Knowledge for a Sustainable Future

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By

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We dedicate this book to Robert Blinc,
our friend, teacher, and inspiration

TABLE OF CONTENTS

PREFACE

In a world filled with danger, the threat of nuclear war is greater than ever – the Doomsday Clock for 2023 is set at just 90 seconds to midnight. Wars, epidemics, environmental disasters, social upheaval, economic turmoil, and food crises threaten the stability of our civilisation. But what if we could transform our world into a sustainable, knowledge-based society where science and technology defeat deadly diseases, fossil fuels, and wars?

This book offers hope amid the prevailing chaos. It presents a vision of a world where everyone has access to the tools and resources they need to reach their full potential.

We must address the problems draining our resources to realise this dream. Instead, we must redirect those resources to education, science, and technology – the critical ingredients for success. Investing in these areas can create a new generation of thinkers and innovators capable of tackling the most pressing challenges of our time.

Above all, education is critical to shaping a sustainable future. We must ensure access to quality education that fosters critical thinking, innovation, and problem-solving skills. This will empower young people to take charge of their future and actively shape change in their communities.

The dream of a sustainable, knowledge-based society is within reach. By joining forces, we can make it a reality in the next decade or two. Let us work toward this vision with determination and hope for our planet's future and all people's well-being.

Crafting an inspiring vision may require an artist's touch, but science and technology will ultimately bring that vision to life. And to achieve this, we must revise our approach to education. By valuing each individual and focusing on developing critical knowledge and skills through science-based educational tools, we can inspire a new generation of thinkers and innovators capable of addressing the most pressing issues of our time.

This book offers an attractive vision of a knowledge-based society that solves its challenges by innovating and creating new knowledge based on value. A vision of the future with a limitless, cheap, and carbon-free energy supply that supports economic development while efficiently achieving zero-carbon goals. And one based on inspiring youth to enjoy creating new knowledge while directly or indirectly finding innovative solutions to recent setbacks. In this endeavour, we follow in the footsteps of Robert Blinc, our

late friend, teacher, and inspirer, whose 90th birthday would be celebrated this year.

We provide an overview of how young people can make a difference in solving the pressing challenges of our time. We also offer practical advice for young people with easy-to-follow steps on joining the creators of the future knowledge society. Let us create a path to a sustainable future by changing our minds and hearts to work together for a better future for all.

Aleksander Zidanšek, Uroš Cvelbar, Ivo Šlaus
March 2023

CHAPTER ONE

SUSTAINABILITY VISION

Join the unlimited cycle of innovation and knowledge building in the rapidly changing world

Imagine a world where fossil fuels are abolished not by decree but by the cheap energy of renewables, nuclear fusion, and other innovative energy sources yet to be developed. A world where deadly diseases are eradicated thanks to advances in molecular biology and smart sensors for early detection of potential health risks. A world where smart sensors are connected to quantum ICT devices (Fig. 1.1), applying artificial intelligence algorithms that ensure our safety and personal freedom in the increasingly complex world.

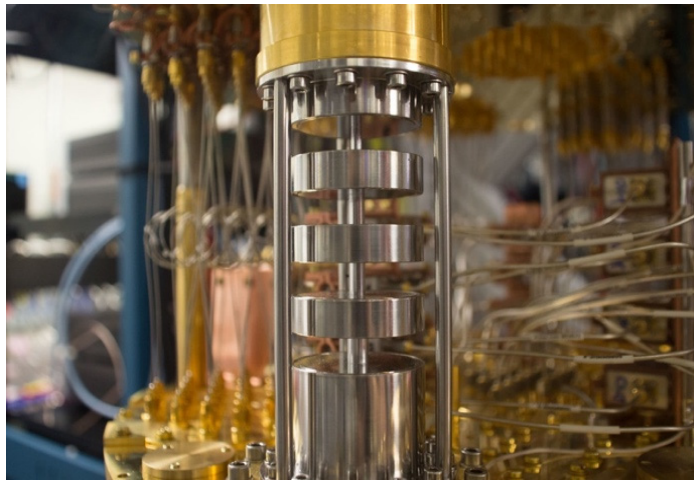

Fig. 1.1 “Quantum Computer Mixing Chamber”. Source: IBM Research licensed under CC BY-ND 2.0 [IB22].

