

*The implications of the biotechnological revolution for changing international
security and war in the post-Cold War era-*

rima djelloul ^{1,*}, karima abassi²

Mohamed Lamine Debaghine, Setif-02- (Algeria), ri.djelloul@univ-setif2.dz

Mohamed Lamine Debaghine, Setif-02- (Algeria), k.abassi@univ-setif2.dz

Labo. Détective massacres of may 1945

Received: 03/09/2025

Accepted: 14/11/2025

Abstract:

Our study aims to analyze the reality of international security in light of the technological and biotechnology revolution, and the transformations and changes it has imposed on the media sector and software used in managing the international security environment and local and global affairs. This is achieved by promoting the right to electronic surveillance, strengthening cyber security operations, and securing countries' smart borders with the aim of eliminating cyber security threats and electronic breaches aimed at undermining countries' security interests. Moreover, the biotechnology revolution has presented a number of repercussions and international, regional, and global challenges, as well as numerous innovations in the fields of cyber security, cyber development, and information technology, leading to the emergence of new technological forces that have changed the content, actors, and dynamics of international security.

Keywords: international security, biotechnical revolution, technology, international peace

*Corresponding Author

I. INTRODUCTION

The post-Cold War period has seen dynamic developments in the methods and means of international conflicts and disputes, making digital technology an essential means of shaping the contours of international relations and managing international security affairs in line with the digital transformation and advanced security and defense strategies in the international peace and war sector resulting from the emergence of a new arms race pursued by the major international powers, China, Russia, India and the United States of America have become one of the main reasons behind the changing contents of international security and wars.

Digital technology has played an effective role in enhancing the security capabilities and competencies of countries, from developing espionage operations and strategies to preventing cyber wars that violate the sanctity of countries and enhancing cyber security methods, which has pushed international efforts towards deepening mutual dependence in the field of military technology and digital war management software in the global system, which requires reconsidering military strategic thinking and building military bases to protect the national security of countries in the era of globalization of international security and strengthening the bond of cooperation and technological alliance in the field of artificial intelligence.

In addition, the biotechnology revolution has introduced many profound transformations that have inherently affected security, military power, some political and biological aspects, by developing international perspectives for confronting diseases and epidemics, combating pollution and other vital issues in contemporary international relations.

Accordingly, the question of the study is as follows: How has the biotechnological revolution affected the contents of international security and international wars during the post-Cold War period?

In order to answer the question, we will address the following topics:

- 1 -A conceptual introduction to the study
- 2 -The impact of digital transformation on the concepts of power, security, and conflict
- 3- Cyber warfare as a mechanism for the development of international wars and the paths of major international power?

1. First axis: Conceptual introduction to the study

Our study introduced a number of concepts:

1.1. Definition of the technological revolution:

The international environment has seen global technological developments represented by the emergence of innovations and inventions in the digital field, such as the adoption of smart Internet systems, computers, and high-quality modern technological techniques to accelerate economic and security growth rates and improve international services in their institutional, political and economic forms, which led to the creation of new concepts that changed the contents of new international studies, such as the digital economy, digital wars, informatics, digital knowledge and digital power.²

The world today is experiencing the largest technological revolution, differing from the periodic waves of technological change in industrial society since its inception to its evolution. The reason behind the development of developmental work requirements in its industrial, agricultural, and environmental aspects, preserving the productive quality of the local and global environment as a transitional period witnessed by the contemporary world, expressing the reality, prospects, and skills of the new industrial society that relies on the internet and the network linking process between local and international sectors to evaluate institutional agendas using systematic and non-systematic algorithms to shape international work efforts followed by the collection of digital data on agriculture, health, and the environment, enhancing global rights according to the type of available protection in synchrony with the emergence of structural, security, and cultural changes that have altered the directions of

² Medi Ibrahim Kante, "The Technological Revolution: Political and Security Implications for African Countries," *New Directions*, Issue: 21, May-June 2017, p. 82.

countries within the international environment, seeking to establish new standards for the relationship between digitization, society, and digital democracy²³.

