HOW DID SCIENCE, ENGINEERING AND TECHNOLOGY AFFECT PEOPLES' SECURITY BETWEEN THE 18th AND 21st CENTURIES

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This article briefly presents the racing developments of the scientific research and development in technology in some domains between the XVIIIth and XXIst centuries.

Efforts have been made to realistically approach these developments' influence on civil and military actions as well as on peoples' security.

How did machines and changes in technology affect people's lives and security? Science, technology and machines make peoples' lives both better and worse (because there are good points and bad points in this).

If we look into peoples' lives from the security viewpoint, we can turn right in time to think of essential aspects of risks, threats and hazards that constitute the subject of this paper. We might not be surprised of that problem and certainly therefore be able to learn something by this time and to know what is lying ahead.

That is why prospective security is considered the main condition for the development of policies and security strategies in order to avoid peoples' insecurity.

The Domestic System had been in use since the 19th century (the Middle Ages) and workers made the goods for the people, but the population grew fast by the beginning of 19th century and this system could not make enough goods for all. The population was growing quickly due to better diet, improved human hygiene and health care.

The water-operated machines were powered by streams (rivers) wheels which drove the machines inside the factories through some gears.

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So, the hand-operated machines were replaced with the new factories of the textile industry by 1770. Then, the steam engine was invented for powering the spinning thread. Thus, the power of steam replaced the muscular effort of people. This invention depended on coal and the factories (industries) were built in coal fields by 19th century.

The discoveries of the French scientist Pasteur (1861) about the existence of microbes and the problem of infection helped scientists to discover how the infection of wounds happened and how the infection of post-surgical wounds was caused by microbes and germs.

Septic surgery techniques were accepted by 1880. The development of aseptic surgery, the improved conditions for workers and personal hygiene made it possible for the people to live longer, and allowed the growing of the population.

These achievements and the development of science, technology and machines made people's security better, but children and adults were worse treated in the textile mills; they had not more than four hours of sleep per day, and they strapped by over-lookers. If they or their parents reported the event it was very likely for them to lose their jobs. This is why the British Parliament investigated the working conditions of children in the textile mills by the middle of 19th century.

Machines were the cause of many accidents; there were no laws for improving safety conditions in factories by 1850.

In factories, discipline was harsh, and children had to work 14 hours a day; they frequently smashed their fingers and shattered their hands because they were very small (under the age of ten). Children were not treated well and neither were the adult workers.

The beating of workers (children and adults alike) was allowed at the beginning of the 19th century. Some factory owners said workers were not good enough, they were lazy and that was why they needed harsh treatments. In addition, in the 18th century it took 14 days for someone to travel from Paris to New York, as compared to the 12-14 hours today.

In 1900, about 50-75% of the European people lived in towns. There were railways in Europe, but now there are a lot of them and the journey between towns is done three to four times as fast than 100 years ago, due to electromagnetic power. Transport and travel on oceans and trade were carried in iron ships. Electricity and gas were new sources of power. Roads and canals were continuously improved. Agriculture was improved too. Modern farming methods were adopted and the soil

was fertilized and produced larger crops. The new methods meant that more lands were farmed and the farmers got more products and more money.

In the 20th and 21st centuries there was a big increase in the amount of crops produced due to better farming methods and agriculture techniques, and goods were made in factories powered by electricity.

What about warfare and its technology?

Science and technology required over time efforts in the direction of research-development for the production of highly effective equipment and weapons. Technology and machines influence wars (the war for world power and the Third Wave war included). The beginning of the 21st century surprised the scene of international security in full process of transformation.

From firepower to networking power and to cognitive power

By 1750, infantry had soldiers who fought with muskets, artillery had artillery guns with solid balls of iron or case-shot (a kind of ammunition), while the importance of cavalry had decreased in time.

But warfare had changed by 1914. The artillery guns were improved, and some of them got very big. The smokeless gun-powder for muskets and artillery guns was already discovered. The Industrial Revolution transformed warfare dramatically.

