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Perspectives on future trends and opportunities in a changing world – with a special focus on the Visegrad Countries

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Abstract

The paper addresses the prospects and directions for the Visegrad nations' economies that should be produced and highlighted, with the purpose of giving substantive conclusions that policymakers and decision makers can use to determine their economies' future paths. Although the Visegrad countries are highlighted, the paper is a theoretical research that focuses on the technique of futures studies, specifically on determining the driving causes and significant areas, sectors – that will shape and define the future. To begin, we will examine the methodologies of futures studies and the changes brought about by the multidisciplinary approach, before highlighting and defining the positive and negative drivers of development, which will enable us to pinpoint those critical areas and sectors. The paper identifies six of these directions that can characterize and drive humanity's growth in the coming decades and discusses how the Visegrad countries can profit from them.

Keywords: V4, futures studies, scenarios, trends, opportunities

Introduction

By 2022, technological progress had advanced further, with 5G technology being implemented internationally, the number of devices capable of using it expanding, and 6G testing now a hot issue for economists in China. By the decade's start, it was also evident that the world was becoming a more uncertain place. Established partnerships and cooperative relationships have been tested, new chances for international collaboration have emerged, and economic planning must take these realities, opportunities, and dangers into account. In these shifting conditions, on the verge of Industry 4.0 and with the advent of new technologies, opportunities are emerging alongside uncertainty and the Visegrad Four countries

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have the potential to become a driving force in a region that has long been a sphere of influence for various interests and powers; however, in addition to balancing foreign and economic policies, it is critical to rapidly identify and exploit new sectors and economic prospects. The Fourth Industrial Revolution's paradigm change creates prospects for the semi-periphery, and Industry 4.0's information network will reshape economic interactions, but their logic will remain governed by the tandem of subsistence and profit.

The significance of this study rests in its examination of the prospects that lie ahead for the region, as well as how to comprehend and foresee trends that can assist the Visegrad nations in becoming regionally and globally competitive. The goal is to provide these countries with direction by identifying certain sectors and industries, taking into account future trends, and delivering an added value to assist their economic development goals, directions, and focuses.

On the other hand, the future remains uncertain. How can the region prepare for the future, and for what kind of future? To make long-term projections, we should conduct futures studies to ascertain the development's driving forces. The paper also aims to define future trends and possibilities in a changing world; it is a theoretical study, concentrating on the methodology of futures studies, on defining driving factors and important areas, sectors – that will shape and formulate the future. The paper introduces these future trends in five chapters, including the conclusion on the region. The first chapter focuses on the paper's methodology while also introducing the current level of knowledge on future studies. The second chapter provides a brief study of the economic position and current structure of the Visegrad countries, which will be placed in a broader context when chapter three defines the geostrategic and geoeconomic environment of the region. The fourth chapter introduces the identified trends and prospects for the Visegrad Four nations to evolve.

1. Methodology

While the methods and styles of foresight have evolved over time, the most significant movement has been a shift away from forecasts and toward alternatives and scenarios. The change is consistent with the accelerating pace of the twenty-first century, with uncertainty and the futility of futurology's ceteris paribus assumption (no change in circumstances). Éva Hideg also acknowledged that futurology had reached a point of crisis in the 1980s and 1990s: „During the 1970s and 1980s, forecasts based on the positivist paradigm largely failed, as predicted, mostly consequential futures and their variants were supplanted by unexpected turns and new, unusual phenomena. Consider the oil crises and subsequent economic downturns, or the collapse of the socialist world order." (Hideg-Nováky, 2012, p. 10).

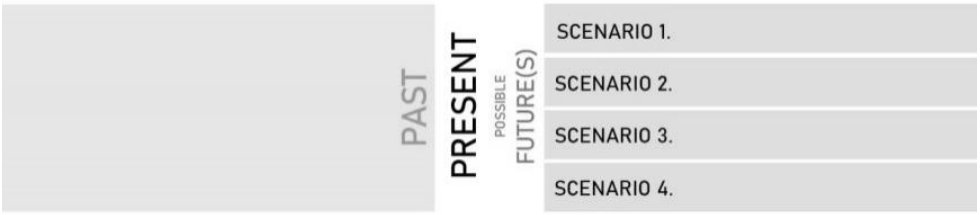
In this environment of increasing instability and uncertainty, it is almost certain that the continuation cannot be unchanged, and thus it is not sufficient to focus on the development of technologies along specific structures, but also on existing institutions,

organizations, and networks, not to mention global-regional social changes. All of this emphasizes the subjective nature of probability and judgment, yet scenario development and alternative development that account for these variables can assist us in preparing for and anticipating the future. By detailing multiple scenarios, it is possible to prevent one-sided partiality. According to Hideg, "futures research has responded to changing circumstances and societal demands by recognising that, while it cannot predict the future, it can aid individual and group future thinking by social actors/stakeholders by highlighting opportunities and threats through the study of futures as they shape the present and/or by contributing to the development of future orientation and future thinking by actors/stakeholders and social groups through its racial and ethnic diversity. Evolutionary and critical futures views on research have succeeded in developing a novel scientific technique and style of conducting science to address this new societal challenge." (Ibid.: p. 11–12).

Figure 1. The past-present-future exists simultaneously in the present

Source: Author's representation

Figure 2. The scenarios outline possible futures



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Futurology is a multidisciplinary science that is first connected to economics and then to engineering via technologies in the region. Methods of foresight are also critical since futurology in the twenty-first century "places the future in the present, emphasizing human foresight" (Ibid.: p. 12). However, this is also why it is necessary to begin with the humanity and because of the coexisting timelines, to begin with the past. The past-present-future triangle is always present concurrently; by

understanding them together, foresight can be facilitated, and by interpreting the past (without expecting it to repeat itself!), various futures can be sketched. The past becomes present in a form of narrative, or story. „A narrative is meant to be a public discourse or story to create an image...The image freezes historical explanation, rendering it a homogeneous picture of a continuous present" (Bretter, 2020, p. 79).