In this complex world, all human material needs will be met soon by autonomous intelligent robots and all mobility needs by autonomous vehicles. Humanity is expected to expand to the Moon, Mars, and beyond (Fig. 1.2) so that humans survive even in the case of a major natural disaster on Earth. Also, a world where humans have rediscovered the power of love in our interactions, according to the words of Teilhard de Chardin:

> We shall harness for God the energies of love and then, for the second time in the history of the world, will have discovered fire.
>
> Teilhard de Chardin [Ch55]

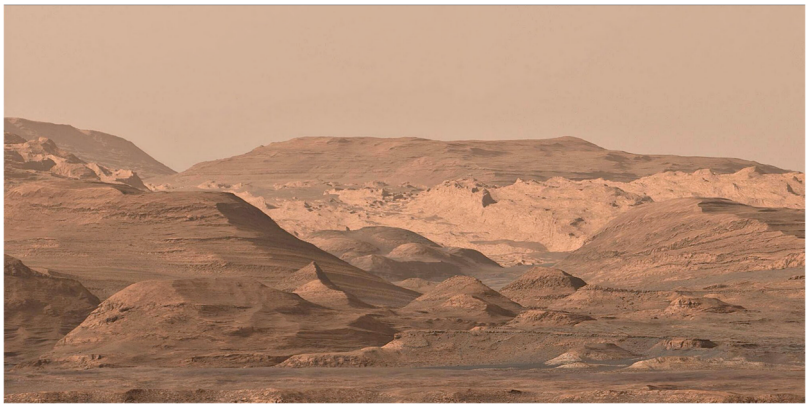

Fig. 1.2 Curiosity Rover: Postcard from Mars. Source: Paul Hammond (PaulH51) licensed under CC BY-SA 2.0, image credit NASA/JPL-Caltech/MSSS [Ha16].

Please take this book as our invitation to the brave new world where all this and much more becomes a reality. Join this wild journey from the presently dysfunctional world to a uniquely harmonious and sustainable civilisation where every human being is valuable. A journey where all our dreams of a better world are no longer dreams but become a reality and enrich the lives of those around us. All this is only possible if we make an effort to grow, to bring out the best in ourselves and bring it to the world.

We invite you because now is the best time for our collective efforts to change the future. Current challenges such as epidemics, war, and a deteriorating environment can be transformed into a more sustainable civilisation with a high quality of life for all.

We believe that every outstanding achievement begins with a compelling vision. Proverbs 29:18 stated thousands of years ago, "Where there is no vision, the people perish" [So50]. At the current, crucial

crossroads in human history, where wrong choices can contribute to the demise of the entire human civilisation, we all must work together to develop a new sustainability vision attractive to all, including the best and the brightest.

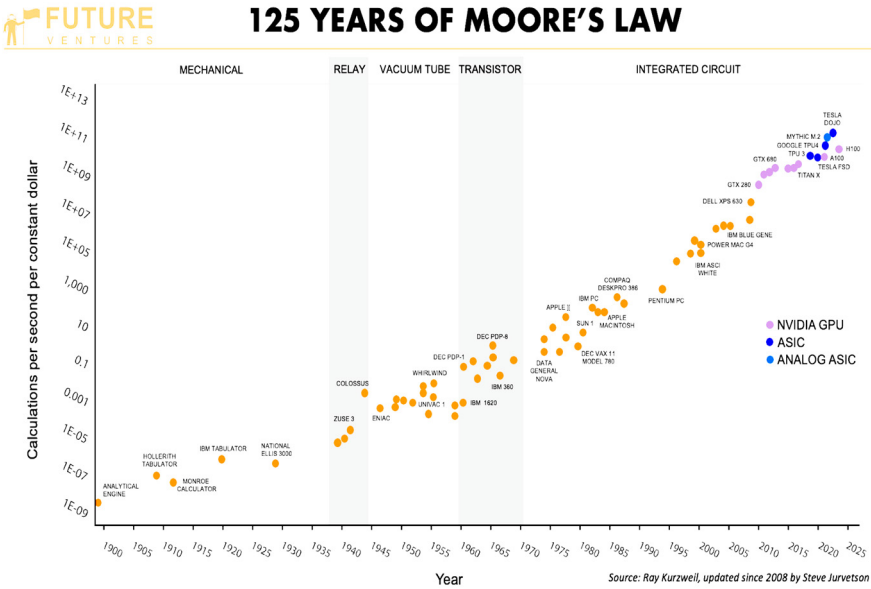

Fig. 1.3 125 Years of Moore's Law. Source: Jurvetson licensed under CC BY 2.0 (colours have been inverted for clarity) [Ju21].