By 1800, guns were not made from iron, but from steel.

Technologies had changed by 1914 (poison gas, machine guns, tanks, aircraft, etc.).

By 1914, infantry had got rifles with eight rounds and machine guns which could fire about 8 times more shots than 20 years before.

The new technologies constitute an accelerator for the society development especially in the 20th and 21st centuries. Science and technology grew fast over time for the production of goods for their use in civil life or in combat. Thus new technologies improved the effectiveness of military and civil actions. Science was permanently established as an efficient support of civil and military practice. The impact of science and technologies on civil and military security may be illustrated by the evolution of the civil and military actions.

If we study history, we might think that Russia and Germany have always been traditional enemies and Russia and France traditional allies. But this is untrue, because Russia and France had been enemies during the Napoleonic wars. In fact Russia and France were at war with each other. The Napoleonic Wars lasted from

1799 to 1815. In 1806 a big alliance was formed: Russia with Britain, Austria and Sweden, in 1807 and Prussia. Napoleon defeated Austria in 1805, Prussia in 1806, and in 1807 forced Russia to change sides.

Admiral Nelson defeated the French fleet off Cape Trafalgar in 1805. This victory and the massacre of the French soldiers in Russia in 1812 meant that only Britain and Russia could defeat Napoleon.

The allies (Britain, Russia, Prussia and Austria) finally defeated France (Napoleon) upon the Battle of Waterloo, in 1815.

In time, the means by which the armed forces defend their states have changed. So, warfare has changed by 2012.

As the world careens into the 3rd millennium, the means by which the states (nations) defend people's lives and their security are entering some transition periods and today there are technologies of machines, equipment and weapons: from sail-powered wooden ships, to steam driven iron ships, then to turbine driven ships: from horse, to vehicles; from manned aircraft, to unmanned ones; from firepower, to networking power. In the 21st century there is an Information Revolution and information technology.

Today it is the transition from information power to cognitive power.

Since the First World War, and the Second World War we have learned about the unpredictability of our future (present) adversaries through loss of lives (during the First World War Romania lost 800,000 men).

It is necessary to adapt security institutions to the interconnection of international risks and threats in the information era.

Science has affected the development of the Industrial, Technology and Information (IT) Revolutions worldwide.

New machines need new solutions to dangers in order to avoid accidents and disasters.

Engineers and scientists should discover how accidents can be avoided in the future.

Engineers should redesign machines and equipment once they have realized the products are badly manufactured and that this will cause things to collapse sooner or later.

The new weapons and systems have to be augmented by information networks and intellectual tools because these will enable soldiers and commanders to gain cognitive superiority and to defeat adversaries.

"Historically speaking, the biggest ecological disasters were provoked by wars. Throughout history, the maneuvers used in battles have degraded very much the environment and the costs to diminish pollution have risen up to billions of dollars ... A well-known example of ecological war use was represented by "Agent Orange" use by the US army to destroy food sources while (during, n.a.) the Vietnam War. Recently, the blast of oil drills in Kuwait generated the emission in the atmosphere of tones of pollutant gases as carbon dioxide and sulfur dioxide bringing on black and acid rains in Saudi Arabia and black snow in Kashmir (over 1,500 miles away)"[1].

Changes in security.
Security must be continuously improved

States, organizations or any other entities should have thought of war (or of any fights) before starting it (them). They should have thought why they became enemies, and of the possibility to lose the war (fight). Any state has to accept that it is possible to strengthen its territory at the expense of other state or not. It means that the other state can strengthen its power at the expense of its own state.

Every state has weaknesses and strengths and can be eventually defeated.

The question is why and how, despite the success of a certain state, some allies can defeat it.

For example, in 1812 Napoleon's power had reached its climax due to his military genius, but he was eventually defeated in 1815 by allies upon the Battle of Waterloo because the French stopped supporting him when he began to lose battles and because of the heavy taxes the people had to pay to keep the wars ongoing.