The new technological revolution imposed an international transformation that affected the structure of the global system and the international business sectors in their economic and political aspects through the emergence of digital units that seek to concentrate technological units for international control and guidance, which moved the world from the centralized control of the state and its institutions to the emergence of unofficial actors with full powers in the process of regulation and

digital guidance that prompted the emergence of the concepts of electronic marketing, digital trade, virtual international markets, robot driving, all of which became essential pillars of economic employment.

At the same time, digital solutions sought access to open sources through new information technologies (such as the Internet and commercial satellites) levels the playing field in intelligence collection between public and private entities. Today's intelligence consumer has many new choices, even as public institutions like the vaunted National Security Agency find themselves falling behind the latest technological developments. The Information Dominance Center at the U.S. Army Land Information Warfare Center (LIWC) takes advantage of new software programs, wireless technology, and video teleconferencing to train for and coordinate information operations in the complex physical and informational environment—such as peacekeeping—in which today's Army often operates. Private sector companies are producing new software programs that bring together databases with structured augmentation processes to create a system of virtual collaboration among intelligence analysts that is open and logical. And technological advances such as data mining and automated learning and discovery are being used by the Computer Emergency Response Team (CERT) at Carnegie Mellon University to create useful intelligence from information it has collected on nearly 23,000 computer security incidents

1.2. Definition of international war

International war is defined as a violent conflict between states and nations for economic, political, religious, and ideological reasons that affect the nature of relations between societies and states. It is related to international humanitarian law to organize and manage armed conflicts in accordance with the provisions of international conventions for wars and conflicts. Thus, war is the most common and well-known form of violence that allows two or several groups to use the most lethal and destructive armed forces that have an international character that reflects the competitive nature of the conflict between the parties concerned, requiring settlement and resolution procedures.

International war refers to the effectiveness of the interconnection and interaction between components and features, including military operations, the high level of tension, and the promulgation of unjust international laws in the law of international war, causing grave violations and crimes against humanity that violate the sanctity of civilians, as it is necessary to put an end to the phenomenon of impunity for international crimes to enhance international security ⁴.

Therefore, it is worth noting clearly the prominent difference between the concepts of war and armed and unarmed conflicts led by certain categories of official and unofficial actors under the pretext of achieving international interests and causing serious damage to the main elements, mechanisms and centers of international security, including: the fragility of the national security of nation-states, the destruction of military bases of countries and other important issues that must be taken into consideration .

As The post-Cold War period showed that the concept of international war has changed from a classic concept to a modern one that relates to the emergence of new concepts and structural transformations that affected the international system and other aspects: Cultural, military, political and

³ Quoted from: Khaled Haji, "Technological breakthroughs and the constraints of technological time," <https://www.aljazeera.net>

⁴ According to : "International Security", <https://www.rug.nl>

economic aspects, accompanied by the emergence of multiple international crises and changing dynamics and actors that changed the contents of international forces and the international system, in which democracy, the rise of globalization and the movements of modernity and scientific modernization played a major role.

Accordingly, the international system has seen a change in terms of the transition from geostrategic to economic patterns, the end of the Soviet Union, the decline in military power and the decline in the level of international armaments compared to before, with the emergence of international conflicts between different regions and ethnicities known as ethnic conflicts.

and the growing role of the economic variable led to the growth of economic conflicts and trade wars, which confirms As countries seek to increase their economic pace in pursuit of global hegemony, we moved from relying on military force in international conflicts to adopting economic aspects in managing relations between countries, which prompted the necessity of engaging in international economic, governmental and non-governmental organizations, establishing economic integration, and the growing roles of civil and international society were the reason. Behind the decline of international sovereignty, at the level of theoretical theses, the thesis of the end of history and the clash of civilizations emerged as approaches that determined the shape of the world and future conflict⁵.

1.3. Definition of the International Security :

International security is a term that represents the pursuit of liberation from threats and the ability of states and societies to maintain independent identity and functional integrity against perceived hostile forces⁵ through a set of military and non-military measures such as the establishment of diplomatic agreements and treaties that regulate security relations between countries, enhancing a security culture shared by a group of states with unified security orientations that ensure the continuity of international peace and stability over the years. International security covers multiple and diverse aspects, including military, political, economic, and social aspects adopted by states and governmental and non-governmental organizations to analyze the essence of security policy and understand the sources of potential regional conflicts and emerging threats and their danger to the international security environment, and the pursuit of governance of international and regional security issues within international and global institutions has led to the development of international public law in all its branches due to the ways in which the security process operates within the current framework of international law, which has allowed for the imposition of standard restrictions regarding the agenda of international security policy.