1.1. Perspectives on foresight

Foresight has long been criticized for lacking a conceptual framework within which it may be conceptualized. However, there already are frameworks and theories that seek to define methodology. One of these is the Six Pillars approach, which is linked with Jim Dator and his school and consists of the principles of Mapping, Anticipation, Timing, Deepening, Alternative Making, and Transformation. (Inayatullah, 2013). By the way, Jim Dator was a proponent of the idea that „futures studies is the study of various conceivable futures, but it is cross-disciplinary, cross-cultural applied research that investigates only new, emerging futures." (Hideg, 2012, p. 71) The core methodological challenge in futures research that focuses on emerging futures is thus the study of emergent issues, or what Hideg refers to as emergent issues analysis, an expression that may be enlarged and translated as emerging, emergent, emerging issues. In relation to Dator and his understanding of futures research, he „consistently contends that futures research is not a true discipline science, but rather an applied, interdisciplinary, and intercultural research" (Ibid.).

According to Inayatullah (2013), the following are the elements of the six pillars:

- Mapping: as mentioned previously, these timeframes are concurrently present - in the present. The pillar is also connected to the 'Shared History' workshop, in which participants create a historical timeline.
- Anticipation, Foreseeing and forecasting the future: recognizing emerging themes and key areas. Inquiring about matters that are not yet current. For instance, will robots have rights?
- Timing: identifying long-term patterns and trends, as well as examining cyclicality.
- Deepening: a four-step process for deepening the future. 1: the data, the current situation, the difficulty. 2: delving into the systemic sources of the problem; why is it even there? 3: worldview and culture, the big vision, the global framework. 4: myth, metaphor, story. At each of the four levels, solutions must be found.
- Alternative making: Creating scenarios as alternatives.
- Transformation: What kind of future do we envision? What kind of future do we desire?

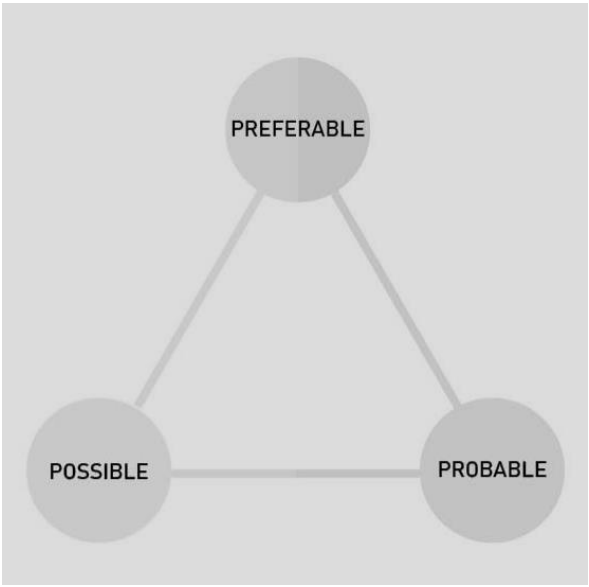
1.2. The probable, possible, and preferable futures

There is no singular future. There are expectations that may differ from the predicted future, there is the short term and the long term, but the widely recognized opinion is that there are three distinct futures, as developed by Roy Amara in his 3P model. The model considers Probable, Possible, and Preferable futures, with the following resolution:

- Probable: the probable outcome you anticipate based on your current knowledge.
- Possible: The notion of a possible future, the occurrence of hypothetical events/processes.
- Preferable: Working toward a desired future or futures (Amara, 1981).

In this view, the future can be characterized in terms of probable, possible, and preferable possibilities, depending on knowledge of the past and present, and various scenarios can be formed using this knowledge. The three futures are abstract projections that aid in future prediction, but they do not always correspond to the actual future, which may be a combination of possibilities or even the polar opposite of the favoured option in the event of failed policies and procedures.

Figure 3. The 3P model



Source: Author's representation

Thus, how can we do future research? By comprehending the past, interpreting the present, imagining prospective futures, and noticing and comprehending the indications that arise on the horizon – if only for a brief period.

1.3. The impetus for invention

Human development has occurred through a series of revolutions' over millennia, with Harari's cognitive revolution being followed by the agricultural revolution and then the scientific revolution (Harari, 2014), each of which contributed to the increase in the number of individuals, Homo Sapiens, and later population (Harari, 2014). In the context of the scientific revolution, it is worthwhile to refer to Wallerstein's World Systems Theory, which describes and interprets the capitalist economic system that began in Europe and spread globally by the early twentieth century, with profit as its central focus. According to his interpretation, profit drove creation, not the hunter-gatherer lifestyle of the start of humanity, not the system of distribution used throughout the days of empires. Wallerstein dated the birth of this capitalist world economy to the long sixteenth century, from 1450 to 1640. Over the previous 500 years or so, remarkable advancement has occurred. According to Harari, „Were, say, a Spanish peasant to have fallen asleep in AD 1000 and woken up 500 years later, to the din of Columbus' sailors boarding the Niña, Pinta and Santa Maria, the world would have seemed to him quite familiar. Despite many changes in technology, manners and political boundaries, this medieval Rip Van Winkle would have felt at home. But had one of Columbus' sailors fallen into a similar slumber and woken up to the ringtone of a twenty-first-century iPhone, he would have found himself in a world strange beyond comprehension." (Harari, 2014). In this universe, Wallerstein views „the never-ending accumulation of capital as the primary motivator for social activity" (Mészáros, 2012), emphasizing the state's and global market's roles. Is profit truly the driving force behind innovation, and is the system that creates and preserves global inequities the driving force behind economic development? Is innovation reducible to the market as a necessary condition of life, to the desire for profit, and to the regulatory and enforcement role of nation states? What role does information, and particularly freedom of knowledge, play in progress, and why is it necessary to have a military policy, which has been translated and modernized into the notion of security policy only since the mid-20th century? In all of this development, where are the individual, society, and humanity?

