

**GYÖRGY MATOLCSY**

**THE GREEN  
BOOKLET  
OF SUSTAINABILITY**



**A holistic guide to achieve a sustainable  
path for society & economics**

# THE GREEN BOOKLET OF SUSTAINABILITY

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by György Matolcsy

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A HOLISTIC GUIDE  
TO ACHIEVE  
A SUSTAINABLE PATH  
FOR SOCIETY & ECONOMICS

**Budapest Centre for Long-term Sustainability,  
2024**

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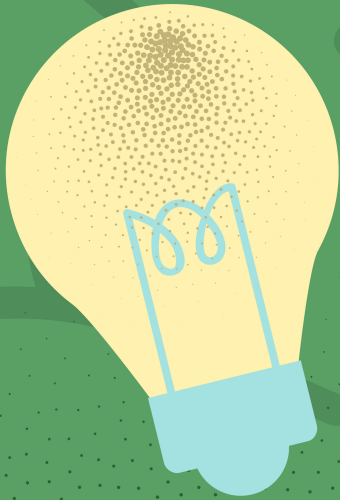
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# I NEW SUSTAINABLE ECONOMICS



“All the flowers of the future are in the seeds of today” says the famous Chinese proverb and it could not be more accurate. Investing in the future has never been more important than now. The knowledge and data we are gathering is expanding exponentially – if we want to keep up with its pace and use it wisely, we must invest in the future by investing in talent, knowledge, and technology. We have already realized what our creativity is capable of: humanity is experiencing rapid progress and innovations every day – we are finding new methods of production, harnessing artificial intelligence, inventing new treatments and medications, developing modern electronic devices, and the list could go on endlessly, reaching as far as the universe which we keep exploring. But amidst these many efforts, we must prioritize making life on our Earth sustainable, if we want our civilization to keep flourishing.

Gazing down from the stars, the 21<sup>st</sup> century features some unfavourable megatrends: worsening demographic trends, declining productivity, problems stemming from high levels of debt, and the challenge of balancing economic growth and environmental sustainability. If we want to change course, we must find the necessary breakout points. This period of change is also a time for preparation and strategy planning for economic actors, society, and political decision-makers.

In the first three years of the 2020s, the world faced a series of crises: the social and economic shocks caused

by the coronavirus pandemic; the Russian-Ukrainian war and its spillover effects; the Red Sea Crisis and the Israeli conflict which threaten to destabilize the Middle East; and rising inflation driven by booming raw material and energy prices. The era of the “Great Moderation”, which was characterized by macroeconomic stability, and moderate economic growth and inflation, is being replaced by the “Great Tension”, a period of hectic change and instability. Above and beyond all of this, we are also facing the local and global challenges of climate change, for which humanity must find solutions (Matolcsy, 2022a).

The ultimate solution is to find a new sustainability mindset when tackling these challenges. If nations want to win the century, decision-makers must simultaneously aim for sustainability in the economy, in society, in the financial sphere, and in the environment, and they may not neglect any one of these aspects at the expense of another. Our short-term views focused solely on economic growth must be put in the backseat and a holistic approach should take the lead, to achieve integrated sustainability in all four of these areas. This forms the basis for an intellectual turnaround which puts sustainability first. As Albert Einstein aptly pointed out: “No problem can be solved from the same level of consciousness that created it”. This booklet intends to serve as a guide for this Intellectual Revolution, directing us towards the era of new sustainable economics. The following section discusses the fundamental theses of new sustainable economics, from the global discussion paper of the MNB, as a post-release chapter (Matolcsy, 2022b, p. 10-19).

# Theses of new sustainable economics

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Why do we not recognize that a sound economic theory is needed for Hungary to achieve sustainable economic convergence, given that the earlier foundations have changed? The classical, neoclassical, liberal, social market and other economic theories of the past are no longer valid. They are being replaced with a new, emerging theory. This is the theory of long-term sustainable economics. As we move forward, we learn new laws. Who else but us, unorthodox economists, would be thinking about this, and when, if not now, in the midst of a convergence process that promises success?

In the form of a logical outline, this essay examines 36 new contexts upon which a new sustainable economy can be built. Let us begin by looking at the leading theorems of today's intellectual revival, comparable to the intellectual revolutions of the Renaissance and Reformation some 500 years ago.

## **1.1 Material wealth is based on an intellectual resource: knowledge.**

When transmitted, knowledge becomes information, and, when shaped to be uniform, it becomes data. Data is the new oil, talent is the new capital, and creativity is the new soil.

## **1.2 Knowledge expands exponentially when it is transferred.**

Material goods are consumed as they are used, and money and capital may increase or decrease linearly as they are used. Knowledge is the first economic resource that expands exponentially as it is shared, i.e. consumed.

## **1.3 Talent and creativity are becoming crucial resources.**

Knowledge grows through learning, work and diligence, and it is radically accelerated by talent and creativity. The latter are now limited resources and therefore become a bottleneck.

## **1.4 The exponential growth of knowledge creates a general abundance.**

The scarcity of material goods is being replaced by abundance, because the expansion of knowledge is constantly creating new technological revolutions that generate abundance.

## **1.5 The breakthrough came with the new technology of knowledge sharing.**

The internet entered our daily lives at the end of the last millennium, followed by other tools of the communications revolution, which together are triggering new technological revolutions.

## **1.6 The knowledge revolution will eventually come up against material limits.**

The exponential growth of knowledge creates a general abundance, which at some point clashes with natural and social constraints. Humanity has reached this point.

## **1.7 Civilization needs a sustainability turnaround in order to survive.**

Knowledge is expanding exponentially at all times and in all directions, which is why it encounters natural and community boundaries. For the human community to survive, new technologies must be channelled into sustainable directions. This is the essence of the 21<sup>st</sup> century.

## **1.8 The sustainability turnaround starts with a revolution in thinking**

As the economy is the crucial arena for new technological revolutions, it is here that knowledge first encounters material constraints. This is why we have reached a turning point in economic thought.

## **1.9 The revolution in thought is based on two principles: sustainability and the principle of life.**

The principle of sustainability is the principle of equilibrium growth, and its formula is E+G (equilibrium and growth). The principle of life accepts that all economic and social organizations are living, and therefore operate according to the principle of “greatest impact”, as opposed to the principle of “least impact” in the inanimate world.

## **1.10 The new economy is built on the primacy of the public interest.**

Each economic and social community takes its own path, but they must follow the laws of sustainable economics. The focus is no longer on capital and profit, but on the public interest, that is sustainability and the respect of life.

### **1.11 Access comes before ownership.**

Today, talent and creativity are the bottlenecks, which means that access to life's basic goods is becoming more important than property for every individual, family and community. The basic goods are the common knowledge of humanity and the means to expand that knowledge (work, home, quality education and healthcare). With access to these, talent and creativity can flourish.

### **1.12 The principle of increasing returns replaces the principle of diminishing returns.**

Exponentially expanding knowledge and technological revolutions are replacing the principle of diminishing returns. Knowledge, an unconstrained resource, is now the premier resource, while today's constrained resources – talent and creativity – are the bottlenecks; thus, increasing returns appear everywhere in human activities.

### **1.13 The conceptual revolution of sustainability builds on the principle of increasing returns.**

This occurs in two ways. On the one hand, it drives research and investment towards sustainable technological breakthroughs in the public interest. On the other hand, it expects that increasing returns generate higher risks, especially in the area of nature/human and individual/community relations. Both methods reinforce the idea of sustainability and then the turnaround.

### **1.14 Together, sustainability and the principle of life cause a non-linear revolution in thought.**

The exponential increase in knowledge triggers non-linear processes that we are already seeing in the field of environmental damage and social problems. With asymmetrical trajectories and multiple butterfly



effects, more and more cause-and-effect relationships that cannot be precisely identified occur; therefore, the renewal of thought is not linear but exponential, and new creative trajectories are created.

### **1.15 The revolution in thought is a “mission”.**

The exponentially spreading changes do not allow for the neutral technical approaches of the past, as uncertainty and unpredictability in all areas of human activity are increasing. The thought revolution of our time (like the Renaissance and the Reformation earlier on) is like a “mission”, bringing emotions and feelings into the transformations of thought and then into reality, thus intensifying and accelerating the paradigmatic shifts in thinking.

### **1.16 The knowledge revolution creates a parallel reality.**

The knowledge revolution is building a virtual world and a virtual business life alongside the existing world and today’s functioning economy. The traditional world of producing goods is joined by a world of communication, which has different rules of motion compared to the real world. Sustainable economics will also be dual, like the physics of large bodies and elementary particles in the world of physics.

### **1.17 The sustainability turnaround creates a new spatial structure.**

The sustainability revolution in our thinking breaks with the previous concept of time, as the temporal diffusion of ever-increasing masses of knowledge is accelerating and the growing energy of human knowledge bends the spatial structure of the modern economy. The value of shared spaces – such as homes, public spaces, spaces for community events, towns and city centres – is increasing. Alongside these, individual and family “recreational” spaces

are also becoming more and more valuable: gardens, parks, forests, waters and mountains. The spatial structure is changing and becoming twofold, in order to share and expand knowledge.

### **1.18 Convergence driven by new visions must be organized around the idea of sustainability.**

Successful examples from the past should be applied to the future. However, the successes of the past are not an accurate guide, because history, along with the laws of economics, have changed in terms of crucial aspects. It is worth following those who are already bringing their operations forward from the future and are building on the conceptual revolution of our time, including the laws of sustainable economics.

We need to realize that the key challenge of the new knowledge-based era is long-term sustainability, and the first steps in this direction are a revolution in thought and the resulting new sustainable economy.

# The logical outline continues with the 18 relations of the new economy.

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## **1.19 Different areas of knowledge merge in the theory of sustainable economics.**

The technological revolution of knowledge, information and data merges traditional economics with the world of other social sciences and then natural sciences, in particular quantum physics and biology.