Apart from being attractive, the vision must also be realistic. On the one hand, it is reckless to bet the future of humanity on unproven technologies that may never work. On the other hand, it is even more irresponsible to rely on old and (soon) outdated technologies. In recent decades, Moore's Law has led to spectacular successes (Fig. 1.3). Many apparent physical limits should have stopped technological progress. Nevertheless, new solutions have emerged again and again in almost miraculous ways and computing power has doubled in about two years.

Consequently, the speed of computer processing doubles about every two years. What Gordon Moore wrote on a napkin during lunch in 1965 is still true today. Due to these rapid technological advances, new algorithms and artificial intelligence approaches became possible and spread to almost all areas of our daily lives.

Whenever we project more than a decade into the future, we need to consider the expected acceleration in computing power, which will improve more than 30-fold in 10 years. This rapid improvement brings faster data processing and communication and opens up new approaches to services and algorithms that are impossible today. If we do not take full advantage of these advances, we will soon find ourselves in big trouble. It is not easy to solve today's challenges with yesterday's technologies. However, if we address today's setbacks with tomorrow's technologies, new opportunities will emerge to solve complex challenges, even those that seem impossible today. Therefore, the new sustainable vision must be both bold and realistic. On the one hand, it must enable continuous improvement in the spirit of kaizen, and on the other hand, it must convey the feeling that it will be achieved. This vision will become a reality when intelligent, educated, and motivated people commit to solving their chosen problems to its realisation.

As the human population approaches eight billion and heads towards nine billion, this added complexity significantly increases the threats and challenges. However, it also makes the opportunities even greater. Each of us can think, imagine, learn, and overcome complex challenges. Our collective experience, knowledge, and outcomes can change the course of history, solve challenges, and create new opportunities for all of us to live creative and healthy lives in thriving and caring societies.

As long as we see every human being with the potential to do good, there are billions of opportunities to move closer to a better and more sustainable world.

In this book, we show that such an optimistic vision can become a reality in a decade or two if we are wise enough to redirect at least some of the current useless subsidies to science and technology.

We have written this book as an invitation to the beautiful world of tomorrow's research, technologies, and creativity.

Therefore, this book primarily aims at young people who want to pursue a career in science or technology or other creative human endeavours that will contribute significantly to a sustainable future. This book is not only for young people but also for those young in spirit.

The following chapters present ideas on flourishing, cultivating a more sustainable vision of the future civilisation and rethinking the established development streams. Moreover, this should motivate us to use our creative capacities fully and contribute to a fulfilling future for all.

Human history is progressing ever faster. While ancient civilisations were built on written rules and mainly remained the same for generations, the industrial revolution was built on steam engines and changed faster. Today's culture is based on information technologies that change rapidly.

Yuval Harari [Ha17] speaks of ancient civilisations as civilisations of the book by which they were defined. It was the essential duty of the individual to follow the rules of the book.

In the industrial civilisation, there were many new inventions, of which the steam engine defined the early industrial age. In this context, it was common for people to compare their emotions to the steam engine and speak of emotions boiling or even exploding. In this paradigm, human emotions and feelings became an essential factor that often determined human behaviour.

Recently, with technological advances and intelligent algorithms, humans have sometimes been compared to algorithms. Harari even talks about humans being biological algorithms that make decisions based on information from their environment [Ha17].

Recent advances in artificial intelligence demonstrated that algorithms with large amounts of data could often make better decisions than humans. Therefore, it seems reasonable to leave important decisions to such algorithms.

For example, when deciding on a career path in the industrial paradigm, you listen to your gut and make the choice that feels best.

In the algorithmic paradigm, you collect as much data as possible and then take the best possible algorithm as a guide for your life. Some people even make radical decisions based on the algorithm's recommendation.

Angelina Jolie, for example, decided to have a prophylactic double mastectomy because the algorithm predicted a high risk of breast cancer based on her family history [Ev13]. Such decisions are complex, so we must understand these algorithms well before deciding. We will show in the following chapters that algorithms and data are valuable tools for human decision-making. They can significantly expand their capabilities if intelligent, motivated, and dedicated people take full advantage of the coming biological and quantum science and technology revolutions, the so-called bio-quantum revolution. It is still essential to make a conscious decision based on the algorithm's results and our knowledge, experience, and feelings.