As Harari points out, the freedom of knowledge has facilitated the resolution of humanity's issues and dilemmas (Harari, 2014). The belief that all issues can be overcome and solved is today deemed nihilistic (again, progressively). The Soviet Union flirted with the idea of rerouting rivers, but after decades of failure, the initiative was abandoned. Since 2008, China's water-scarce capital region has begun obtaining water via manmade canals and tunnels from rivers further south. To paraphrase Nobel Laureate economist Robert Solow, „the world can, in effect, get

along without natural resources, so exhaustion is just an event, not a catastrophe" (Solow, 1974). Similarly, Harari draws connections between knowledge, industry, and military technology, emphasizing the interdependence of these three disciplines „intertwined only with the advent of the capitalist system and the Industrial Revolution. Once this relationship was established, however, it quickly transformed the world." (Harari, 2014).

The first industrial revolution fundamentally altered the world, and since then, there have been an increasing number of modernisations, an increasing number of industrial revolution stages. So what enabled all of this development, and how can we forecast future developments and technologies?

There is currently no consensus in research about what drives economic progress and innovation. There is no agreement on how and to what degree it is influenced by economic and social processes, and indeed, a variety of theories suggest that in some circumstances, several elements and occurrences generate or create an environment that activates and encourages its creation. This study does not intend to pick and choose amongst various theories and trends; rather, in our more interdependent, globalized, and accelerated world, the sum of all these ideas may be the key to comprehending the processes of innovation and forecasting future trends.

Among the various theories (Taalbi, 2017a), some emphasize the importance of *'positive' drivers* such as market needs and profits, revenue generated by innovation and its exploitation (Scotchmer, 1991; Moser, 2005; Moser, 2013; Lundvall, 1988), or the benefits of knowledge accumulation and new technological opportunities (Romer, 1990; Aghion-Howitt, 1992; Klevorick *et al*., 1995). On the other hand, there are perspectives that all discovery is driven by necessity; these are sometimes referred to as *'negative' drivers* (Taalbi, 2017b), but the majority of them also take an economic view, emphasizing, for example, the loss of profit as a cause of the drivers (Greve, 2003). While the economic approach is critical, as many theories continue to link the emergence of innovations to the economy's cyclicality and the process of crisis recovery (Archibugi-Filippetti, 2011, Berchicci *et al*., 2014), one cannot interpret development solely through these explanations; rather, while all processes have an economic component, none of them can ignore the human and social factor. And in this regard, necessity is already synonymous with subsistence; it is about the issues confronting society (our community), it is about the will to exist, the desire to survive.

All prior technological and economic advancements are dwarfed by the industrial revolutions and subsequent growth over the last two centuries – despite the fact that these earlier advancements were also critical for evolution and species preservation. However, we cannot dismiss them in order to maintain a forward-looking perspective. While the iPhone (and its competitors Samsung and Huawei) are perhaps the most sophisticated and advanced technologies in the world, can we disregard the ancient aqueducts that allowed humans to migrate away from rivers and coasts and enhance agriculture? Can we disregard concrete, roads, and even bulkhead partitions

in the ships? These are all inventions that have aided in the maintenance of human existence, the production of basic necessities, and the adaptation to changing conditions. However, it is also necessary to highlight the ancient Greek astrolabe, which was used in astronomy to identify the planets, because it demonstrates that growth was fuelled not only by necessity but also by a thirst for knowledge, a curiosity that has defined humanity for the previous 10,000 years.

Thus, returning to the primarily economic theories mentioned previously, and examining the causes of inventions, discoveries, and innovations, development can indeed be described by the positive and negative driving forces associated with economics, along with the human factor, the desire to understand the world around us and the need to survive.

Figure 4. Positive and negative drivers

Source: Author's representation

However, categorizing the drivers of innovation does not imply an understanding of its direction, and contemporary institutional-political structures are more complex and fragmented than humanity's desire for knowledge or survival, which can only be defined as a shared manifestation of the planet's population. For all of these reasons, it is critical to comprehend and incorporate as a variable for all of these reasons, it is critical to comprehend and incorporate as a variable the

- condition and state of global societies,
- and the structure and (anticipated) tendencies of the world order.

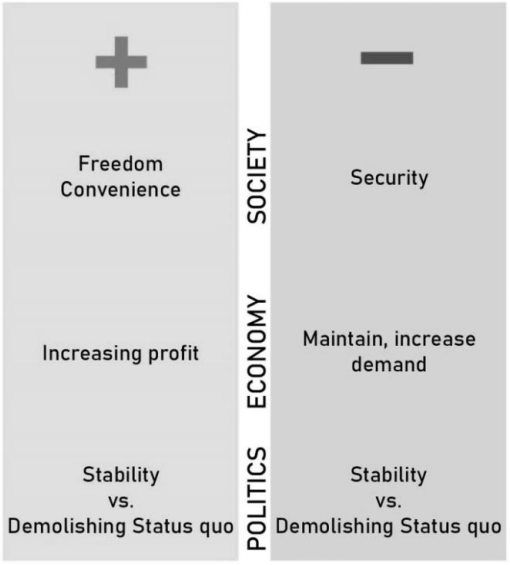
Convergence of knowledge, industry, and military technology has merged political, economic, and military aims, revealing the interests of the world's big powers behind global policy decisions. Thus, international procedures foster the development of technologies that address human desires for knowledge or survival. Today, we are witnessing the change of a US-dominated international order into a

multipolar system with numerous regional foci, where hegemonic control is progressively challenged in an expanding number of industries and areas. It also contains thoughts for the future, according to Wallerstein's philosophy and practice. Wallerstein, who died in 2019, envisioned a future in which the current system is replaced by one or more new world systems, one of which is more hierarchical, with higher advantages for particular sectors and even greater inequities. In any event, there is already speculation of another odd conflict occurring in 2022.