In general, international security in its abstract concept means the set of security measures agreed upon by the members of the international security community and is related to the idea of an authority that intervenes in the international system to provide countries with security and stability by eliminating security threats of all kinds to achieve freedom and freedom from fear and international anxiety. Through the improvement of practical and scientific procedures to support the fight against security threats and the increase in training and education opportunities for the cadre of personnel working in the operations of an international security environment and its connection to the processes of integration and international cooperation and the increasing influence of informal actors in shaping international security operations as new actors on the international security scene, several criticisms have been presented, the most important of which are the following⁶:

1 -International security is not limited only to states as formal actors, but has included new security variables, including international corporations, international and non-international organizations, individuals, decision makers, and others

⁵ Johan M.G. van der Dennen , " CONCEPTS, DEFINITIONS, RESEARCH DATA - A SHORT LITERATURE REVIEW AND BIBLIOGRAPHY", [universityof Groningendigitalarchive](https://www.rug.nl/universityof Groningendigitalarchive),p5

⁶ According to : "International Security", <https://www.rug.nl>

2 -The expansion of international security after the Cold War meant the inclusion of non-military dimensions such as diplomatic, political, economic and other dimensions in the management of international conflicts

3 -The change in the content of international powers after the Cold War period and its repercussions on the change in international security trends

4 -The rise of the new world of technology and its implications on the foci of international tensions and conflicts and its impact on changing the contents of international security 5- 5- The necessity to consider the human dimension and humanitarian issues that imposed the international shift from concern for the security of states to the security of individuals.

6 -The transformation of cyber wars to tools to influence the information used in the levels and stages of electronic combat and various conflicts, whether at the strategic, tactical or practical levels⁷.

7 -Employing cyberspace to maximize international power was the motivation behind the outbreak of cyber wars.

8- The impact of post-Cold War variables on the decline in military expenditures and the expansion of the topic of international security.

2. Second axis: The impact of digital transformation on changing concepts of power, security and international conflict

2.1. Transformations in the content of power and the emergence of cyber power:

After the Cold War, attention to cyberspace increased because of its effects on the structure of the international system with its important technological tools that affect political, security and ideological values to achieve international and national goals.

It is common knowledge that the sources and forms of state power are changing from the hard power represented in military and economic capabilities, there is an increasing interest in the non-material dimensions of power and the emergence of soft power that depends on the attractiveness of the model and persuasion, and with the information revolution, a new form of cyber power emerged that has a great impact at the international and local level, reducing the role of the state in managing international affairs to give roles to microscopic actors, and the concept of cyber power addresses all issues related to the control and control of computers and digital and information systems in pursuit of achieving the development of digital international sectors.

2.2. The impact of the technological factor on the changing content of international security:

Coinciding with the emergence of the fourth technological revolution and its global and international manifestations on global security stability, linked to the foci of geostrategic balances that made large armies less important than access to data and information building, technological prowess and digital literacy, which pushed international wars and the means of managing them and achieving international security change to robot warfare and the militarization of artificial intelligence, so we are facing a new arms race with serious destabilizing consequences.

After the Cold War, the effectiveness of attention to technology in the management of international and security affairs emerged in order to enhance the reality of technology within the requirements of military action with high quality and accuracy, imposing a multidimensional technical hegemony and strategic aspects to achieve political interests governed by intelligent satellite links, smart global positioning systems and digital networks related to command action centres, bringing closer to the goal of achieving the potential of digital battlefields using the most dangerous means of warfare, including the adoption of unmanned aerial vehicles to manufacture , the most dangerous types of biological weapons: Adopting unmanned aerial vehicles (UAVs) Manufacturing the most lethal types of biological weapons, such as those used in the US war on Iraq and the US war on Afghanistan

⁷ Mahmoud Ali Abderrahmane, Oussama Farouk Mekhaimer, "Cyberspace and its impact on the concepts of power, security and conflict in international relations," Journal of the Faculty of Politics and Economics, Vol. 15, No. 16, 2022, pp. 425,428.