To join this worthwhile endeavour and get the most out of the book, we recommend to read it with an open mind. In Chapter 2, we introduce some of the many current threats to the future. Chapter 3 continues with a historical account of humanity's progress towards a democratic society. In Chapter 4, Knowledge as Opportunity, we present recent and expected new advances in human knowledge in the coming years, particularly in nanotechnology, molecular biology, and quantum computation, which have the potential to work together in synergy and mark a new bio-quantum

revolution. This enormous potential can only be realised if enough motivated and intelligent people with specific values, missions, and visions come together to address and solve each significant challenge. With the current civilisation so far out of balance, it will take many competent people to steer global development in a better direction. Some possibilities for global networking are presented in Chapter 5.

Following the story of the giant turnip (Fig. 1.4), everyone is important and can make a difference. Therefore, start now and continue on the new path. The story of the giant turnip is about an elderly man who wanted to pull the turnip out of the ground but could not manage to pull it out. So he called for help and was joined successively by his wife, granddaughter, dog, and cat, but they could still not pull it out. When finally, a little mouse joined the efforts, the turnip was successfully pulled out of the ground.

Even if you do not know much, if you have a challenging background, if you feel like the little mouse from the story, you could be the one to steer the current unsustainable trends in a new direction.

When you find your purpose, work becomes enjoyable and can feel like play. Because it feels good to play a meaningful game, results often follow and complex challenges are solved; even the biggest turnips are pulled out of the ground.

For those looking for a significant research challenge, we discuss some of the most difficult existential challenges, including human health, clean energy, pollution, and many more. As these challenges require multi- and interdisciplinary knowledge, there are many opportunities for scientists, inventors, artists, educators, and others who want to tackle complex challenges and develop creative solutions.

Chapter 6 presents values and indicators for a sustainable future and offers simple guidelines for changing our mindset and attitude to improve our quality of life and health significantly. This change can be an essential step in your personal transformation.

How we can achieve a sustainable future is the question we ask in Chapter 7.

Chapter 8 allows us to complete our personal transformation and align our vision with our attitude and heart's desire. In this way, we transform our burning desire into a creative contribution to the world of tomorrow, as Albert Einstein stated:

> The important thing is not to stop questioning. Curiosity has its own reason for existing. One cannot help but be in awe when he contemplates the mysteries of eternity, of life, of the marvelous structure of reality. It is enough if one tries merely to comprehend a little of this mystery every day.
>
> Albert Einstein [Mi55]

Fig. 1.4 Children in a turnip field, Peabody Bros. Farm, Woodstock, New Brunswick / Enfants dans un champ de navets, ferme Peabody Bros., Woodstock (Nouveau-Brunswick). Source: BiblioArchives / LibraryArchives licensed under CC BY 2.0 [To17].

If we are equipped with our personal vision to contribute to the coming bio-quantum revolution and with a burning desire to realise our vision, we will all create a new future on parallel paths that will be exciting and fun to live in.

We can not wait for you to join us on this transformative journey and we look forward to meeting you on our shared journey towards a sustainable future. Let us begin our journey by exploring the global threats, each of which could be an opportunity to transform our personal vision and burning desire into solutions necessary for a sustainable civilisation.

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[To17] William James Topley, *Children in a turnip field, Peabody Bros. Farm, Woodstock, New Brunswick / Enfants dans un champ de navets, ferme Peabody Bros., Woodstock (Nouveau-Brunswick)*, Library and Archives Canada, date unknown, uploaded on March 13, 2017. See also: https://www.flickr.com/photos/28853433@N02/32604294043 licensed under CC BY 2.0 https://creativecommons.org/licenses/by/2.0/ (accessed on 10 December 2022).

CHAPTER TWO

FUTURE UNDER THREATS

2.1 Self-destruction

On our walls, our hand writes 'destruction', but we do not seem as worried as the Babylonian king Belshazzar (Fig. 2.1), even though destruction and self-destruction are repeated many times. For three consecutive years, we were 100 seconds to Armageddon – 100 seconds to our catastrophe, even before the Russian aggression in Ukraine, which has moved the clock even further to 90 seconds to midnight. This clock has never been closer to Armageddon. The battle is not between evil and virtuous forces; it is the suicide of an arrogant, ignorant, and violent species – us – humanity, led by incompetent and arrogant individuals – a political leadership prone to lies.

Fig. 2.1 Madrid_Museo del Prado-Rembrant (Belshazzar's Feast). Source: Gary R. Caldwell photo licensed under CC BY-ND 2.0 [Ca10].

Contrary to Aristotle's opinion that politics is a master science aimed at the good of society [Ar35], YouGov opinion polls of British voters in 2012 found that 62% thought their leaders lied all the time [Ke12].