In light of this, the critical questions in terms of positive and negative drivers are what motivates

- societies, and in some ways humanity,
- economic actors, including not only profit-driven businesses but also states,
- and political interests, which include not only states and international organizations but also market players.

Figure 5. In light of positive and negative drivers, social, economic, and political demands



Source: Author's representation

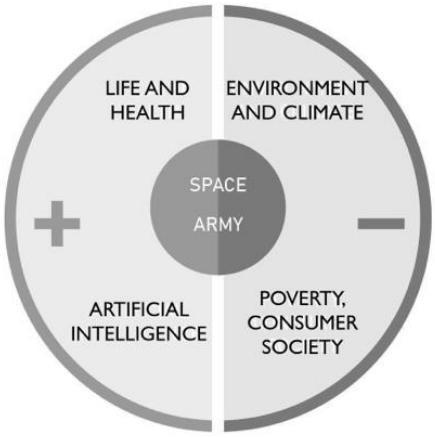
Societies face a dual dilemma of eternal freedom vs. security: we want to live in safety (societies also reject wars; it is no coincidence that professional armies are being formed in place of compulsory military service and that the proliferation of combat tools that do not endanger human life is spreading), but we also want freedom, which in today's societies is frequently interpreted as a convenience (fingerprinting, face payment, app tradability). While it may be important for

economic actors to maximize profits and halt or maintain demand declines, politics will always be interested in increasing its own power in an interest-driven manner; if we are talking about a core country or developed state, it will defend the status quo; if we are talking about a developing country, it will be interested in overthrowing or changing it to the extent that it can gain greater control.

In light of all of these social goals, expectations, political and economic mechanisms, it is easier to determine the direction in which the desire for knowledge, for a better understanding of the world, for further profit, and the processes that threaten our lives, our survival, and our profit should be directed, thereby enabling the future of humanity and the maintenance of demand with new ideas and concepts – in both cases, taking political determination into account.

If we consider the positive drivers, such as increased comfort and quality of life, as well as the introduction of new and more effective medicines („In fact, in many societies more people are in danger of dying from obesity than from starvation." - Harari, 2014), further extending life span may be a goal of society, which can be classified under the headings of health and life sciences and artificial intelligence (artificial applications that improve and further help people's lives). Negative drivers are dangers to our security, which include environmental issues, the threat of climate change, energy consumption and technologies, and the continued eradication of poverty – all of which can be replaced economically by the expansion of consumer society. Military (to maintain or increase our security and, in political terms, our power) and space exploration (extraterrestrial life, resource mining, and potential escape routes) can be identified as common drivers, responding to both the desire for knowledge (new and more destructive weapons; the search for signs of life) and the desire for survival (to guarantee security; habitable planets).

Figure 6. Definable objectives, focal points, and innovation drivers



Source: Author's representation

The purpose of this attempt at definition is to identify development trends and directions – all of which can assist in defining the region's economic and technological focus in the coming decades – and later in the paper, we will discuss the anticipated trends and their application to the regional context.

Taking into account and focusing on the positive and negative factors, we may identify the following directions that will undoubtedly be critical for the economy in the coming decades, allowing for a more confident forecast across multiple decades and a firmer grasp on the expected scenarios. The following directions are discernible:

- Health and life sciences,
- Artificial Intelligence,
- Climate change and the environment, energy,
- Poverty and the consumer society,
- Security, army,
- Space (exploration).

2. A quick analysis of the region's economic position and present structure

„If counted as a single country, V4 would be the 5th largest economy in Europe" (CET, 2021) – highlights the Central European Times, though it is important to mention, that in the past, deep regional cooperation was not welcomed by any of the V4 countries and still up to today, there are just signs of the willingness to elevate this cooperation to a higher level.

When it is about the economy, though the recovery from the pandemic within the V4 economies were among the success stories, the structural challenges, mainly the dependency on manufacturing and FDI remain a threat for the region for the future. The „largest companies in the V4 countries [..] are mostly foreign-owned and typically operate in the automotive, retail and electronics sectors." (CET, 2021) In a political-geostrategic way we can say that „from time to time, the region remains in the focus of attention of the great powers while between two so -called active periods, the entire region is neglected" (Schmidt, 2020, p. 2).

In the case of Hungary, industry contributes significantly to GDP in terms of composition, albeit at a lower rate than the EU average, but the automotive and pharmaceutical industries excel in this regard. While the importance of innovation in the pharmaceutical sector is undeniable, the increased reliance on the automobile sector poses a threat to the country's economy. And it's not just Hungary: „All four countries have large shares of FDI, due to their close proximity to Western Europe and favourable conditions offered by the authorities to multinational enterprises. In manufacturing, the share of FDI to GDP has remained around 30% in all four countries since the early 2000s. The automotive sector is almost fully foreign-owned, as the major car manufacturers have also brought with them foreign-owned

suppliers. With a couple of notable exceptions, most domestic suppliers are embedded only in lower levels of supply chains" (Szabo, 2020).

Only when we consider the current issues facing the automobile sector - the impact of the worldwide pandemic, the chip scarcity has resulted in significant factory closures around Europe, and domestic companies have not been spared - and the shortage is expected to endure until 2023. And these interruptions are unrelated to Industry 4.0 and possible reductions in labour requirements. Innovation and knowledge are trends that will be critical to success, and Industry 4.0's knock on the door will unavoidably expose gaps in knowledge and adaptability.