## **1.20 As separate areas of the economy come full circle, the circular economy requires a new theory.**

Consumption data become the raw material for production. The areas of consumption and investment merge, because the “consumption” of knowledge becomes an investment. The boundaries between industry and services are disappearing. In all production areas, circular chains are created for sustainability. This can only be described by a new theory.

## **1.21 The traditional relationships in economics are “getting flat”, fading or disappearing.**

The new theory of the circular economy – complemented by other social and natural sciences – breaks down the old causal and linear relationships and replaces them with probabilities, uncertainty relations, and trajectories with unusual geometries.

### **1.22 The set of factors in the new economy will be more diverse and larger in scale.**

Long-term sustainability requires the analysis of essentially all social and economic data, so the number and types of factors addressed by economics shows a leap in scale.

### **1.23 The mathematics of pure numbers and the relationships of life sciences are both strengthened and united.**

Mathematical economics returns to Pythagoras (pure mathematics) and is complemented by the Bauer principle (life principle). The theory of sustainability focuses on the formulas of the golden ratio, the golden spiral, and sustainable growth.

### **1.24 The new economics redefines the global, regional and local economies.**

The composition of global trade today is shifting away from material goods towards intellectual goods, while regional trade is expanding as a result of the circular economy. It is the local economy (family knowledge production, local businesses, national companies) that stands to gain most from the knowledge revolution, because knowledge is increasingly produced and consumed locally.

### **1.25 The new economics is deepening towards the past and accelerating into the future.**

The fusion of economics with social and natural sciences brings about a two-pronged change in economic thinking. It reveals and transforms into data and incorporates all of the knowledge of all previous civilizations that describes

the functioning of society and the economy of the time. It looks for the interconnections of today's economy. In the meantime, it uses the laws of natural sciences to decipher the economic relationships of the future.

### **1.26 The new economics measures everything and transforms it into data.**

As the new economic thinking is characterized by new contexts and new trajectories, it is necessary to be ready for change and self-correction at any moment. This requires all economic events to be measured and then converted into data, along with a constant review of previously recorded items. There is no longer an orthodox economics set in stone, only an ever-changing and therefore always unorthodox economics.

### **1.27 The new economics is also a networked and platform economics, like the economy and society.**

The new economics is not based on eternal laws (such as the invisible hand, self-regulating markets, inflation, and wage increases), but on rapidly changing knowledge networks and platforms. These are constantly producing new data, locally valid relationships, conjectures, and contradictory theories.

### **1.28 Business merges with economics education.**

In the digital transition, everything becomes data, accumulating in large databases and providing the basis for business decisions and economics education. All higher education – especially in economics – becomes dual, because the educational material and the business data form a unique, circular web.

### **1.29 Economic theory is also becoming culture-based.**

As the exponentially expanding knowledge-based economy becomes culture-based, economics merges with culture. An economics organized around sustainability incorporates everything that is the cultural source of the economy and growth (patterns of thought, values, behaviour, community intellectual capital).

### **1.30 The new economics creates a new theory of prices.**

In the new era of information, the real value and price of the economy's basic resources is heading towards zero. This will apply first to information, and then to money, energy, and other material resources. This is due to the other technological breakthroughs made possible by the communications revolution (Industry 4.0, Society 5.0, the new agricultural revolution).

### **1.31 The new economics redefines complexity and simplicity.**

The knowledge revolution increases the value of everything that incorporates more and more diverse knowledge into the production of goods. This valorizes the density of connections (complexity) in the areas of circular production/consumption. At the same time, simplicity is becoming more valuable, as intermediaries are eliminated in more and more areas of life (online commerce, financial investments, online banking, learning).

### **1.32 Interoperability will be a fundamental law of the new economics.**

As a result of the demand for and speed of knowledge diffusion, vertical organizations are transformed into networks, intermediaries are eliminated, and interpenetration between previously separate domains

becomes pervasive. The new integrations between the financial system and the technology sector, the IT sector and the automotive industry, and higher education are already examples that the interoperability between capital and knowledge will be complete in the future economy.

### **1.33 The new economics needs new metrics.**

As economic relationships are changing faster and faster, more and more varying factors must be measured. More and more areas and more and more changes have to be measured, because the links between them are also becoming faster. This will require new metrics in addition to and instead of those used today. The new compass is long-term sustainability, where both parts of equilibrium growth – equilibrium and growth – need to be measured more widely, more quickly, and more reliably than today.

### **1.34 The sustainability compass increases the time horizon of economics.**

The time span of measurements is shortening, because it is necessary to increase the volume, types, speed and manner of measurement. At the same time, the time horizon of the economic context is growing longer, as the long-term behaviour of more and more diverse factors has to be taken into account in the evolution of the trajectories and patterns that influence the future.

### **1.35 The role of the state is changing in the new economics.**

Since its inception, the state has always been involved in the management of the economy, to varying degrees in different eras. Only states – individually and collectively – have the capacity to accelerate the transition to long-term sustainability. They can achieve this by working in two mutually reinforcing ways: by accelerating the knowledge

revolution and by steering the economy in a sustainable direction. The digital switchover and the green transition, education and health, families and communities, and the preservation and strengthening of public and cultural assets will be at the heart of public action.

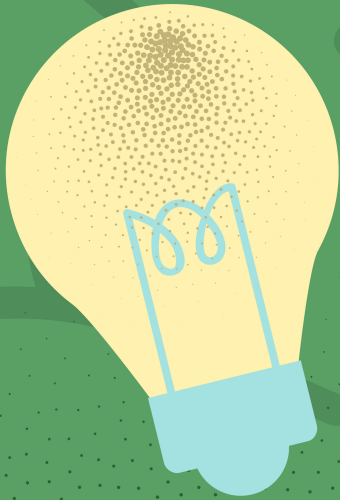
### **1.36 Sustainable economics is the science of human relations.**

So far, economics has been predominantly about the connections between humans and the world beyond humans. It analysed the links between the land and man, the means of production and man, and money/capital and man. The revolution of knowledge is connecting human communities, where it is no longer the connection between the living and inanimate worlds that is decisive, but rather human-to-human connections. Sustainability is about human civilization, and thus human relationships are at the heart of sustainable economics.

(Matolcsy, 2022b, p. 10-19)







## II THE NEED FOR SUSTAINABILITY, ITS LIMITS, AND THE GLOBAL MEGATRENDS



We are at the end of an era, and at the same time we are facing a new era. In the past, the increase of welfare was based on economic growth. In the long term, however, attaining and maintaining well-being can only be ensured if not only economic growth is considered, but social, financial, and environmental aspects are also taken into account in an integrated manner (MNB, 2021). This is the fundamental principle of sustainability. The sustainability revolution stems from a revolution in thinking. With economic and social development in mind, only what is sustainable in the long term can be competitive, and vice versa. All four considerations (economy, society, finance, and the environment) are necessary together for sustainable economic convergence. To showcase this, the next subsection reviews the current processes that define the dynamics of the 2020s. Afterwards, we discuss much longer and larger processes: the megatrends that determine the course of the entire 21<sup>st</sup> century.

# 1 Economic and geopolitical patterns in the 2020s

Looking at the economic and geopolitical trends that are shaping the 2020s, more and more people are seeing similarities to the 1940s and the 1970s. In our time, geopolitics seems to be reshaping the international power-political playing field, just as it did in the 1940s. The crisis phenomena in the first part of the 2020s and the stronger inflationary pressure have parallels both in the oil crises in the 1970s and to the war-induced period of high inflation in the 1940s (Matolcsy, 2022b).

At present, the main challenge for economic policies is to fight inflation, while simultaneously boosting economic growth. To keep inflation under control, central banks have raised key rates and tightened monetary conditions, leading to higher interest rates on the financial markets. Although inflationary pressure has been declining recently, lessons from the 1970s still serve as a deterrent. If economic policy is not committed enough, inflationary pressure could easily return and become lasting, which would undermine a recovery period in the economy. Budget deficits and public debts may remain permanently high, and the major central banks may adopt a tighter monetary policy. At the same time, the uncertainty caused by geopolitical tensions is also hampering the investment environment and the opportunities for economic recovery. All in all, growth in the world economy is expected to be slower compared to the previous decade, the 2010s, because of unfavourable changes in global framework conditions for business (Matolcsy, 2022a).

Geopolitical tensions and systematic monetary changes resemble the patterns seen in the 1940s. At that time, war was still present with looming geopolitical tensions between the parties. Amidst these conflicts and uncertainty, the monetary system changed: the Bretton Woods Agreement established the gold-based dollar monetary system in 1944. Shortly thereafter, the world split in two in a financial sense as well, as the gold-based dollar system became the monetary system of the West. Today, the former “G2”, a partnership between the United States and China, may be replaced by “G-2”, which describes a world order filled with oppositions. In conjunction with this, the global financial system is moving towards a dual system of order, centred on the US dollar on the one hand and the renminbi on the other (Das et al., 2023; EIU, 2015; Locket & Leng, 2023). It is already worth preparing for this prospective future, as the key determinant of the geopolitical space in the 21<sup>st</sup> century will be the escalating US-China rivalry in all dimensions. It is important to emphasize that a “G2” balance in geopolitics would be favourable, rather than an opposition with a “G-2” scenario. A divided world is less able to ensure sustainable economic convergence for the rest of the world (Matolcsy, 2022a, p. 16.). Within the realm of geopolitics, in the 2020s it is becoming more and more obvious that the European Union, which represents the continental region of the developed world, has fallen behind in the new world order that is polarized around the USA and China. This lag could reinforce political risks, leading to a potential weakening of the EU’s institutions in the future (Matolcsy, 2023). Will the EU manage to revitalize itself in this century? It certainly depends on the European decision-makers and the broader European public, but also on the international context that is being shaped by several megatrends. An overview of these dynamics is presented below.