The use of soft and smart infrared bombs to locate enemy targets and strike them with high accuracy and reliability, and this extended to the state of asymmetry in war operations, such as the case of Iraq operations⁸.

Accordingly, the concept of international security is characterized by the variables of the international security environment in the form of transformation, not limited to issues of borders or military arsenal, but extends beyond it to include economic, technological and social issues, which inherently reflected on the model of the global security community, as McNamara explained in this context that international security is not a military activity, but extends beyond it to other activities for other activities.

3. Third axis: Cyber warfare as a mechanism for the development of international war and the trajectories of major international powers.

The international arena witnessed intense international competition in which technology and cyberspace played a major factor in managing international wars and the paths of major powers. On this basis, the following was discussed:

3.1. The dynamics of cyber wars and their impact on international conflict:

After the Cold War, the nuclear strategy in managing international wars was replaced by indirect warfare strategies that coincided with the emergence of international concepts such as proxy and electronic warfare and the use of the economy to control and polarize international and regional areas of influence, through which the political map of the international system changed from the decline of American control to the emergence of rising international powers with technological and economic capabilities that qualify them to dominate and control, and China and Russia are one of them⁹.

The decline in engaging in international armed and nuclear wars does not mean in any way that countries have stopped thinking about new means of confrontation, represented by the use of military technology through strategies of defense and indirect attack, which represent the latest development in the world of international conflicts and rivalries. Striving towards reprogramming political reality requires avoiding the concept. The traditional international war is based on creating the required strategic military impact on the behavior of others and the environment surrounding the state, defeating the enemy's strategy, achieving permanent interests instead of temporary ones, and procrastinating national concepts across the global system, such as modifying the implications of military and nuclear power during the Cold War period to refute the implications of international war.

Within the general context of the qualitative impact of the post-Cold War period, and its reflection on the change in the concept of international from rigid to flexible, which uses cyber power as a strategy for managing wars and international affairs, several concepts that represented the main pillar of the international system, such as international sovereignty, national defense and national interest, have declined, giving rise to concepts that reflect the nature of the new international reality, such as digital and economic diplomacy, propaganda and media and their role in international information management.

Thus, international war is a dynamic concept associated with the evolution of war strategies and mechanisms over different periods of time during which international attitudes, reactions, international losses and war crimes varied, including targeting a sensitive area where the enemy can achieve international interests.

⁸ Fahad Hamad Al-Athba, "Foreseeing the impact of technological development on modern warfare and the military power of small states," Seventh Book of Future Issues., p.p. 221, 222.

⁹ Lakhdar Boutmain, "Transformations of Nuclear Strategy after the Cold War", Magazine of Intellectual Dialogue, Issue:17, Volume:14, 2019, p.p. 120, 121

3.2. Secondly: Cyberwarfare and the collective security and self-defense exceptions

During the 21st century, the international environment has seen the emergence of electronic spider networks that have redefined the lines of peace and war in their virtual form, changing the contents and processes of the political game by adding microscopic actors with the ability to manage international affairs, and adopting viruses and cyber weapons as a goal and objective through which the state seeks to deal successive blows to the enemy¹⁰.

Within the context of studying the qualitative impact exerted by cyber power by the powers contributing to the development of its assets as a field of international wars that surpasses previous international wars in terms of strength, speed and intensity of impact and influence, both open and hidden, by transmitting messages and information that penetrate sensitive systems in a way that exceeds the expected volume of the international authorities responsible for monitoring espionage operations and attacks used to disrupt information systems aimed at destroying the infrastructure of states.

The process of achieving collective security also includes taking some legal measures directly related to regulating the use of technology as a military mechanism for self-defense stipulated in the agreement issued by the United Nations regarding the realization of human rights and in accordance with the outcomes of the United Nations and the International Security Council on direct cyber deterrence towards a threatening cyber war. International peace and security. The content of cyber war was also linked to realistic disasters related to political and security aspects, including direct and indirect international armed conflicts, in the charter of the body and council responsible for documenting cyber attacks in the context of armed conflict, and in light of the presence of international security and cyber challenges that made it difficult to apply basic laws and rules on a wide scale. The wide scope of cyber warfare has made the international law of treachery in its contemporary form unable to face the various new challenges imposed by development in the field of cyberspace.