According to Szabo, „The V4 will be particularly impacted by the new industrial revolution. [..] [and] the share of jobs likely to be automated in the V4 is higher than the EU average. This is due to the significant share of the manufacturing sector in GDP and the high degree of predictable physical work involved therein. The number of deployed robots is already relatively high and new installations will continue. On the other hand, the V4 countries still lag behind in many other aspects of the transition and may struggle to remain globally competitive in the longer-term." (Szabo, 2020).

Looking ahead, one thing is certain: the digital readiness of businesses (including SMEs capable of connecting to global supply chains) and, more importantly, of workers, as well as the availability and integration of new technologies, will be critical factors in the Visegrad region's competitiveness in the coming decades.

In the information and communication technology (ICT) industry, the region lags behind the European average, notably in terms of R&D activities. According to the European Union 2020 DESI index[1], the Czech Republic is ranked 17th out of 28 members (at the time, the United Kingdom was included), Hungary is 21st, Slovakia is 22nd, and Poland is 23rd, with a significant gap in terms of population digital readiness and use of digital public services. The European Commission's index, the Digital Economy and Society Index (DESI) summarises indicators on Europe's digital performance and tracks the progress of EU countries.

However, not everyone is so sceptical. Sanandaji and Tikkanen noted that, prior to the pandemic, knowledge-intensive jobs had been steadily emerging in Europe; however, the pandemic situation slowed this growth, and the subsequent resurgence demonstrates that Central and Eastern European countries are capable of higher growth and the potential to reduce their backlog. They highlighted, that „despite the 2020 slum, the long-term trend is a rapid increase of the share of working age population of European nations that work in knowledge-intensive enterprises. The growth is particularly strong in the Eastern and Central European nations, and

[1] DESI (2020), Digital Economy and Society Index 2020, European Commission (retrieved from: https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-desi-2020).

some Southern European nations. The two regions with lower brain business jobs concentration are thus gradually catching up to northern and western Europe, which have a higher concentration of knowledge-intensive jobs, but a slower rate of increase. [..] The capital regions of Central and Eastern European nations have some of the highest levels of brain business jobs concentration. The Slovakian capital region of Bratislava emerges as the number one region in Europe in terms of the concentration of brain business jobs. [..] Fully 22 percent of the working age population of the region is employed in knowledge-intensive businesses, [..] and Bratislava is also the region with the second highest rate of increase in knowledge-intensive jobs" (Sanandaji-Tikkanen, 2021). Following Bratislava comes the Czech capital region of Prague, followed by Budapest.

In conclusion, regardless of the time horizon, the region's primary economic priority should be in technological and scientific growth, so further reducing its periodic lag behind European (and global) leaders and reiterating the region's significant position in regional comparisons. Given the region's role in the economic division of labour and its size (and location - thinking about the region's in-betweenness), there is no way around international economic specificities; however, it is critical to increase added value within global value chains; otherwise, the economies will be vulnerable to the aforementioned market exposure, and profits will be lost domestically. This will not only increase economic prospects, but will also lessen the region's susceptibility and exposure to international players; a more flexible labour market is better able to adjust quickly to new difficulties, assisting economic processes in their sustainability. Processes with a high level of added value are no longer threatened by relocation or outsourcing, and trends become more predictable.

All of this demonstrates the critical role of technological innovation and knowledge in developing an information and knowledge-based society that is focused on research and development and is capable of responding to the economy's ever-changing needs and competing with other societies in the region.

3. Defining the geostrategic and geoeconomic environment

What can we confirm about the twenty-first century? How are international relations changing, and how are these changes affecting Europe's and our region's role in this world order, as well as their interactions with other actors? To comprehend global processes, we must recognize that the world is steadily moving toward a multipolar order, in which there is no longer a single centre. We can identify several emerging states that are exerting an increasing amount of influence not only regionally but also globally, and are becoming increasingly ingrained in global processes. The economic crisis has resulted in a certain decline in the West, leaving the US, which has been somewhat more successful in managing the downturn, with a weakening Europe grappling with internal problems and a few non-confrontational (e.g. Canada, Australia), independent (e.g. Japan, South Korea), or acutely

challenged partner states (e.g. Israel, Mexico) in its alliance force field. While emerging powers, but also countries with a trusting relationship with the US, are attempting to adapt assertively to changing circumstances, the West is noticeably weakened and forced to reassess its role.

Within the context of unfolding international and global events, three very clear passages stand out: to begin, an arms race is unfolding. As stated in the most recent Stockholm International Peace Research Institute Yearbook, „virtually all the major global indicators for peace and security have moved in a negative direction: more military spending, increased arms trading, more violent conflicts and the continuing forward march of military technology." (SIPRI, 2017). Second, we can also observe an accelerated decline in the US's willingness to accept responsibility for international organizations, agencies, and events. Finally, the People's Republic of China's growing importance (and desire for power). After securing his position for the next decade, President Xi Jinping delivered a speech on the country's future in which he emphasized Beijing's' movement toward the centre of the world stage' and even stated that „China and the world are now on the verge of profound and complex changes" (Shi, 2017).

As Europe remains preoccupied with its own problems and struggles with internal conflicts and crises, China and other regional powers in the world are gaining prominence (Tarrósy-Vörös, 2014).

Thus, the new world is uncertain – ever-changing.

Perhaps this is the most accurate description of the challenges that international actors will face in the coming decades. Uncertainty, of course, implies that established truths are challenged, new partners and directions become critical, and the region's place in this environment must be defined.