## 1.1 Several megatrends are simultaneously shaping the 21<sup>st</sup> century

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The 21<sup>st</sup> century is already strongly characterized by megatrends (Sharma, 2022). The global impact of the coronavirus pandemic marked a turning point, leading to a number of changes and reorganizations in the world after 2020. These changes are acting as catalysts to strengthen the changes resulting from megatrends (Wolf, 2020). In the post-pandemic world, transformations stemming from megatrends have become even more pronounced. Increasingly unfavourable demographic trends, declining productivity, problems stemming from high levels of debt, and challenges related to the growth and environmental sustainability of the economic system are all major issues (Matolcsy, 2022a, p. 17.).

One inevitable challenge in our time in the developed countries – and according to model forecasts in the future in some parts of the developing world, for example in China – is the unfavourable transition stemming from demographic processes, which originates from the long-term consequences of persistently low birth rates (Vonnák, 2022). The deterioration in demographic processes in the developed world is expected to worsen further, challenging the sustainability of the current socio-economic system. A long-term increase in life expectancy has also occurred in countries around the world, and this trend is forecast to continue in the future. As a result of this process, the number and proportion of the elderly in societies is expected to increase. According to UN forecasts, the old-age

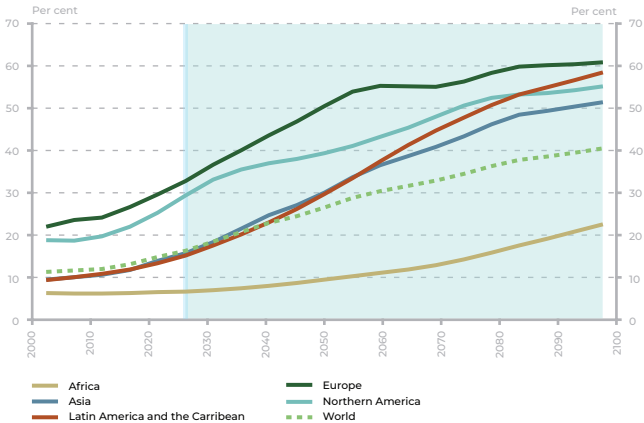
dependency ratio (the proportion of the elderly population compared to the working-age population) will keep rising globally during this century, continuing the dynamics experienced in recent decades (Figure 1). This demographic transformation will change the developed economies first and foremost, particularly in Europe (Matolcsy, 2022a).

In economics, there is a broad consensus that the major demographic trends have a strong effect on the growth potential of an economy over the long term. Population growth primarily affects total output, while GDP per capita – which is a more important indicator from the aspects of productivity, competitiveness, and well-being – is much more strongly affected by the age structure of the population (Vonnák, 2022, p. 26.). In the economy, a gradual decrease in the number of active people and a parallel increase in the number of inactive (elderly) people leads to a decrease in income per capita (Bloom & Canning, 2008), resulting in a slowdown in economic growth over the long term (Bloom et al., 2010). The demographic trends in the developed countries suggest that the dependency ratio will increase rapidly and constantly during this century, and this process will be difficult to manage (Prskawetz et al., 2008). Consequently, this issue represents an increasingly significant constraint on the sustainability of economic growth and well-being.

**FIGURE 1:** Forecast of the old-age dependency ratio in the 21st century

Source: United Nations, 2022

Note: Ratio in percentage, Population, age 65+ / Population, age 15-64



Productivity growth has been constantly slowing in recent decades, and its rate is just above zero in most developed economies (Figure 2). There are several explanations in the description of this phenomenon (Goldin et al. 2021): some point to the slowdown of progress in technology and innovation (Gordon 2012, 2018), while others find the answer in insufficient demand in economy (Erber et al., 2017).

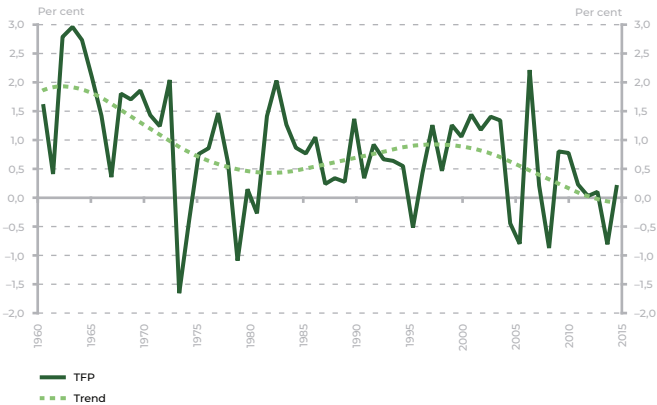
The facts in economic history highlight that the cyclical development of productivity in the world economy is characterized by rising and declining phases of industrial revolutions, linked to phases of innovation waves (MNB, 2020). Slowing productivity growth may be partly due to the fact that the innovations which have achieved business success in recent decades have mainly come from shallow tech applications related to consumption (e.g. internet-based sharing services, streaming services). However, deep-tech innovations (e.g. mass production



and storage of renewable, clean energy, nanotechnology, artificial intelligence, and self-driver artificial systems), which could fundamentally transform the entire economy, have not spread on a critical mass scale. One need but think of the civilization-shaping effects of the steam engine or electricity, as the mass spread of innovations stemming from new technologies dynamized economic progress during previous industrial revolutions (Matolcsy, 2022a, p. 18.).

**FIGURE 2:** Development of TFP (total factor productivity), annual change (1960–2019)  
 Source: MNB calculation, based on Penn World Table (GGDC, 2022)

Note: Based on the average for China, France, Germany, Italy, Japan, United Kingdom, United States, and Spain.



As for the development of productivity in the future, there are optimistic and pessimistic views (MNB, 2020). The former assumes that the diffusion of innovations stemming from deep technologies will lead to their mass-scale application, which will facilitate the development of productivity in general, similar to other industrial-technological revolutions in past history. By contrast, according to the pessimistic approach, a relatively low level of productivity growth will be a permanent feature

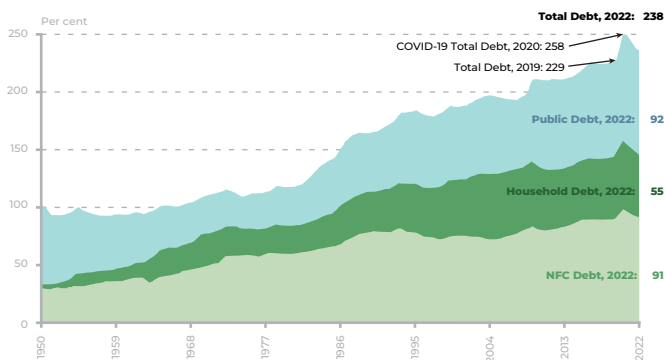
of the economy over the long run. In the downward trend, structural negative factors also play a role, such as the observed decrease in the efficiency of technology development (R&D results/expenses) (Bloom et al., 2020; Boeing & Hünermund, 2023; Miyagawa & Ishikawa, 2019). One of the main outcomes of a declining productivity trend is that economic growth in most countries is becoming increasingly debt-driven, which is unsustainable over the long term (Matolcsy, 2022a, p. 18.).

In recent decades, debt levels in economies have increased sharply. In an economic era characterized by mounting inflation pressure and high interest rates, problems related to the sustainability of debt also come to the fore (Beetsma & Baarsma, 2022). The global financial crisis in 2008 and the resulting real economic crisis were handled by governments and central banks with quantitative easing and rising budget deficits in the 2010s, leading to a massive surge in the volume of debt at the global level. To address the acute crisis caused by the pandemic, governments once again carried out significant fiscal interventions, further increasing public debt, and the debt of the private sector also rose substantially. Based on calculations by the IMF (IMF, 2023), total global debt (public and private debt stocks combined) amounted to USD 235 trillion in 2022, equivalent to 238 per cent of global GDP (Figure 3). However, the debt-to-GDP ratio has fallen compared to the historic peak in 2020, a year that was hit hard by the pandemic crisis. Nevertheless, compared to 2019, the debt-to-GDP ratio has risen by nearly 10 percentage points (Matolcsy, 2022a).

**FIGURE 3:** Global public and private debt, percentage of GDP (1950–2022)

Source: IMF Global Debt Monitor, 2023 (IMF, 2023, p. 7.)

Note: NFC: non-financial corporates



In order to ensure the sustainability of the financial balance, it is essential to stabilize debt levels, and debt financing should primarily finance productive investments that increase productivity in a multiplicative way. The financial crisis sharply highlighted the economic principle in practice: debt-driven development relying on cheap money in conjunction with stagnating productivity is unsustainable. It distorts the economy and leads to the accumulation of hidden systemic risks in the financial system via the formation of potential credit and asset bubbles (Vonnák, 2022).

While the period of super cheap money has come to an end, the volume of debts has nevertheless increased significantly in the world and appears to have returned to an upward trend (IMF, 2023). One of the biggest challenges of the 2020s – as in the 1970s – is once again curbing inflationary pressure in the economy, which requires a consistent and much stricter monetary policy by central banks compared to the previous period. The generally rising costs of debt servicing make it difficult to refinance debts,

which poses a sustainability challenge, especially for highly indebted countries (Matolcsy, 2022a).

Last but not least, beyond the social and economic aspects, the biggest challenge in the coming decades will be to achieve and ensure long-term environmental sustainability. Until recently, we considered the natural environment as a resource that could be used without limits. But the fact is that this is far from the case. Economic growth inevitably runs into the limits of environmental sustainability. Over-pollution of the atmosphere and the over-exploitation of water resources, land, and natural resources leads to the fact they cannot be renewed. As a result, the resources of future human generations are being exhausted by the current economic structure, including the destruction of the environment, or, in a worse case, the disintegration of ecological systems. Due to its importance, a later section of this booklet also discusses the topics of environmental sustainability and the path leading to it.