According to: the analysis of some legal articles, including: "The Law of Justice and War on the physical and psychological damage caused by cyber-attacks, which must be equivalent to the security damage caused by conventional war in order to be directly deterred by the Security Council.

3.3. Third - the new cyber power and its impact on changing the contents of international powers:

After the Cold War, cyber power became the main indicator of the amount of state power, especially after the emergence of international wars within cyberspace, and in this way, whoever owns the cyber power and the mechanisms for employing it at the international and local level, this led to a change in the major international power centres, which redefined the map of the international system based on technological and digital foundations and principles that rely on computers and information systems capable of monitoring the international situation over thousands of kilometres, and the Chinese vital cyber domain is one of the most prominent living examples of this.

Thus, the aim of states has become to seek to acquire cyber power and develop its means and tools for international and global superiority. This is reflected in the mechanisms used in contemporary international wars that have changed the form of conflicts and the patterns of soft and hard power in employing interactions within cyberspace, reflecting the growing capabilities and escalating threats to the security of the global information infrastructure.

As the content of cyber warfare is related to military applications and software and its role in eliminating the monitoring of jamming and cyber-attack cases, multidimensional and multifaceted, the adoption of information and communication networks and the field of warfare uses that helped spread

¹⁰ According to : Keren Elazari, "Cyber Warfare in context of global conflict", <https://www.iberdrola.com>

cyber threats to the interests of states and thus the possibility of the emergence of cyber warfare in several contexts:

- 1 -The world is increasingly connected to cyberspace, which has expanded the interest in developing cyber infrastructure.
- 2 -The decline of the role of the state as a major actor leading international war and the emergence of non-state actors with the ability to create multifaceted international interaction.
- 3 -The low cost of cyber warfare compared to conventional armed wars because it has the characteristics of destroying civilians and military personnel
- 4- Employing cyberspace as a new battlefield.

II. Conclusion:

Through the foregoing, we conclude that cyberspace is one of the most important modern strategies in managing international wars and issues related to international peace and security, as cyber warfare has become a realistic perception that emerged from the security reasons that affected the structure of the international system, and its seriousness and impact on collective security and its economic, humanitarian, political and diplomatic sectors is greatly confirmed by the increasing link between the latter with information activities, advanced technological systems, and high-quality digital transformation tools in managing global security affairs.

III. Referrals and references:

First: Articles:

- 1/- Medi Ibrahi, Kante. "The Technological Revolution: Political and Security Implications for African Countries," New Directions, Issue: 21, May-June 2017.
- 2/- Alli, Mahmoud, Abderrahmane, Oussama, Farouk Mekhaïmer. "Cyberspace and its impact on the concepts of power, security and conflict in international relations" . Journal of the Faculty of Politics and Economics, Vol. 15, No. 16, 2022.
- 3/- Fahad Hamad, Al-Athba. "Foreseeing the impact of technological development on modern warfare and the military power of small states." Seventh Book of Future Issues.
- 4/- Boutmain, Lakhdar. "Transformations of Nuclear Strategy after the Cold War". Magazine of Intellectual Dialogue, Issue:17, Volume:14, 2019
- 5/- Thomas E, Copelan." THE INFORMATION REVOLUTION AND NATIONAL SECURITY". Strategic Studies Institute, August 2000.
- 6/- Johan M.G. van, der Dennen. " CONCEPTS, DEFINITIONS, RESEARCH DATA - A SHORT LITERATURE REVIEW AND BIBLIOGRAPHY. university of Groningen digital archive
- 7/- the analysis of some legal articles, including:" The Law of Justice and War on the physical and psychological damage caused by cyber-attacks, which must be equivalent to the security damage caused by conventional war in order to be directly deterred by the Security Council

Second: Websites:

- 1/- Quoted from: Khaled Haji, "Technological breakthroughs and the constraints of technological time," <https://www.aljazeera.net>.
- 2/- "The Practical Guide to Humanitarian Law", https://guide-humanitarian_law.org
- 3/- "International Security", <https://www.rug.nl>
- 4/- Keren Elazari, "Cyber Warfare in context of global conflict", <https://www.iberdrola.com>
- 5/- "The Practical Guide to Humanitarian Law", https://guide-humanitarian_law.org