Two states deserve special mention here: Russia and China, with which the European states, the European Union, have tense relations. Apart from the great power rivalry and human rights disputes, both countries are dependent on the other, the former for raw materials and the latter for trade (and investment). The critical nature of pragmatic relationships should be emphasized here.

In conclusion, CEE is a safe region in this changing and uncertain world, not only from conventional threats but also from natural disasters. This could be especially beneficial in the coming decades, as the countries in the region can serve as a backdrop and home for research and technologies that require existing and guaranteed security, both technologically and human resources-wise.

Internationally, in addition to the global situation and our region's security structure, it's worth noting that, as Sanandaji and Tikkanen noted, there is a growing appreciation for our region within Europe (Sanandaji-Tikkanen, 2021).

4. Trends and processes

Due to the defined directions, it is possible to project decades ahead with greater certainty and control over anticipated scenarios. With this in mind, consider the issues that can be highlighted for the Visegrad countries over the next few decades.

The new digital revolution, like previous industrial revolutions, is about efficiency and optimization. At the new level of production, networking entails that all elements of the production chain – sensors, artificial intelligence, machines, and even humans – are connected and exchange real-time data. As the European Parliament puts it, „Industry 4.0 describes the organisation of production processes based on technology and devices autonomously communicating with each other along the value chain: a model of the 'smart' factory of the future where computer-driven systems monitor physical processes, create a virtual copy of the physical world and make decentralised decisions based on self-organisation mechanisms." (Smit *et al.*, 2016).

To begin, it is necessary to recognize that, because the fourth industrial revolution will have far-reaching consequences, it will affect every sector – there will be no area, sector, or industry that will remain unaffected, including the services sector. However, the first signs of change will occur in the secondary sector, in assembly plants and manufacturing, and logistics chains will also be affected – but we cannot overlook the potential consequences of AI in the world of science and research.

Given current economic trends and developments, the threat is real – and the region cannot avoid it. For the foreseeable future, assembly plants will require human labour, but in the long run, and in the case of Hungary, Slovakia, and the Czech Republic, even the anticipated car manufacturers and the automotive industry will struggle to retain human resources as technology advances.

What will be the determining factor in the future? What about research and development? Complex jobs requiring creative thinking will be created, and those lacking the necessary skills and abilities for the twenty-first century will be unable to compete. This demonstrates the critical nature of education and research, as well as the dissemination of usable and adaptable knowledge. If we are unable to arm society with such knowledge, the social divide will widen even further, large segments of society will be unable to find work, and their importance in the labour market will dwindle and eventually vanish.

4.1. Health and life sciences

Medicine's evolution has been inextricably tied to technology advancements, which have not only improved technical medical equipment, but also significantly increased the capacity of hospitals to offer care. Robots, artificial intelligence,

biotechnology, and nanotechnology are all on the horizon for application in healthcare, allowing for increased surgical capacity, quicker treatment durations for some diseases, and more precise diagnosis. Genetic alteration and stem cell transplantation may enable the cure of cancer-causing disorders.

The region possesses enormous potential for such developments, with medical universities, existing and accumulated knowledge, a pool of experts established during the coronavirus epidemic, and pharmaceutical companies providing the necessary foundation, background, and environment for further development.

4.2. Artificial intelligence

Artificial intelligence (AI) is a collection of algorithmic systems that are capable of self-learning and self-improvement in response to input data. Although we can only speculate on thinking robots at the moment, learning algorithms are already formidable, capable of anticipating events, improving problem solving, and profiling society (for the time being) for the purpose of targeting advertisements.

Today, dozens of self-improvement algorithms filter, advertise, profile, and even improve on their own. Who decides what information on YouTube or Facebook is rude or inappropriate? We no longer anticipate thousands of censors to constantly monitor our activities; instead, the work has been delegated to learning algorithms.

What is the current state of affairs in the region, and may this technology be a game changer? While we can absolutely speak of an opportunity in that technology, it is still in its infancy and connectivity is still relatively easy at this stage, there is already a divide between the region and Western Europe, and an even larger divide between the region and the two superpowers, the US and China. While the area is rapidly developing, underinvestment, brain drain, and the region's reliance on the dominant players make it difficult for the region to thrive in this regard (Hardy, 2021).

4.3. Climate change and the environment, energy

Because transportation is a significant source of pollution, one of the most critical goals today is to make all of these trends more environmentally friendly. Electric vehicles are one of the solutions we are looking for today, but the question is whether it is sufficient to replace our vehicles with electric ones to protect the environment, given the disadvantages such as harmful substances produced, battery life, and electricity used for charging. The growth of electric transportation necessitates attention to electricity generation, which means that in the long run, we must invest not only in renewables, but also in nuclear energy, which could provide the region with a competitive advantage (Poland does not have a nuclear power plant, there pollution from coal-fired power plants could cause problems).

What can and should be important for the region in terms of environmental pollution is the development of public transportation and the development of rail