This section presented megatrends which are certainly not sustainable. If we want to achieve a sustainable convergence path, we must revolutionize our way of thinking with an intellectual turnaround. The know-how for this turnaround is discussed in the next section.





### III HOW CAN WE ACHIEVE GLOBAL SUCCESS ON THE PATH TO SUSTAINABLE CONVERGENCE?



#### 1 Intellectual turnaround: new sustainable economics, measurement, and competitiveness

Sustainability requires a complete renewal of our thinking. Everywhere we look, we see signs of the inevitability of this renewal. We see the need for this in environmental data, demographic trends, the explosion of technology, especially the emergence of new types of artificial intelligence (hereinafter AI), the revolution in money, geopolitical changes, and the impact these have on our everyday lives. We can see that all of this is a fractal picture: whatever part of the process we look at, we can see the whole (Matolcsy, 2021a). The following subsection presents the factors that underpin the need for a revolution in the idea of sustainability and the principles of the new system of thought.

## 1.2 Why is now the time for an intellectual turnaround?

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### 1.2.1 History repeats itself, but always differently

History and historical cycles should be used as a compass. Events repeat themselves, but of course always in different ways. We can compare the present day with the early decades of the 1500s. At that time, the Renaissance, the Reformation, and the great geographical discoveries, which had started earlier, heralded the dawn of a new era. Today, the Renaissance is a rediscovery of sustainability, the Reformation is a revolution in thought, and the geographical discoveries are breakthroughs in scientific technology. This era is characterized by proportionally less material and more spiritual determination. The new great 500-year cycle began in 1996, some 500 years after Columbus landed in the New World, when a dramatic technological revolution began with the spread of the internet (Matolcsy, 2022b).

The industrial revolutions that have shaped our world to this day started in the middle of the 500-year cycle, at the boundary of two 250-year cycles. And revolutions do not happen alone: The mid-18<sup>th</sup> century saw a simultaneous revolution in technology and money, leading to an intellectual revolution and a new geopolitical world order. The industrial revolution began in 1769, when the Scottish engineer James Watt patented the steam engine. His invention greatly increased the efficiency of production and transport of goods and gave new impetus to transport. The spread of technology was only made possible by the revolution in money: engineers and entrepreneurs could get funding for their daring ideas as a result of innovations in the British banking system. The material



side of the industrial revolution was also accompanied by an intellectual revolution. In 1776, Adam Smith, also a Scotsman, published *The Wealth of Nations*, laying the foundations for modern economics (Smith, 1776). Ultimately, the technological, financial, and intellectual revolution, which was concentrated in one country, led to a century of world dominance for Great Britain.

The combination of these changes also calls for a paradigm shift in our thinking. The development of science does not take place through a linear, continuous accumulation of knowledge, but rather through periodic revolutionary changes. The first sign of a paradigm shift is the emergence of more and more phenomena that cannot be explained by the theoretical contexts we have used so far. For a while, scientists try to adapt the old model to the new facts, but sooner or later the limits of the model are inevitably overstretched. Then comes a period of productive brainstorming, in which competing ideas crystallize and spread into a new paradigm. In this process, old approaches are replaced, in whole or in part, by new ones (Kuhn, 1962). The recognition of new paradigms is brought about by their ability to solve the problems addressed by the discipline more successfully than the old frameworks of thought.

Today's technological shift – the rise of data, digitalization, and AI – is making a new intellectual revolution necessary, similar to what happened 500 years ago, and is leading to the emerging theory of long-term sustainable economics.

### **1.2.2 Constraints on economic growth are becoming increasingly severe**

Sustainability has come to the centre of humanity's thinking nowadays because we have moved away from the path of equilibrium growth. Today's civilization is consuming the available resources at an exponential rate without ensuring their sustainability. Climate change,

unsustainable economic structures, high global debt levels, wealth and income disparities all demand a rebalancing.

Our environment and our habitat, the Earth, can only be preserved for future generations, if we break out of the trap of short-term thinking and focus on long-term sustainability.

Today, the environmental constraints on economic growth are becoming increasingly apparent as pointed out in Section II. Global warming has accelerated at an unprecedented rate in recent decades, and we now know that it is caused by human activity, in particular using fossil fuels such as coal, oil, and natural gas. Temperatures in the last four decades have been warmer than any decade since 1850 (IPCC, 2021), and moreover 2023 was the warmest year on record in the Earth's modern history (NASA, 2024). Every month from June to December 2023 broke the monthly record for warmest temperatures on Earth. The effects of global warming are increasingly highlighted by extreme weather events, extreme heat waves, forest fires, and rising sea levels.

We have not yet reached the tipping points in the evolution of climate change, but we are already rapidly approaching them. After a certain level of warming, exponential and irreversible environmental changes in some Earth systems can occur at a rate that is irreversible (OECD, 2022). Such key tipping points could include the collapse of the West Antarctic or Greenland ice sheets, the collapse of the Gulf Stream or the extinction of the Amazon Forest. These tipping points would presumably be reached if average global temperature exceeds the industrialization threshold by 1.5 degrees Celsius (OECD, 2022). If we would like to stop these processes, the sustainable economics of the future must provide answers to environmental challenges. As Sándor Kopátsy writes, there can be no stable

future for a society that separates man from nature and “makes nature a slave of man” (Kopátsy, 2022).

The iron laws of financial sustainability have long been known, but we are increasingly pushing the boundaries. The 2007–2008 financial crisis proved that the growth model of excessive debt accumulation is not sustainable. Public debt may be justified in certain circumstances, such as to cope with recessions caused by adverse external shocks, but excessive, long-term debt accumulation significantly reduces the economy’s capacity to grow. The converse is also true: reducing high public debt is difficult when growth potential is low (Matolcsy, 2022a). The ownership structure of public debt is also important: high indebtedness to foreign actors can imply external vulnerabilities and risks in renewal.

According to IMF data, the world’s total debt amounted to 238 per cent of GDP in 2022, with public debt at 92 per cent of GDP and private debt at 146 per cent of GDP (Gaspar et al., 2023). As Ruchir Sharma points out, global debt levels have tripled over the past decades (Sharma, 2021). Sovereign debt tripled between the mid-1970s and 2022, while private sector debt has tripled since 1960 (Gaspar et al., 2023). The world is in a debt trap, threatening the proper path to a sustainable future for future generations.

### **1.2.3 The technological explosion calls for a qualitatively new economics**

From time to time, new technologies call for new intellectual ideas, and – when organized into a system – these ideas call for new intellectual paradigm shifts. As discussed above, at the beginning of the first wave of the industrial revolution, the technological and financial revolution gave rise to capitalist economics. The current technological explosion, as an exact analogy, is accompanied by a revolution in money and requires

a completely new approach to economics. Money is becoming digital, and its flow in digital form is unthinkable without energy. But an even more direct link is being formed in the mining of cryptocurrencies, where energy and computing capacity are explicitly transformed into (crypto)money. The link between energy, data, and money is being renewed.

All economic actors can benefit from the appropriate use of the large amounts of data that are available. As LinkedIn CEO Jeffrey Weiner says, “Data really powers everything that we do”.<sup>1</sup> This holds true for consumers and businesses, and even for the state. Consumers can use the internet to easily and efficiently obtain information on the price, quality, and availability of a product or service they want to buy, and quickly compare their characteristics. By using more data, companies can provide their customers with a better customer experience and personalized services, and develop new business models, products, and services (McKinsey, 2011). Big data<sup>2</sup> can help companies optimize their production processes. Just as companies can use big data to increase their profits, national governments can use big data to promote the public good, economic growth and sustainable development. The use of big data is key to understanding and effectively improving the way healthcare works. In addition, its application can increase the efficiency of tax collection, as shown by the introduction of online cash registers in Hungary (Baksay & Szőke, 2020).

<sup>1</sup> Jeffrey Weiner message on X: “Data really powers everything we do.”

<sup>2</sup> The most widely accepted definition of big data is based on the 3V's, introduced by Doug Laney in 2001 to describe data management in three dimensions. The 3Vs are Volume, Velocity, and Variety. **Volume** refers to the distinctly larger amount of data, which are usually high volumes of low-density, unstructured data – e.g. clickstreams on a web page. **Velocity** is the fast pace at which data is received, e.g. internet-enabled smart products operate in (near) real time. **Variety** regards the many types of data that are available (such as text, audio, video, clicks, sensor signals, etc.), which often come in incompatible formats and are unstructured (Laney, 2001). In summary, big data means very large sets of data that are produced by people using the internet, and that can only be stored, understood, and used with the help of special tools and methods (Cambridge Dictionary).

Digitalization is also transforming the labour market and production. The IMF Managing Director draws our attention to that, saying “AI will transform the global economy. Let’s make sure it benefits humanity” (Georgieva, 2024). Around 40 per cent of the world’s workforce and 60 per cent of workers in developed countries could be affected by the rise of AI in the future: in around half of the jobs concerned, AI will increase productivity by augmenting human labour, while in the other half, machines may partially replace labour (Cazzaniga et al., 2024).

## 1.3 Principles for the intellectual revolution needed for sustainable convergence

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Convergence can only be built around the idea of sustainability. The 36 theses listed in the first section present the innovative economic theory foundations of a new intellectual revolution which has sustainability at its core (Matolcsy, 2021b, 2021c). There are several key areas for a new intellectual paradigm shift towards renewal: the creation of strong visions for the future, the prominence of knowledge and talent (see Subsection 2 of Section III), the multidisciplinary nature of economics, the increasing application of the Pareto principle, the exploitation of robustly available data, and the renewal of measurement. A more detailed overview of these five principles of the intellectual revolution, which are essential for sustainable convergence over the long term, is presented below.