Resentment against a colonial state's rule (for instance against the Occidental rule) can grow for some time or any time. It is necessary to trouble people in some ways or to play them tricks like some attacks on customs, hard labor and, fagged out, people would not be able to bear it. This is why they set off the revolt.

People can see some events as a deliberate policy of the colonial state (or empire) to weaken the traditional national religions and educational customs.

For example, the Indians had been bitter and resented the British rule. Resentment against the British rule grew in India due to the British policies towards the Indian religions and customs and the Independent Indian states.

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[1] Mirela Atanasiu, *Consequences of ecological disasters upon human security*, Annals Series on Military Sciences, Academy of Romanian Scientists, Issue 2, volume 3, 2011, Bucureşti, p. 95.

Warfare was less deadly in the 1700s and 1800s, but it was deadly (very deadly) during the two World Wars and casualties were high because weapons were very effective. (The weapons were even more effective in the 1900s).

By 1900, a machine gun fired eight bullets per second and this is why the casualties were high. However, it was the artillery shell (shrapnel shell) which caused most of the casualties in the First and Second World Wars.

The future security is possible and uncertain, despite the scientific and technological development.

The experts in economy and security state that the global security system and the global economic system are threatened by events and risks with disastrous or catastrophic processes and phenomena for years on. The catastrophic potential and this prediction are true or have become true. It is more and more obvious that the future events will have a powerful impact on a short and long term perspective. However, the effects are felt by all the countries (states) worldwide because of the inter-connection of global processes and phenomena. These effects will affect our security either directly or indirectly.

The better or the best tool for the security management system is security planning that will give us the information that can be used as a basis of the strategic security map creation. But many organizations (including international ones) pay no attention to security planning (this is a strategic planning). That means evidently that the problem of no use of security strategy (security planning) might ruin our security (including global security).

Science and technology are used both in times of peace and war; this means both for construction and for destruction and murder.

Alvin Toffler, when referring to the high tech impact on security, concluded: "Tomorrow's revolutionary technologies, if not anticipated and reoriented, open new perspectives of destruction for the planet"[2].

Information power and brainpower are no less sweeping than the technological changes that have improved warfare. The technical capacity to feed updated and analyzed information is very important for commanders and soldiers because in this way they could maintain tactical and strategic advantage.

[2] Florea Surdu, *Securitate, conflicte, mediu înconjurător*, Univers Strategic, nr. 2/2012, Universitatea Creştină „Dimitrie Cantemir", Bucureşti, 2012, p. 113.

The security is an objective "of all actions, processes and phenomena ... channeled towards satisfying all needs, aspirations"[3], etc. The efficiency of activities within the security systems implies the existence of high technologies.

"Science and technology play a major role in the development"[4] of human society. There are some interdependencies between the technologies' evolution and the communication systems development over time and the globalization phenomenon. The reliable, secured and disseminated communication systems constitute a catalyst and an accelerator to globalization and the national states' security.

Everybody is talking all over the world, texting or surfing the Internet on their mobile phone, laptop or PDA.

The IT&C (Information technology and communications) have changed every aspect of the way people live their lives. The progress made by people's "ability to communicate and process the information digitally is reshaping the economies and societies of many states on the globe"[5].

The systems provided by the IT&C "field ensure the technical support of every state and started to become essential to the (day to day) human, business and governments existence"[6].

People are living in a world where time and distances are wiped away by technology. Globalization is perceived as a benefit in the fields where it is supposed to trigger social content. Where it is about the reversed situation, globalization is perceived as being responsible for all evil and suffering.

Technological disasters are caused by human errors or omissions. Deliberate human acts as wars, revolutions or terrorist acts constitute causes of huge human casualties and material losses constituting themselves as social disasters. Technological ecological disasters can be: chemical (they occur when, consequent to a violent explosion of some fuel, chemical substances produce destruction through chemical processes), nuclear or thermo-nuclear (characterized by accidental release of radioactive substances after a nuclear accident leading to the

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[3] Visarion Neagoe, Nicuşor Moldovan, *Eficiență-eficacitate-eficientizare a cooperării în domeniul securității naționale. (Efficiency-effectiveness-making effective the cooperation in the field of national security)*, Revista de Ştiințe Militare, Nr. 3(28), Anul XII, 2012, p. 37.

