclear weapons could also be found in several countries such as India, Pakistan, South Africa, and post-Soviet Union countries. The problem regarding these new weapons requires complicated diplomatic solutions, but still can be maintained and simplified to ensure the status quo and keeping the power balance between countries.

Aside from its correlation with war, nuclear technology also holds the potential to be used more peacefully. Nuclear powerplant, for example, could be a new hope to be the most effective power source despite all the contradictions. Nuclear technology could also be used in different scientific fields such as agriculture and medic. Various technologies that were developed during the Cold War era such as aerospace and computer engineering have been proven beneficial to our lives in the present time. It also caught our interest that the peaceful usage of these technologies has only happened recently. This shows that the development of these weapon technologies for war and peace purposes were related to each other and can be progressing respectfully. Nevertheless, the armament technologies nowadays will still be considered as a bargaining chip in the diplomatic meetings rather than practical implementation in a real war.

A complete understanding of technology is a key to a nation's success in the 21st century. Technology transfer becoming an important method recently because most advanced technologies are too complicated to be developed from scratch. We can't become fully dependent on other countries, but to acquire such knowledge from the country that already owns said technology is a lot more reasonable. Therefore, diplomatic relationships and the economy can become defining factors to address this issue. It is very important to us to understand the diplomatic of technology, especially in an era where economic warfare is becoming more relevant than an armed conflict. But we can also safely assume that military power is still relevant regardless of how peaceful our world is now.

3 Conclusion

The evolution of weapons during the Cold War has affected the lives of the present era whether it is in technology development or socio-politics. The hazardous progress of armaments changed our mindset about the war in general. We are no longer seeing war in a nationalistic romanticism viewpoint, but rather we see war as a form of calamity and destruction. The superpower countries are hesitating to start an open war because of the awareness about the destructive capabilities of their weapons. Therefore, the hegemony

struggle in modern times has shifted into proxy war and competition of influence. On the other side, the development of nuclear technologies has a huge benefit towards various scientific fields such as energy, agriculture, and logistics. Unfortunately, this topic is barely covered in our education and is still lacking in its existence as a big picture.

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