### 1.3.1 Vision, strategy, and structuring into measurable goals

Strong visions fuel great success. The importance of a vision is that we come closer to achieving it when we outline it. As Winston Churchill said, “He who fails to plan is planning to fail”. The secret to success is to assign a strategy to your vision and break it down into goals. Every complex system, such as a nation, a city or a family, can have its own vision and purpose. István Széchenyi’s vision was of a multitude of educated human leaders, as he described in his work *Hitel* [Credit]: “The multitude of scientific men is the true power of the nation.” (Széchenyi, 1830). With fewer resources, but a clear vision, we can achieve greater results

than if we have an abundance of resources, but no vision and no purpose.

According to the Carnegie Principle, a positive vision yields a result, i.e. an idea that creates a reality (Hill & Stone, 1960). Everything is decided in our minds. Our attitude is the key: if it is positive, our thoughts and actions will help us achieve our goals, while if our attitude is negative, we can, even if unconsciously, constantly undermine our own goals. It is also important to set a goal that meets the conditions of the vision, i.e. is measurable, dynamic, and achievable. Measurement can trigger two types of effects: on the one hand, positive feedback can accelerate progress in the right direction, while on the other hand, negative feedback can encourage a change of direction (Matolcsy, 2023).

### **1.3.2 Multidisciplinarity**

Multidisciplinarity is a feature of the new sustainable economics. Traditional economics has reached a dead end, and in the course of its renewal economics should build on the knowledge and methods of other disciplines to an even greater extent than before. Above all, it must take into account the rules of living systems, but also the laws of physics, spatial structure, and systems theory. Economics is also a social science; it must build on the results of psychology, history, and anthropology. More than ever, the implications of geography and geopolitics must also be taken into account. The economy interacts with all aspects of life and must therefore pay attention to all dimensions of life.

Among the natural sciences, physics could play a key role in the renewal of economics. Even Adam Smith knew and used the physical context of his time. For example, in *The Wealth of Nations* he compared the natural and market price of goods to gravity (Smith, 1776). Classical economics assumed that the economy, like a machine,

always responded to certain inputs with the same outputs (Orrell, 2018). Just as physics has transcended the Newtonian worldview through quantum theory, so also could economics incorporate the new theories of quantum physics into its intellectual renewal. We know from Heisenberg's law that we do not necessarily have causal laws, but rather laws of uncertainty (Blankmeyer, 1999). Just as in quantum physics, the measurement affects the whole system of measurement, so in economics, when an analyst makes predictions, he influences the behaviour of economic agents. The world economy, cities, companies, and national economies are complex systems with properties that are not yet taken into account in today's economics.

### **1.3.3 Applying the Pareto principle**

The role of the Pareto principle is becoming increasingly important as the material constraints on economic growth are increasing. But what is the Pareto principle? The Italian economist Vilfredo Pareto studied the distribution of wealth in different countries and found that 20 per cent of society owned 80 per cent of the wealth. He found the same correlation for income as well as wealth, and looking at earlier periods, he also found that roughly one-fifth of the population enjoyed four-fifths of the wealth (Pareto, 1897).

Pareto's findings were further developed by the American economist Richard Koch, who pointed out the disproportionality between resources and outcomes. Koch found that in all areas of life, Pareto's formula holds: 20 per cent of the causes are responsible for 80 per cent of the consequences (Koch, 1997). That is, only one-fifth of our activities produce four-fifths of our results, and thus four-fifths of our inputs are effectively useless. Koch also discovered similar ratios in an increasing number of areas of life, and, as the world has accelerated, even more extreme ratios. The modern world has now broken with the



principle of proportionality, where less is more: investing time, energy, and money beyond a certain ratio does not add proportionately to the result, and even loses what was achieved before. Koch's recommendation is that we should always look at what the 20 per cent is that yields the 80 per cent result. With scarce resources, the role of the Pareto principle becomes particularly important. We know that there is a crucial 20 per cent of the 20 per cent, and if we go down the line, we will find that only 1 per cent of our resources can deliver about half of our results. So, our challenge is to find the 1 per cent that opens the door to success.

### **1.3.4 Competitiveness – Quality instead of quantity**

The concepts of competitiveness and sustainability cannot be separated (Matolcsy, 2020). Both can only be understood from a long-term perspective. Just as balance and growth are the alpha and omega of sound economic policy in the short term, so are sustainability and competitiveness in the long term. There is an almost direct correspondence between these factors. Economic growth in the long term can only be achieved through a high level of competitiveness, and equilibrium in the long term can only be achieved through sustainability. This is how the short term and long term converge. That is why we cannot achieve our short-term goals without looking to the longer term.

There are two ways to achieve competitiveness and sustainability in a world of limited resources. One is to attract new, sustainable resources and the other is to use existing resources more efficiently. As with the movement of quantum, we need to move along both paths simultaneously.

Intensive growth, i.e. growth based on qualitative rather than quantitative factors, leads to more efficient use of existing resources. As we have seen, we are at the

quantitative limits of the resources that can be mobilized in terms of fossil fuels, domestic labour in developed countries, and financial resources in indebted countries. There is, however, no theoretical upper limit to the efficient use of these same resources. The output per unit of resource (energy, man-hours, capital) can be increased for a very long time. In practice, this can only be achieved through a high and increasing level of awareness and technology, with a focus on high added value, R&D (research and development), and innovation.

The other approach is to find and use new resources. Along the road to quality, we are moving in this direction at the same time. The finite resources we have used up to now can be transformed by technological progress into new, unlimited resources. This is true for the economy through the money economy, for production through the emergence of data as a new resource, and for environmental sustainability through green energy production.

### **1.3.5 Renewal of measurement**

As essential as vision is, measurement and back-testing are also essential, as without them we will not know how we are progressing towards our goals. But we must carefully choose what we measure. Chasing obsolete targets will lead to harmful results.

The economics of sustainability needs new metrics. Once again history offers an analogy and repeats itself, but in a different way. In the 1930s, under the impact of the Great Depression, economics and measurement were renewed essentially at the same time. In 1936, Keynes published his General Theory, which laid the foundations for macroeconomics to prevent a repeat of the post-1929 depression through public intervention and an increase in domestic demand (Keynes, 1936). One year later, US economist Simon Kuznets presented the precursor to

the concept of national accounts, the calculation of GDP, at the request of the US government (Kuznets, 1934). The coincidence was not at all coincidental. In order to achieve the vision (to filter out economic fluctuations), it was necessary to correctly measure the target variable (real economic performance).

Just as the creation of macroeconomics was followed in time by the development of the GDP methodology, we now need to develop new measures of sustainability. This should take account of environmental, social, and financial sustainability, in addition to economic development.

The technological reform of measurement is now underway through digitalization and data processing. We have an unprecedented amount of information at our disposal, which we can process at unprecedented speed. We need to be ready to absorb and interpret this information, and AI can help with this.

## 2 Breakout points for achieving sustainability

### 2.1 Key to the future

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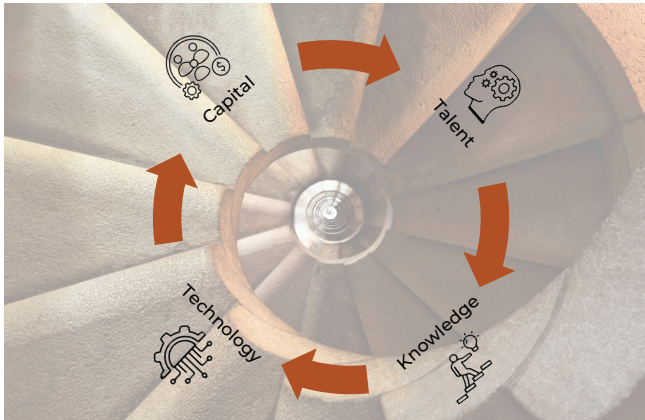
In the 500-year cycle behind us, the rise or fall of nations was due to the proper or weak utilization of the capital-technology-knowledge-talent foursome. Those which appreciated, duplicated, connected and shared these four sources won. Those nations rose up which transformed money into capital, invented and spread new technologies, disseminated knowledge to broad layers of society, and fostered the development of talent (Matolcsy, 2023).

With the end of the pandemic, we have entered a new quantum world, the main feature of which is uncertainty. This world is the world of creativity, visions, big dreams, and projects: the world of talented people. The information technology revolution that began in the 1970s is becoming permanent, and talent and creativity are replacing the dominance of money and capital. At the same time, uncertainty is the breeding ground for talent and creativity, as it promotes curiosity, in-depth thinking, hopes, and dreaming (Matolcsy, 2022b).

In the first half of the 21<sup>st</sup> century, we are sailing in a new Renaissance era, which has a new ideological focus, called long-term sustainability. The driving force of this era is not great geographical discoveries, but great technological breakthroughs. The determinants of success remain the same four factors, but we must be cognizant of an

important change: the internal order of the factors has been reversed. In the previous 500-year cycle, the basis of success was capital, which drove technology, knowledge, and talent. By contrast, in this new era, talent is at the centre of the processes and it determines the development of the other three factors (Figure 4) (Matolcsy, 2023).

**FIGURE 4:** New fusion in the economy  
Source: Author's work, 2024



In the new sustainable economics, talent and creativity become crucial resources. In the future, the material economy will be based on an intellectual resource, namely knowledge. When knowledge is passed on, it becomes information, which expands exponentially with its sharing, i.e. with its consumption. But the time available to acquire knowledge is finite. The maximum amount of knowledge that can be acquired in a limited time is largely determined by talent and creativity. However, in order to be able to acquire this maximum knowledge, we also need diligence and dedication. All people and all nations have these factors, but they can convert them into economic growth to varying degrees (Matolcsy, 2023).

How can we get the most out of the four success factors?