It is common wisdom usually attributed to James Freeman Clarke that politicians are those who focus on the next election, while statesmen are those who think about future generations [Cl88]. When you are not in power, can you be dedicated to the next generation? Yes, we can. However, our social, economic, and political systems need to be transformed.

The Doomsday Clock is set every January and 'measures' threats and dangers from military conflict. In addition to nuclear war and the use of weapons of mass destruction (WMD), it also considers the extinction of natural and human capital by our social, economic, and political systems. The Bulletin of Atomic Scientists' Science and Security Board, responsible for setting the clock (Fig. 2.2), decided to keep it at 100 seconds in 2022 but lowered it to 90 seconds in 2023.

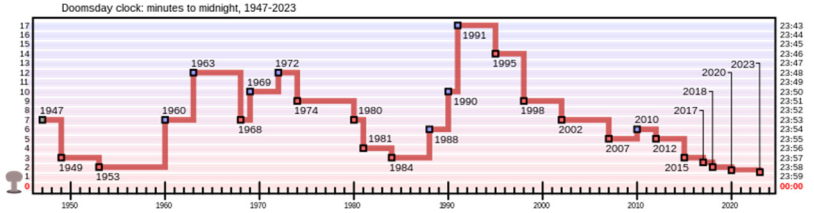

Fig. 2.2 Doomsday Clock graph, 1947–2023. Source: Fastfission [Fa23].

Although the official value of the Doomsday Clock is still 90 seconds (January 2023) [Me23], a more realistic value is well under a minute because of the enormous stupidity of the political and other leadership in allowing the political situation in the world to deteriorate so much.

Moreover, as Dietrich Bonhoeffer wrote in the Nazi prison during World War II [Bo11], "stupidity is a more dangerous enemy of good than malice. Evil can be protested against, it can be exposed, and we can prevent it by force. Evil always carries within it the germ of its overthrow... Against stupidity, we are defenceless."

2.1.1 Nuclear catastrophe

In his speech accepting the Nobel Prize in 2005, game theorist Thomas Schelling said [Sc05]: "The most spectacular event of the last 60 years was the event that did not happen: We have lived 60 years without detonating an atomic bomb in anger." Never has a new weapon been used once or twice

with great effect and then never again. Realising that there is no 100% sure defence against a nuclear attack is crucial. The Star Wars idea of Teller and Reagan was a hope to develop a defence, but many recognised its serious shortcomings. Instead of defence, the concept of deterrence was used. It was called Mutually Assured Destruction – MAD [Av12]. The nuclear arsenal of the two superpowers – the United States of America (US) and the Union of Soviet Socialist Republics (USSR) – was and still is (since the arsenal of the USSR was transferred to the Russian Federation) many times larger than the arsenal needed to deal a death blow to an adversary, regardless of who uses weapons of mass destruction first.

At the height of the Cold War, the US and USSR had 99% of all nuclear weapons (NW), over 60,000. That number is much smaller today, but the vast majority are still under US and RF control. About 50% of all nuclear weapons are on alert. It is not one person pushing a button. It is a fixed chain of control that could destroy our world in less than an hour.

The existence of nuclear weapons is a threat to our civilisation; therefore, any use of nuclear weapons is immoral. A nuclear war between two countries with much smaller nuclear arsenals, for example, between India and Pakistan, would trigger a nuclear winter phenomenon that would seriously affect our civilisation [Os16]. Therefore, nuclear weapons are useless except in a political game of threats, deterrence, blackmail, and prestige building.

Are nuclear weapons legal? On 3 September 1993, the World Health Organisation (WHO) requested an advisory opinion from the International Court of Justice (ICJ). However, the ICJ did not give an advisory opinion and argued that WHO was ultra vires, i.e. acting outside its legal powers. The General Assembly of the UN voted on the initiative of WHO, resulting in 78 votes in favour, 43 votes against, 38 abstentions, and 26 non-votes. This result was submitted to the ICJ with the same request in December 1994. The essential question of whether the threat to use nuclear weapons (NW) violates the rules of international law applicable to armed conflict ended with a split decision by 14 judges. Three judges, C. Weeramarty (Sri Lanka), Koroma (Sierra Leone), and Shahabuddeen (Guyana), argued that there is no exception to the general principle that the use of NW is illegal in all circumstances, including the survival of a state.