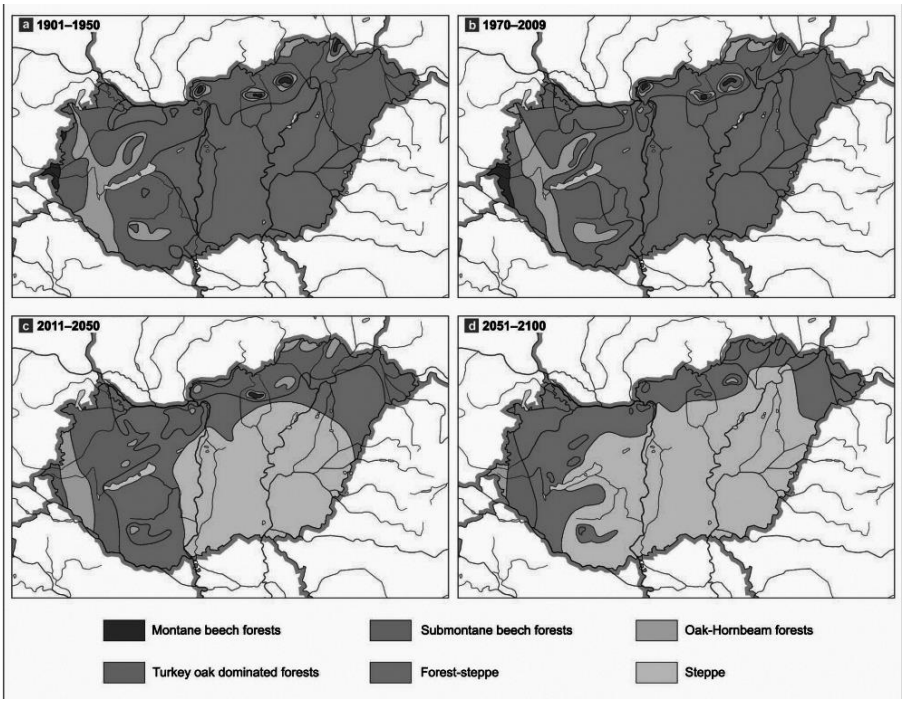
transport, both of which have shortcomings, primarily due to financial constraints, although the level of development of rail transport varies considerably across the region's states.

Climate change poses a challenge to agriculture and food production, which is particularly acute and interesting in the context of a changing climate and the potential loss of indigenous and cultivated crops. One possible direction is the use of so-called genetically modified products, which is still a controversial technology that is prohibited in Europe and raises numerous questions – but it may be worthwhile to consider in the future.

What exactly are genetically engineered fruits and vegetables? GMO stands for Genetically Modified Organism. It is the process of artificially introducing DNA into a food, typically seeds or vegetables, that they did not previously contain, in order to increase their resistance to insects and pests or create new flavors. Thus, the primary goal is to develop resistance to a specific disease or to develop a new flavor.

Hungary's example demonstrates the critical nature of this consideration, especially in light of global and local climate change, desertification, water scarcity, and food security.

Figure 7. Projected changes in vegetation climate zones by the end of the century



Source: Kocsis, 2018, p. 103

The map demonstrates that in the case of Hungary, desertification is a possibility for the future (Kocsis, 2018, p. 103). In the case of Hungary, this means that it will be necessary to grow vegetables and fruit that can survive in a warmer climate and also resist infection and pests from new, warmer southern climes in the future.

4.4. Poverty and the consumer society

One of the world's current global challenges is feeding the planet's population; the human body requires nutrient-dense food in order to survive. Today's scientists are attempting to find ways to feed an expanding population, but their efforts are hampered by global climate change, which is becoming increasingly unpredictable, and the global pandemic situation, which has stymied numerous food initiatives.

What might be significant for the region in this regard? The transfer of knowledge and export of technologies that can aid in the eradication of poverty and the creation of safe drinking water, while also preparing for the adverse effects and consequences of climate change.

We cannot ignore the critical need to safeguard our waters. Water covers 70% of the earth's surface, but much of this water is unfit for human consumption. Additionally, our freshwater resources are limited. Water scarcity is one of the most serious global problems of the twenty-first century. Water demand increased sixfold during the twentieth century, while population increased fourfold. Water demand increased not only as a result of population growth, but also as a result of massive industrialisation following World War II. Water scarcity can be addressed in a variety of ways. The first priority should be to safeguard water. Each day, thousands of tonnes of waste are dumped into the seas and drinking water. When it comes to water resources, it's critical to recognize regional companies and businesses that have installed and are installing water purification plants in a variety of countries with a global reach. Technological knowledge can also be used as a foreign policy tool, so it is well worth continuing to prioritize this area, because on the one hand, we have the technology, and on the other hand, demand for the methods will grow exponentially globally as population growth and industrial and agricultural demands increase.

There are also a number of potential solutions to the food supply problem, one of which, as mentioned previously, could include the controlled use of genetic modification.

4.5. Security, army

The military can be viewed as a crossroads of positive and negative forces, as ensuring or increasing our security and, politically, our strength will continue to define humanity, our future, and our international relations.

When discussing the coming decades and prospects for the Visegrad countries, it is impossible to ignore the military and military-related investments, but the topic's importance can be understood on two mutually reinforcing levels:

- Do countries have the capability to defend their sovereignty, their citizens' lives and interests?
- Does the region have a defense industry that, in addition to meeting the needs of armies, has stable revenues and the capability for long-term research and development?

The topic's diversity is reflected in the fact that the first question can be answered in a number of different ways. While the region's accession to NATO has essentially guaranteed its security, the region, with the exception of Poland, has long struggled to meet NATO's military expenditure requirement of 2% of GDP. Hungary, the Czech Republic, and Slovakia could be described as stowaways in this regard, and comprehensive reforms in the field of force development have only been initiated in recent years.

A critical point to emphasize is that, in addition to a modern army, in a changing world, the federal structure's obligations must be met, which may encounter resistance from society.

The region is not a major arms exporter, but the Czech Republic, inheriting socialism's arms industry, stands out among the region's states – Hungary has been attempting to build a similar industry through German cooperation and Czech licenses in recent years.

Another aspect of security and the military has grown in importance as a result of the new era's challenges: cyberspace. In this new world, we must be prepared for attacks other than traditional ones, and cyber warfare is likely to be one of the most significant security challenges in the future. Today, when information, data, is essentially worth its weight in gold, we can anticipate that this will continue to be the case in the future (Kovács, 2018, p. 21). As technology advances, warfare advances at a breakneck pace. Diverse actors are employing an increasing number of modern tools, forward-thinking technological achievements, and inventions in their conflict. States vs. states, and citizens vs. citizens. The trends in cyberspace demonstrate a truly revolutionary shift in military technologies. By the twenty-first century, various civilian technological advancements had infiltrated the military industry. At the same time, it's worth noting that cyberspace lacks nation-state borders and that attackers' identities are frequently unknown (Kovács, 2018, p. 24).