In the case of talent, early recognition is crucial, in which families and smaller communities have a prominent role. All talents must be valued, as we cannot yet know whether the skills that will lead to success in the future will differ from the aspects considered important today (Matolcsy, 2023). We must search for talent everywhere, because everyone is good at something, we just need to find it. It is also important to create a supportive and stimulating environment, which inspires young people to continuously improve and develop their talents.

The key to accumulating knowledge as much as possible is to provide opportunities and motivation. Knowledge is public property, to which all citizens must have full and free access. A new knowledge infrastructure is needed, one of which is free internet access, which is a subjective right for everyone (Matolcsy, 2023). The channels of knowledge and information acquisition have expanded, and thus the role and functioning of teachers and the entire education system must be reconsidered. The key question for the long-term success of the education system is whether it is possible to make the students fall in love with the process of learning and whether it is possible to make them understand the need for continuous self-improvement. The possibility of lifelong learning must be made accessible to everyone. Educational processes must also be adjusted. Competition and cooperation must be made common in all areas (Matolcsy, 2023). Emphasis should also be placed on the confident knowledge of foreign languages, since at least knowledge of the English language is essential to access the world's knowledge base.

In order to join the newer and newer waves of the technological revolution, it is necessary to continuously monitor the current development trends. Development is accelerating in many areas, which requires a faster reaction

on the part of individuals and companies. In the field of the energy transition, the utilization of renewable resources, especially solar energy, is the basis of development, which can and should be built on. A full-scale digital transition is unavoidable in everyday life, and public and business operations. The possibilities (and dangers) of AI are only now unfolding before our eyes, but it will certainly turn our everyday lives upside down. As society ages, significant space will open up for the development of a new health sector, the longevity industry (Matolcsy, 2023). Dare to dream big and dare to make them come true, because these dreams will also move our society forward.

The economic growth of the new era is also capital-intensive, so success requires both capital accumulation, capital import, and capital investment (Matolcsy, 2023). The key question of capital accumulation is how we can sustainably expand the capital at our disposal. We must focus on investments at the individual, corporate, and social level that contribute to the sustainable strengthening of our other three key factors. We should spend as much as possible on the development of our human capital, since this is the basis of the new economic cycle. In addition, we should focus on prioritizing smart investments. We should use the Pareto principle in our economic decision-making. Let's find the gazelles, the potential unicorns, and support these companies in achieving success.

Finally, one piece of advice that applies equally to all four areas: dare to be unique, because in the words of Sándor Kopátsy: "life rewards eccentrics" (Kopátsy, 2021).

## 2.2 Productivity: the driving force behind convergence

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Increasing productivity is today's key issue, as it forms the basis for long-term, sustainable convergence. There is no doubt that the 2020s will feature many megatrends and challenges which are reminiscent of the 1940s and 1970s. Among other things, these challenges include the technological revolution, climate change, imbalances, geopolitical conflicts, and the aging of some societies. In addition to preserving political stability, improving productivity is the only panacea that can be deployed to overcome all of these challenges (Matolcsy, 2022b). Therefore, it must be increased in all areas of the economy.

Increasing productivity is a key factor in terms of growth, which can be illustrated especially through the example of countries that are catching up. Experience shows that countries in which productivity was consistently high were able to achieve a high level of development. In the past more than half a century, only a dozen countries were able to reach the high-income level and avoid the middle-income trap. The successful countries were, for example, the Asian Tigers, and among European countries Ireland, Finland, and Austria. Along with many other factors (such as labour force expansion, effective education policy, high investment rate), high productivity is one of the common characteristics that contributed to the successful convergence of these countries. Increasing productivity is the key factor that ensures growth even if production factors become limited or the benefits that ensured the earlier stage of development disappear (Baksay & Nagy, 2022).



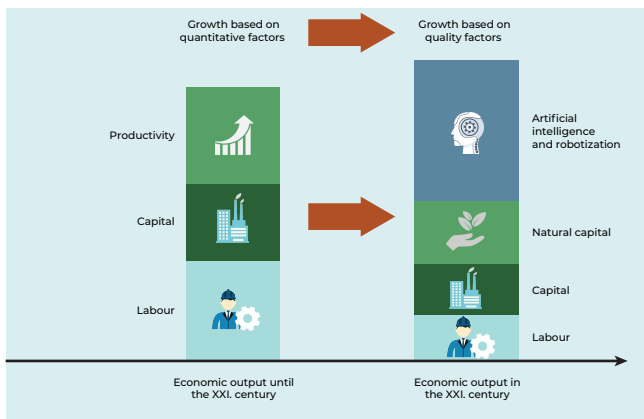
In developed countries, despite the technological development seen in recent decades, a slowdown in productivity growth has been observed. By the 2010s, economic growth in the European and American economies had dropped from the 4 per cent rate that was characteristic of the middle of the last century to 2 per cent. This is primarily explained by the slowdown in productivity growth, which already fell below 2 per cent in the 1990s. The key question is whether the current slowing productivity expansion or the increasing returns resulting from new technological waves will be determining the future. Probably both will occur at the same time: some will progress on the traditional path with slowing productivity, while those companies and countries that successfully adapt the latest, even not-yet-existing, technological achievements may be able to achieve a continuously increasing expansion of productivity (Martonosi, 2022).

The role of productivity and efficiency in sustainable growth is therefore becoming more important not only because of the limitation of resources (both human and physical), but also because of the digital transition, innovation, and the successful application of new technologies. The acceleration of the digital transition and innovation plays a crucial role in the evolution of productivity. One good example from recent years is the success of Estonia, where a services-based reindustrialization was carried out which was based on the IT sector and a comprehensive digital transition, with the result that Estonia became a leader in digital transformation. The success of Estonia is demonstrated by the fact that productivity in the country has increased by almost one-third since 2010 (Matolcsy, 2023).

The importance of smart capital in boosting productivity is reinforced by the fact that, among the developed countries, productivity improved to a greater extent in the economies where ICT capital grew more significantly over the last two decades. Experience has so far confirmed the importance of a high investment rate (consistently above 25 per cent) and thus capital formation in economic growth, but the latest trends in capital theory also highlight that not only the quantity of investments, but also their quality is determining. Even nowadays, the role of smart capital, i.e. information and communication technology, and intangible assets, is increasing, which increase efficiency and productivity. According to estimates, investments in intangible assets in developed economies accounted for one-half of labour productivity growth in the private sector (Várnai, 2022).

In the case of Hungary, the model based on productivity and competitiveness can ensure successful, sustainable convergence. If we do not act quickly and decisively in this area, the balance cannot be restored and convergence may be interrupted (Matolcsy, 2023). Hungary is also increasingly faced with the limitations of certain resources, like demographic constraints, such as the shrinking and aging of the population. However, Hungary may also face constraints if we base economic growth solely on quantitative factors. The successes of the 2010s were largely based on progress in quantitative factors, but in the future – already now in the 2020s – we must primarily focus on the improvement of quality factors, which goes hand in hand with improving productivity and efficiency (Figure 5).

**FIGURE 5:** Sources of the quantitative and qualitative growth model  
Source: MNB, 2024



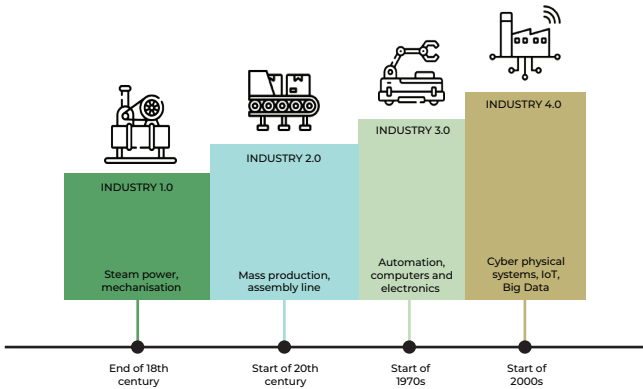
In Hungary, on the sustainable convergence path, a significant portion of the growth can come from the expansion of productivity, while a smaller part may derive from the expansion of employment. However, in the case of a middle-income trap, this distribution would be almost similar, and thus stronger productivity growth is what can help to achieve successful convergence. For the continuous improvement of productivity, all of the reserves that have not been or only partially utilized so far will be needed. Several of the MNB's programmes (330 points for competitiveness, 144 points for sustainable balance and convergence) provide suggestions for this, which need to be implemented together (Matolcsy, 2023). In order to progress, we need quantifiable and measurable goals – as highlighted in Subsection 2 of Section III – because measurement results provide the fuel for the reform path.

## 2.3 Digital transition – Data is the new oil

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The widespread electrification of human activities has been taking place since Edison, Tesla, and the early years of electric vehicles in Detroit (1907). However, the 1970s brought a fundamental change for humanity: with the birth of computers based on the revolutionary research of John von Neumann, automation, and the electronics revolution, the 3<sup>rd</sup> industrial revolution arrived (Figure 6). Thanks to the birth of computers and then the internet, extremely rapid technological development has occurred in the last 50 years, which has placed the growth potential of the economy on a fundamentally different path. The launch of the internet has created an age of information abundance. The data- and knowledge-based economy accelerates the transition from general scarcity to a complete abundance of basic resources – knowledge, energy, money, skilled labour, efficient technologies (Matolcsy, 2023). Nowadays, at the dawn of the 5<sup>th</sup> industrial revolution, we have reached a stage of the digital revolution where the electrification of the human brain is also possible through AI and virtual reality (Matolcsy, 2022b). Data, the new oil, provides the “fuel” for all these revolutionary changes.