There are ongoing efforts to declare NW illegal, they said. The International Campaign to Abolish Nuclear Weapons (ICAN) campaigned to abolish nuclear weapons. On 7 July 2017, the UN General Assembly adopted the UN Treaty on the Prohibition of Nuclear Weapons (TPNW). On 22 January 2021, the UN TPNW became international law. Since then,

it has been illegal to possess, develop, deploy, test, use or threaten to use NW. In 2017, ICAN was awarded the Nobel Peace Prize.

Nevertheless, the communiqué of the 2016 North Atlantic Treaty Organisation (NATO) conference in Warsaw reaffirmed the value of NW and the role of deterrence for the alliance. On 18 July 2016, the UK House of Commons voted overwhelmingly in favour of the use of nuclear weapons. The current nuclear strategy is based on a strange argument – countries should diversify and modernise their nuclear forces to have more deterrence options. The US is planning a renewal of its nuclear arsenal, including intercontinental ballistic missile (ICBM) and ballistic missile submarines (Fig. 2.3), bombers and air-launched cruise missiles, which will require a trillion dollars over three decades [Ga16a].

Fig. 2.3 An unarmed Trident II (D5LE) missile launches from Ohio-class ballistic missile submarine USS Maine (SSBN 741). Source: Official US Navy Imagery licensed under CC BY 2.0 [US20].

The US, the RF, and China's emphasis on NW and conventional forces are constantly changing with technological progress, e.g., the US is now in favour of eliminating tactical NW.

In contrast, 40 years ago, the US favoured them. To counter the technological superiority of conventional forces in NATO, the RF now favours tactical NW. Such particularly small NW can have low power, only about 0.1 kt from TNT. The RF favours MIRV (multiple independently

targeted re-entry vehicles), while the US is opposed. The RF also recently suspended participation in the New START treaty on the reduction of strategic NW, which was signed in 2010 and was the last remaining nuclear treaty with the US.

Currently, the US secures its allies – NATO countries, Japan and South Korea – through nuclear deterrence. If allies lose confidence in the US umbrella, they might decide to develop their own NW. The Obama administration discussed declaring a no-first-use policy, i.e. the US will only use NW in response to a nuclear attack by an adversary. It is claimed that such a policy would carry more risks than benefits [Mo16].

Also, there is no evidence that other nuclear states would pursue such a policy.

Today, military conflicts can be fought on land, sea, air, space or cyberspace. There are also hybrid conflicts. Here, we focus only on NW. Unfortunately, nuclear war can be triggered accidentally. Terrorists can use NW, which, fortunately, they have not done so far.

There are different types of possible conflicts, all of which pose different but serious threats to the survival of human civilisation or even to the survival of humanity and life on Earth:

1. A confrontation between nuclear powers with an almost equal number of nuclear weapons, e.g., the RF vs NATO: In the case of NATO vs the RF, nuclear war means catastrophe for humankind regardless of which side initiates the war. Military conflict between small or medium size nuclear states would also result in nuclear winter affecting not only these two countries but almost the entire Earth, affecting climate, food production, transportation, and everything else. War involving small or medium size nuclear states could also trigger the use of other weapons of mass destruction (WMD), which are illegal (chemical and biological). Fortunately, these types of nuclear wars have so far been avoided.
2. The confrontation between a nuclear superpower and states with much weaker NW: The first example was between 1945 and the development of the first USSR nuclear weapons (29 August 1949, despite the assessment of the CIA that the Soviets would not have the bomb before 1955). Although hostility between the USSR and the US had already developed by the end of World War II, it would have been risky for the US to use NW to attack USSR. Large Soviet forces were in Europe and many Americans and Western Europeans regarded the Soviets as allies. Moreover, the NW of the US were not so superior to the conventional USSR forces that they could have

guaranteed a quick victory. The second example comes from the period between the end of the Cold War (1990) and 2000. Although RF was in crisis, it still had a considerable nuclear arsenal. Another example would be the confrontation between the US and North Korea. Fortunately, these types of nuclear wars have been avoided so far.

3. The confrontation between a nuclear state and a state without NW: Several times, we have been confronted with such a situation, but fortunately, states with NW have not used them. The first case was when General McArthur wanted to use NW against China during the Korean War. President Truman relieved him of his command. There have been several wars in which NW states and those without NW have been involved, e.g., wars in Vietnam, Cambodia, Afghanistan, Iraq and in the 21st century, fighting in Syria and Libya. The USA was involved in all these wars, and for the first ten years in Afghanistan, also the USSR. Its successor RF attacked Georgia in 2008 and Ukraine in 2014. So far, nuclear wars have been avoided in these cases as well.
4. The situation in Iraq is far from satisfactory. The idea that the US and its allies would succeed in making any of these countries democratic and free market states was unsuccessful. All these wars could escalate into a much bigger confrontation between nuclear superpowers. Fortunately, it did not come to that. The defeat of the USSR in Afghanistan coincided with the disintegration of the USSR. The defeat of the US and its allies in Vietnam, Laos, and Cambodia and most recently – after 20 years of fighting – in Afghanistan has shown that a superpower can be defeated and humiliated by a poor, ill-equipped country. This is a very important lesson, but one that can easily lead to the wrong conclusions.