Although military developments began in the region or it has always been critical to maintain an effective military force (Poland), the region's use of alliance structures and the European Union's organization will remain critical.

4.6. Space (exploration)

As with the military, space and space exploration can be defined as a collection of positive and negative driving forces. On the one hand, the desire for knowledge, the search for alternate forms of life, the mining of possible raw materials on asteroids and planets, the colonisation of the Moon and Mars, and on the other hand, the presentation of alternate scenarios in the event that the Earth becomes uninhabitable. Perhaps the most certain predicted directions for the next several decades. While the headlines focus on space tourism, beneath the surface, a Cold War-style race to develop new methods and technologies is underway. Not only are the opportunities enormous, but the market is sizable, and scientific involvement is, fortunately, not entirely new. According to the Harvard Business Review, 95 percent of the space sector's estimated $366 billion in revenue in 2019 came from the so-called 'Space to Earth' economy, which refers to goods and services produced in space for use on Earth. The space-to-earth economy encompasses telecommunications and internet infrastructure, as well as capabilities for earth observation and national security satellites. It is a thriving economy, with not-yet-advanced 'space to space' technologies, but perhaps space tourism, which allows crowds to be in space concurrently, to get astronauts up there faster and safer, and to experiment with additional tools and technologies. Naturally, the enormous revenues will explode, and the regional space industry and economy can participate in this upward cycle. However, it is clear that there is not yet complete coherence in this area, with all states engaged in space exploration, agreement-making, and technological advancements. Hungary developed a space strategy in 2021 and plans to launch a Hungarian astronaut into space, Poland collaborates with NASA on space projects, Slovakia has a strong space industry, and the Czech Republic also developed a space strategy in 2020 to support research and strengthen collaboration with the European Space Agency.

Hungary has also increased its contribution to the European Space Agency (ESA) to €16.8 million in 2021, while Poland and the Czech Republic have increased their contributions to €39 million and €43 million, respectively.

Table 1. 2021 Budget of ESA

Country	Contribution (M euros)	Percentage of full budget
Switzerland	172.6	3.8
Sweden	80.0	1.8
Spain	223.6	4.9
Romania	43.0	0.9
Portugal	28.0	0.6
Poland	39.0	0.9
Norway	83.2	1.8
Netherlands	87.9	1.9

Luxemburg	46.9	1.0
Italy	589.9	13.0
Ireland	18.8	0.4
Hungary	16.8	0.4
Greece	19.9	0.4
France	1065.8	23.4
United Kingdom	418.8	9.2
Canada	24.9	0.5
Slovenia	3.1	0.1
Austria	54.8	1.2
Belgium	255.8	5.6
Czech Republic	43.0	0.9
Denmark	33.3	0.7
Estonia	2.7	0.1
Finland	27.5	0.6
Germany	968.8	21.3
Latvia	0.3	0.0
Other	197.6	4.3

Source: ESA Budget, 2021[2]

While the issue of education and the unique role of educational institutions and research centres, as well as the issue of specialist supply, can be highlighted in the context of space research and the space program, the increase in the number of companies and their growth can only be achieved with the availability of qualified labour, and the sector has highly knowledge-intensive specifications,

Overall, it is worth noting that the Visegrad countries have not only recognized the sector's potential, but have also taken steps to successfully integrate it into the global bloodstream, primarily by embracing initiatives and companies that have been running successful projects for years, whether supported by ESA or NASA.

However, the sector faces challenges: skill shortages, capital-intensive programs, the occasional lack of an interdisciplinary vision, and the dependence generated by the sector's relative and absolute distance from major infrastructures (launch sites, spacecraft) can all have a negative impact on the region's space industry.

Conclusions

To begin the summary, it's worth noting that the paper's objective is to forecast economic trends that, when combined with global trends, will enable the region to successfully confront new challenges and directions. As a result, the study

[2] Retrieved from: https://www.esa.int/Newsroom/ESA_budget_2021).

is not organized around pre-existing strategies and materials, but rather around principles that can guide us in defining directions - and then strategies. We have not been guided by personal interests or preconceived notions, but by historical processes, attempting to comprehend what is possible by building on humanity's history. This was necessary to meet the requirements of futurology, which are not to make predictions but to sketch alternative and scenario-based futures along the preferred, possible, and probable trajectories.

Thus, futurology in the twenty-first century is concerned with the present-day future, with human foresight. In our increasingly interdependent, globalized, and accelerated world, a set of theories can provide insight into the processes underlying innovation, allowing for the prediction of future trends. Different theories approach 'positive' and 'negative' drivers differently, and while they are all economic in nature, they are all connected to human and social factors.

As a result of considering and focusing on both positive and negative drivers, we identified six directions that are certain to be significant for the economy in the coming decades, allowing us to look ahead several decades with greater certainty and a firm grasp on the likely outcomes.

It's worth noting that innovation and knowledge will play a significant role in economic trends, and that Industry 4.0 will ruthlessly expose gaps in knowledge and adaptability. COVID-19 and the pandemic situation have demonstrated that we continue to face gaps in digitalisation and digital knowledge, which are intrinsically linked to Industry 4.0, jeopardizing innovation and jeopardizing the region's future economic performance.

Finally, it is worth noting that the study can serve as a springboard, a methodological foundation, and a guide for adapting scenarios and alternatives within various thematic areas and disciplines – while taking into account the requirement for multidisciplinarity, the changing and uncertain global environment, regional trends and specificities, and opportunities.

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