**FIGURE 6:** Industrial revolutions and their most significant innovations  
Source: Author's compilation, based on WEF, 2024



Datasets that play a key role in production processes, as new production factors, can be fundamentally differentiated from other production factors. While physical capital and labour are available in finite quantities, data and information are not finite and are indeed available in continuously increasing quantities. Their uniqueness lies in the fact that, similar to knowledge, data are not lost during their use, but are preserved and even expanded, as new data can be created by using the information. In recent decades, information technology has resulted in the exponential expansion of global data assets. Entering the era of big data, data are available in such quantities and are so complex that they cannot be processed with the previously used tools. That is why the winners of the future can be those countries that use information resources faster than others, which requires a complete digital transition (Matolcsy, 2023).

Today, data has become a decisive factor in value creation. One need only consider that in the European Union alone, if the data assets were utilized, 50,000-200,000 lives could be saved each year, thanks to faster emergency services and fewer road accidents. The optimization of transport networks would economize 27 million working hours and pollution comparable to nearly 5.8 million tonnes of oil equivalent (Izsák, 2022). One of the biggest potentials can be identified in the financial sector, where with the open-data sharing and analysis of data through digital ecosystems, up to 1.5 per cent higher GDP growth could be achieved by 2030 (White et al., 2021). In the latter sector, the advantages of the digital transition include more accurate credit risk evaluation and risk-based pricing, improved workforce allocation, better product development and customer service, and stronger protection against fraud.

In the decade ahead, those that can convert all segments of the economy to digital operation will come out ahead in international competition, whether it is the state, the households, the corporate sector, the education sector or even the financial sector (Matolcsy, 2023). The state must play a leading role in the digital transition and, amongst other things, this can be seen in the full development of digital public services, in education, and in setting up the appropriate regulatory and operational environment. In Europe, Estonia is often referred to as a model country for digitization, which gradually switched to digital operation and today 99 per cent of public services are available online. In addition to many positive aspects, the digital transition also creates challenges on the regulatory side: there are an extremely large number of risk factors (e.g. data management, data protection) that legislators must respond to in the rapidly changing environment. With the emergence of AI, competition will become even more intense. The creation of a data-based economy would also be supported if the possibility of regulated access to important state and market data assets were secured.

As discussed in the previous paragraphs, the digital transition brings obvious economic benefits. Another important advantage is that it makes a greener future possible. Digital technologies provide effective tools and innovative solutions to identify environmental challenges. The climate and biological ecosystem of our planet is a very complex system, that is often difficult to predict. More and more available databases and AI offer support for more accurate forecasting of climate change and the prevention of natural disasters. Among other things, advanced monitoring and forecasting systems can mitigate the negative effects of forest fires, which have caused extraordinary destruction globally in recent years.

The digital transition also supports the green transition by increasing energy efficiency, as new technologies enable a higher degree of controllability, optimization, and analysis of energy systems. Digital (smart) devices (for example automatic vehicle locators, smart meters, smart thermostats) are already available that provide greater energy savings for transportation, shipping, the real estate market, and the manufacturing sector. The information collected by smart devices is used by algorithms, and in some cases by AI, to optimize energy consumption (IEA, 2019). The more households and businesses that these technologies are available to, the greater the energy savings that can be achieved, which contributes to the achievement of environmental sustainability with moderate emissions.

## 2.4 Green transition for the survival of humanity

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In the history of humanity, this is not the first time that climate change threatens the survival of civilization, which is why we must see the patterns of history and learn from them (Matolcsy, 2022b). Climate change was a common factor in the fall of Egypt's Old Kingdom, the Maya civilization and the Angkor empire, which diminished the opportunities for agriculture and subsequent famines sealed the fate of those civilizations (Sohn, 2014). No matter how advanced the technological solutions that were applied by these societies from different continents, they were not able to adequately solve the problems locally. Besides climate change, the overexploitation of natural resources can also significantly impact the course of many civilizations. For example, deforestation and its negative consequences (soil erosion, loss of freshwater resources, development of swamps, malaria) were major factors in the decline of the Roman Empire and the society of Easter Island (Juhász, 2022).

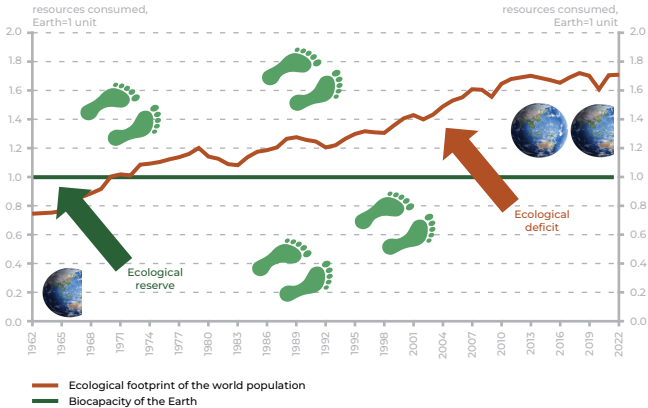
Egypt's Old Kingdom was considered a prosperous society between 2700–2150 BC, in the era known as the “Age of the Pyramid Builders”. Based on modern pollen and charcoal dating analysis, the demise of the kingdom was accompanied by an extremely severe drought period in roughly 2250 BC. The Nile provided the basis for the food production of the Old Kingdom, but even with the extensive water management infrastructure, the civilization could not survive the severe and long-lasting drought (Bernhardt et al., 2012). Research demonstrates that a similar factor



was behind the decline of the advanced Maya civilization around 800. The largest Maya cities were depopulated in 50-year cycles between 760 and 910, partly due to prolonged periods of drought (Gill et al., 2007). Last but not least, turning to the Angkor empire's collapse in 1431, there is evidence that the changing weather patterns contributed to the depopulation of this once prosperous area. At the beginning of the 15<sup>th</sup> century, unusually strong monsoon rains and protracted drought periods alternated, and even though this civilization had one of the world's most well-developed water infrastructures it was still unable to cope with these changes (Lovgren, 2017).

In light of these historical examples, it is clear that the excessive use of natural resources cannot be continued, and economics must also be renewed in order to achieve long-term sustainability. For more than 50 years, humanity has used more natural resources than the Earth could renew. At the current rate of consumption, we use more than 1.7 Earth's worth of resources every year (Figure 7). This cannot be maintained in the long term, otherwise the harmful processes will become irreversible as a result of climate change, which threatens the survival of our civilization. The previous economic thinking must be replaced by new sustainable economics, which moves global production and consumption in the direction of sustainability. We need a more "holistic" approach that harnesses the results of various disciplines, so that we can progress through the green transition towards a more liveable future (Matolcsy, 2022b).

**FIGURE 7:** Change in the ecological footprint of the world population  
Source: Global Footprint Network, 2024



In the transition to a new sustainable economic structure, green taxation and environmental tax instruments must play a stronger role in the economic policy toolkit. The goal is to raise the price of environmental pollution with financial regulatory instruments, and thus reduce the level of environmental burden by increasing the costs for economic actors that emit harmful pollutants.

Innovative regulatory thinking plays a particularly important role in the green transition. Currently, for example, there is no regulation that already requires a green approach in the design phase of a product, while up to 80 per cent of a product's environmental impact is determined at this phase (Matolcsy, 2022b). In order to ensure sustainability, independent, project-by-project analysis is necessary, and all investment decisions should comply with regulations aimed at an accelerated green transition. Government and central bank programmes are of particular relevance in the green economic transition, and the creation

and implementation of climate-transition technologies will be feasible with appropriately targeted green subsidies and green financing. All green programmes, from reforestation to irrigation, from the use of solar energy to the transition of transport, must be accelerated. The MNB acts in this spirit with its Green Programme and environmental sustainability mandate. All central banks need a “sustainability” mandate to take a proactive role in the green transition. As a result, the banking sector can be encouraged to help businesses and households reduce emissions faster.

While a green, safer energy supply is exceptionally important in its own right, the Russian-Ukrainian war provided yet another impetus for the transformation of the energy structure due to the energy crisis. For example, Hungary’s share of net energy imports is currently higher than the average of the region and is also slightly higher than the EU average, standing at around 60 per cent (Eurostat, 2024). As part of the shift towards energy independence, it is necessary to rely more on renewable energy sources and nuclear energy and to increase energy efficiency investments. These investments can simultaneously reduce energy dependence, reduce the environmental burden and improve the external balance – by replacing imported energy with domestic production (Matolcsy, 2022a). At the same time, the outdated model based on the “take-make-waste” philosophy must be scrapped (Matolcsy, 2022b).

We have to admit that technology alone will not be able to solve the problems outlined above, and that the green transition must also be started with a revolution in thinking. Since economic growth cannot be forced at the expense of nature, it is crucial to build structures for long-term sustainability in all areas of life. It is not enough to merely address one segment of the economy and society and encourage them to act, as a comprehensive

social consensus is needed. The cost of a green economic transition may be extremely high, but if we are able to avoid the pitfalls of short-term thinking, then our home, the Earth, can be preserved for the long term for those who come after us (Matolcsy, 2023).

## 2.5 Demographic change – The basis and goal of sustainable growth

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Global population developments are characterized by two megatrends: continued population growth and aging. Demographic trends have significant, predictable economic and social consequences, as they transform the labour market, influence productivity, and change consumer and savings habits, while also having an impact on long-term growth prospects and the sustainability of social care systems. Economically less developed countries with a growing population face different challenges than developed countries with declining population trends. Although the challenges are different, their priority is not: demography will continue to shape world politics, and thus all the countries of the world will have to deal with these challenges (Matolcsy, 2022b).

Historical experience shows that successful economic convergence can only be achieved with population growth. In his book, *The Rise and Fall of Nations*, Ruchir Sharma states that 50 per cent of the economy's growth is explained by changes in the size of the population (Sharma, 2017). That is why the reversal of population decline in developed countries is not only a key issue from a social point of view, but also from an economic one. Thus, the challenge is clear: the negative trends must be reversed and the path of positive population growth must be found again.