Each of the above-described conflicts is distinctly different. However, valuable lessons can be obtained from past conflicts with a grain of salt. The actors of the past conflicts and the world geopolitical situation were significantly different at the time of each conflict.

Lessons from the fighting during the disintegration of former Yugoslavia from 1991 to 1999 are also important. However, they fall into a different category as the role of NW states was limited to a few weeks of NATO intervention in 1995 to end the war in Bosnia and Herzegovina (Fig. 2.4) and a few months in 1999 to end the war in Kosovo.

Fig. 2.4 IMG_4602 Sarajevo Bosnia war images. Source: Ulicar licensed under CC BY 2.0 [Ul10].

More significant lessons could be learned from the war in Ukraine, where an NW superpower is waging war against a country that voluntarily gave up its NW in 1994. This gives a wrong signal to other countries and reduces the incentive for other NW states to give up their NW. It also stimulates non-NW states to develop their NW to prevent an attack by an NW superpower.

2.1.2 Accidental Use of Nuclear Weapons

The US Department of Defense estimated 32 serious accidents involving NW between 1950 and 1980. On 26 September 1983, the Soviet early warning system indicated one, then two and then five US NW attacks. The end of 1983 was a time of the highest US – USSR tensions.

Nevertheless, the Soviet officer on duty, Stanislav Petrov (Fig. 2.5), correctly assessed that it was a false alarm and saved the world. This was not the last. On 25 January 1995, the Russian early warning system detected a missile launch from Norway. The ‘detected’ missile was the launch of a US-Norway scientific rocket to study the aurora borealis and Norway

informed the Russians in advance. Still, the information did not arrive in time.

Fig. 2.5 Beatrice Fihn delivered remarks at the Museum of Mathematics in New York honouring Stanislav Petrov, the winner of the Future of Life Award for 2018. Source: Author PhaedrusofAthens [Ph18].

Although the peaceful transformation of a nuclear superpower seems like an illusion, there is too much at stake not to try. A possible long-term vision for a peaceful settlement of the current wars could be achieved within a regional cooperation organisation, such as the European Union (EU), the African Union (AU), the Association of Southeast Asian Nations (ASEAN, Fig. 2.6) or similar regional organisations.

Fig. 2.6 Map showing the members of the ASEAN Football Federation. Source: Author Zuanzuanfuwa [Zu12].

A common European future for Ukraine and Russia within the enlarged EU could ensure peace and stability in Eastern Europe. Strange as this may seem today, the integration of Germany into a peaceful Europe also seemed an impossible dream in 1945. Nevertheless, less than 20 years later, Germany joined its former adversaries and finally united in the EU.

The EU accession process for Ukraine has already begun. If we follow the example from recent European history, the next two decades are a realistic time frame for Russia to join the European Union as well. Such a vision of a united Europe from Lisbon to Vladivostok would also remove the incentives for future large-scale military conflicts in Europe.

Therefore, if we are to survive the current dangerous times, no option may be off limits for a peaceful resolution of the war and avoidance of nuclear war.

A similar strategy of economic cooperation agreements is also helpful for other continents, where closer integration of countries would reduce the likelihood of military conflict. Some promising examples are the AU (Fig. 2.7) and the ASEAN.

Fig. 2.7 African Union Executive Council group photo. Sandton, Johannesburg, South Africa, 2015. Source: DIRCO licensed under CC BY-ND 2.0 [DI15].

Whatever strategy is adopted, war and military conflict must be eliminated as a method of conflict resolution if we are to reset the Doomsday Clock and ensure a prosperous future for humanity.

2.2 Economic Threats

While the economy has contributed significantly to the current prosperity, it has also created many important threats to a democratic future in which the creative talents of each of us should collectively contribute to a better future for all.

The big question today is also how to decouple economic growth from pollution. At first glance, this seems to be an impossible task because more economic output usually requires more raw materials and energy, which have a negative impact on the environment when they are taken from nature.