[4] Marius Hanganu, *Rolul ştiinței şi tehnicii în sistemul militar (The role of science and technology in the military system)*, Revista de Ştiințe Militare, Nr. 2 (27), Anul XII, 2012, p. 51.

[5] Cristea Dumitru, *Sisteme IT&C în epoca globalizării (IT&C systems in the globalization age)*, Revista de Ştiințe Militare, nr. 2(23), Anul XI, 2011, p. 41.

[6] Ibidem, p. 41.

growth of the radiation level beyond the standard safety levels), colliers (appear when mine gases or coal dust are accumulated which are self firing up and react explosively in contact with the air), and biological.[7]

Disasters (natural and anthropological) became more destroying mainly due to the climatic changes and unsustained development. The human society bears the action of some dangerous phenomena with human origin able to produce extremely destructive detuning in many established systems or situations. These events (fires, armed conflicts, accidents on communication ways (they can be air, land, fluvial or maritime), explosions, technological accidents, etc. and can cause a lot of victims and material damage. These disasters have continuously multiplied with more diversified effects than ever, and changed their probabilistic structure and intensity as to the same phenomena recorded a decade ago.[8] Technological disasters produce the interruption or perturbation of society functioning and generate some casualties, a lot of material losses, and environmental destruction. These disasters are produced by the design errors of the industrial equipment and facilities, by enterprises' defective management or explosions; these can be initiated by natural causes (earthquakes, tsunamis, volcanic eruptions, storms, floods, etc.) "a succession of extreme complex elements as chain reactions taking place"[9]. Some of them can have spill over effects and neighboring countries can be damaged by such events (chemical, biological or nuclear accidents; mass fires; faults to the hydro-technical construction or ducts; major accidents to equipment and major technological installations, etc.).

Conclusions

Technological disasters have always been and still are a permanent threat to the peoples' security and cause annually a lot of human casualties and equipment (material) losses. These casualties and losses are too high because of the lack of local specialized structures in disaster management, unstable and chaotically developed economies, etc.

Believe it or not, scientific and technological developments have made human lives easier and longer, but at the same time more dangerous. In the current context, international terrorism (Al- Qaeda is a non-state terrorist threat), the financial-

[7] Mirela Atanasiu, *op. cit.*, p. 81.
[8] Ibidem, p. 80.
[9] Ibidem, p. 91.

economic crisis, trans-border crime, frozen conflicts, international migration and other threats and risks to security have a direct impact on the people's safety.

So, Al-Qaeda already realizes the leverage that networking offers and is busily networking. Coalition troops in Iraq and Afganistan are battling networked terrorists. Both military and non-military organizations have embraced networking because this is a platform for more effective use and performance of people's actions.

Our duty is to do something about the people's lives or we will be the witnesses of their security ruin. A new equipment or technology in any domain of any time had, has or will have a powerful impact over national, international and human security.

Now, the confusion of risks takes shape and through the fog of years we can see the impact of science and technology on security in the civil or military domain. The peril is not desperate, but could be if humanity is not looking out for risks by this time. All is a problem of probability.

In the future, the United States of America must seek multinational solutions to security issues.

The rise of new states and centers of power could lead to the emergence of a multipolar world in the next 25 years.

G.W.F. Hegel (1770-1881) explained the dialectics of value, and we, when referring to security as a value, can quote the brilliant German philosopher stating that security, as an absolute value, is ideal (an ideal requirement) compared with the limited possibilities of the human being subjective in character.

The world, being objective, is careless to the human/individual goals and, therefore, the security provision itself is submitted to infringements, obstacles and even impossibilities.[10]

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[10] G.W.F. Hegel, Ştiința logicii, traducere în limba română D.D. Roşca, Bucureşti, Editura Academiei, p. 821.

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