In addition, economic development improves technologies, making current and older technologies obsolete and the machines associated with these technologies become waste that is disposed of back into nature. Such a linear economic model may have been possible in past centuries at a lower level of production, from the extraction of natural resources from nature to the disposal of useless products back into nature. The exponential growth of natural resources used by humans has made such a concept obsolete.

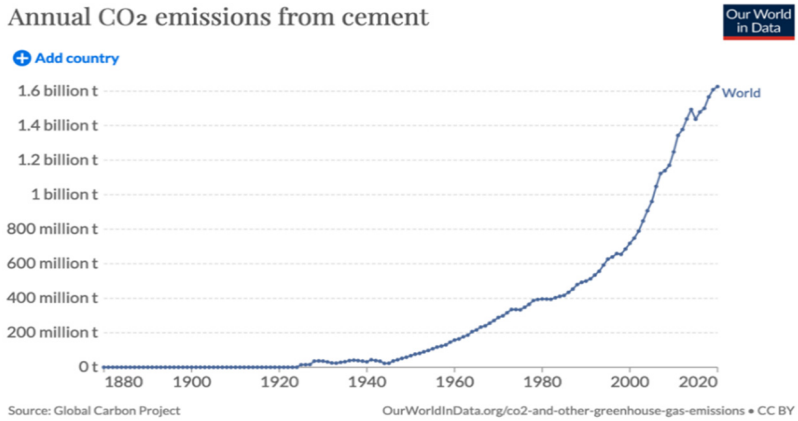

Fig. 2.8 Annual CO_2 emissions from cement. Source: OurWorldInData licensed under CC BY 4.0 [Ro21].

For example, while cement production has increased more than 100-fold in the last century [Ce20], this trend continues, as can be seen in Fig. 2.8.

Despite global sustainability initiatives supported by the United Nations since 1987, the extraction of natural resources from nature continues in the 21st century. Oil and coal extraction is on a similar scale to the global production of cement. Many other materials are also taken from nature in a similarly unsustainable way.

These issues were outlined as early as 1972 in the report to the Club of Rome entitled *Limits to Growth*. The book dealt with the problem of the Earth's resources and the global system of nature in which we all live. In the summer of 1970, an international team of researchers at the Massachusetts Institute of Technology (MIT) began a study of the effects of continued global growth. They examined five basic factors that determine growth and ultimately limit it in their interplay: population growth, agricultural production, depletion of non-renewable resources, industrial production, and pollution. The team at MIT fed the data on these five factors into a computer model as a simple system of ordinary differential equations. They then tested the behaviour of the model under different assumptions to identify alternative patterns for the future of humanity. The book *Limits to Growth* reports the results and sends a strong message: "Humanity can create a society in which we can live indefinitely on Earth if we impose limits on ourselves and our production of material goods to achieve a state of global equilibrium with population and production in carefully selected balance" [Me72].

In addition to the challenge of decoupling economic growth from pollution, another major challenge arises from the internal organisation of the current economic system. Most economic activities are carried out by public enterprises, which are supposed to be controlled by the public and thus democratic. However, the public has little influence on the management of these enterprises.

Another important challenge also arises from our successes. Technological progress may lead to the worst-case scenario of intelligent machines competing with humans for power, similar to the Terminator movies.

After the enormous success of the internet boom, the companies that control the internet have become a kind of oligopoly that allows about half a dozen people to make important decisions about the future of the internet, which is closely linked to the future of humanity. This challenge by monopolistic/oligopolistic corporations is one of the greatest threats to a democratic future for humanity.

2.2.1 Threats of Monopolistic Corporations

Monopolistic corporations, usually controlled by extremely wealthy individuals, often resist the idea of separating economic growth from environmental damage, as this could jeopardise their monopolies and power.

Today we see extremely wealthy individuals shaping the future of humanity and nature [Ms21]. The most high-profile examples are tech billionaires like Jeff Bezos, Richard Branson, and Elon Musk (Fig. 2.9), who want to colonise space and the oceans or even build large infrastructures in private ownership.

Could this lead to even more significant degradation of the environment or be a safe haven for those who want to escape the apocalyptic changes?

Their vision of the future is commendable as it advances human progress and satisfies our research efforts. However, it competes with an alternative, common sense or more democratic approach, where the vision of the future is not the monopolistic vision of a single individual or a few ultra-rich individuals but is designed democratically, considering the contributions of all. To this end, the education of our future generations must be strengthened to enable young people to contribute significantly to a democratic and more public-spirited vision of the future.