Plans for stopping population decline can be divided into two groups according to whether they seek to break unfavourable trends from external or internal sources. Developed Western European and American countries

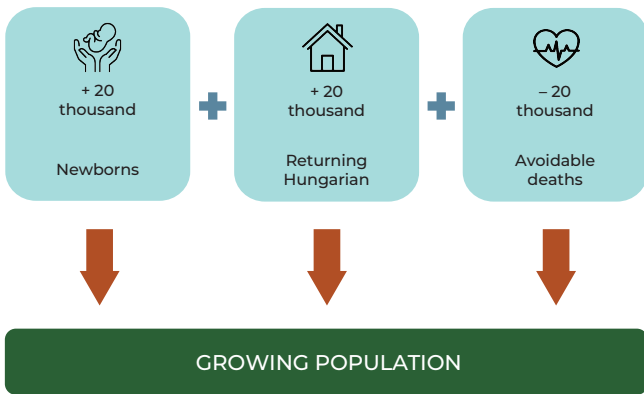
have mainly focused on external sources, i.e. immigration, in recent decades. While applying this solution may have advantages in the short term, according to experience, it has many and overall greater disadvantages. The mass, uncontrolled acceptance of immigrants and their failure to integrate, and the insurmountable nature of deep cultural differences, weakens the basic fabric of the receiving society. These changes present the countries with challenges that are difficult or simply impossible to reverse.

Hungary, on the other hand, believes that demographic challenges must primarily be dealt with from internal sources. In order to achieve this, we should look at the example of the Czech Republic. In 1990, similar to Hungary, the country had a population of 10.4 million people; by contrast at the beginning of 2022 the Czech Republic had over 800,000 more people than Hungary. The Czechs managed to substantially increase the fertility rate (from a low point of 1.13 in 1999 to 1.83 by 2021, which ranks second highest in the EU), while simultaneously reducing the mortality rate (since 1990 nearly 800,000 fewer people died in the Czech Republic than in Hungary) and preventing the mass flow of emigration with adequate economic development at the same time (Matolcsy, 2023). These are the same goals that Hungary also strives to achieve. Although Hungary has also achieved tangible results over the past decade, as the Hungarian fertility rate rose from its historical low of 1.23 in 2011 to 1.61 by 2021, putting it above the EU average. However, the effectiveness of domestic measures needs further development.

The demographic turnaround must rest on three pillars, as we should gain at least 20,000 people per year in three areas to increase the population (Figure 8). To ensure a long-term demographic balance, it is essential to increase the number of births. In order to achieve the 2.1 fertility rate necessary for social sustainability, the number of newborns in Hungary should be increased to 110,000 by 2030.

In order to achieve this, it would be necessary to rethink the family support system. The current support system places great emphasis on improving the financial and housing situation of families, but bringing the birth of the first child forward, supporting the everyday life of families, and improving the quality of public services should all receive more attention.

**FIGURE 8:** Hungarian demographic goal: to gain 3 x 20,000 people per year  
Source: Author's compilation, 2024



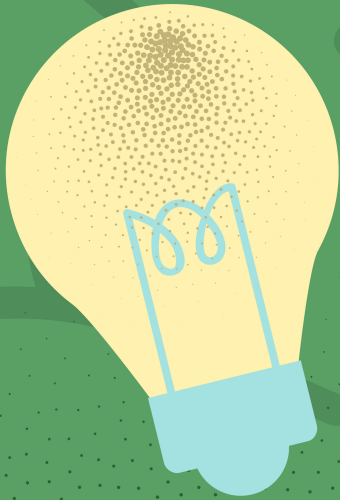
Facilitating the return migration of Hungarians living abroad could also make a significant contribution to reversing demographic trends. In addition to targeted measures, this goal could be promoted by raising the wage level, strengthening the awareness of family support systems and simplifying their use, as well as improving the quality of public services. These measures would help not only to attract people living abroad, but also to keep those living at home and to reduce the number of daily commuters.

The third pillar of the demographic turnaround is the reduction of the number of deaths, which can primarily be

facilitated by increasing the population's health awareness and strengthening the prevention system. The health status of the population is mainly determined by socioeconomic conditions and the behaviour of individuals, while the healthcare system is only responsible for less than 20 per cent of the health status (Hood et al., 2016). The adequate health of individuals, especially the working-age population, is a very important aspect of competitiveness and sustainability from a social, economic, and demographic point of view. Since 2011, an average of nearly 50,000 people have died annually in Hungary from avoidable causes, representing more than one-third of all deaths. In order to increase the number of the population, it is also essential to reduce the number of deaths, because even if we increase the number of births to 110,000 per year and bring home 20,000 more Hungarians living abroad than the number who emigrate, this will still only just offset the average number of deaths (average 130,000 per year). The demographic turnaround therefore requires progress in all three areas.







## IV THE MNB'S GREEN MANDATE AND HOW IT IS CONVERTED INTO ACTION



### 1 Sustainability actions in comparison with other central banks globally

#### 1.1 The emergence of sustainability in the activities of central banks

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Rapid transitions are the main characteristic of the current decade. We are already witnessing them in all areas of life, ranging from geopolitical changes and shifts in economic power centres, digitalization, technological disruption such as robotization, machine learning, big data, and AI, and last but not least, climate change (Matolcsy, 2022). Leaders need to understand the megatrends so that they can respond to the challenges appropriately: to react, to adapt or to cope.

Climate change is specific, because we are close to the final hour to respond; it seems that global warming is on track to reach 1.5°C as soon as the early 2030s. It is hard to estimate what impact the other transitions will have on our everyday lives in the future, but the physical consequences of climate change are being scientifically modelled with supercomputers and these models predict a serious intensification of extreme weather conditions if climate change is not addressed in time.

Although governments and fiscal measures need to be in the frontline in addressing these issues, central banks and their mandates are also affected, and thus central bank policies need to take into account climate risk aspects.

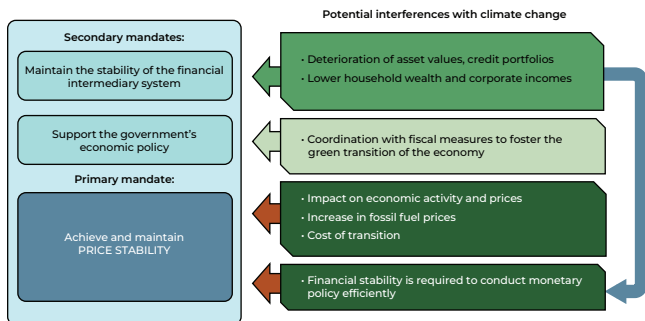
## 1.2 Why is the sustainability mandate important?

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The primary objective of the MNB is to achieve and maintain price stability. At the same time, however, the MNB recognizes that changes in climatic conditions may not only have ecological consequences, but also severe social, economic, and financial effects that can potentially impact the mandates.

For example, an increase in the number of supercells and wildfires can destroy means of production, while droughts and floods can disrupt agricultural activity. Low river levels can block transport routes and jeopardize energy production. These phenomena can have direct or indirect effects on different price levels via lower supply. But these shocks can also translate into a deterioration in asset values, collaterals, lower wealth and incomes as well, which engenders financial stability risk. For instance, a drought for corn farmers means lower production and a higher price level for corn, but also lower income with a possibility of the growth of non-performing loans, which indicates that both primary and secondary mandates are affected, as shown in Figure 9.

**FIGURE 9:** Potential interference of climate change with primary mandates  
Source: MNB, 2024



Climate and sustainability policies are set by elected governments, so fiscal policies will always take the lead, but central banks have unique toolkits in the form of their monetary policy and their financial regulatory and supervisory capacities to support such actions.

Based on the collection by Dikau and Volz which analyzed on central bank mandates, only 12 per cent of the examined 135 central banks and monetary communities explicitly mention the goal of environmental sustainability (Dikau & Volz, 2021).

In May 2021, the MNB was among the first central banks in Europe to receive an additional secondary mandate from the Hungarian parliament to explicitly promote sustainable economic development and mitigate environmental risks.

Despite the primary mandate itself providing opportunities to address the topic of climate change, the explicit mention of environmental sustainability is particularly important, as it serves a clear legal ground for the MNB's actions (MNB, 2023).

### 1.3 International collaboration is essential for global issues

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The most important goal is to change the entire mindset around climate change. In this regard, the MNB believes that central banks should lead by example. Climate change is a global issue that requires global cooperation.

One important forum for collaboration is the Network for Greening the Financial System (NGFS), consisting of 134 central banks and financial supervisors, which pursues the aim of accelerating the scaling up of green finance practices and developing recommendations. As a result, more and more central banks are coming forward with some kind of green initiatives, and best practices are then spreading as central banks pull each other.

Good input for this is [greencentralbanking.com](https://www.greencentralbanking.com), a web portal produced by Positive Money, that publishes the Green Central Banking Scorecard on an annual basis. It collects the full range of green policies and initiatives adopted by G20 central banks and assigns a score in four main dimensions: research and advocacy, monetary policy, financial regulatory policies, and leading by example. The maximum aggregate score is 130, and the 2022 results were the following:

**TABLE 1:** Results of the Green Central Banking Scorecard (2022)  
Source: Eames and Barmes, 2022

Rank		Country	Research and Advocacy (out of 10)	Monetary Policy (out of 50)	Financial Policy (out of 50)	Leading by Example (out of 20)	Aggregate Score (out of 130)	Grade (A+ to F)
1 (1)	-	France	10	12	31	17	70 (52)	B-
2 (6)	↑	Italy	10	12	31	8	61 (45)	C+
3 (7)	↑	Germany	10	12	30	8	60 (44)	C+
4 (4)	-	European Union	10	12	28	8	58 (47)	C
5 (5)	-	United Kingdom	10	10	27	9	56 (46)	C
6* (2)	↓	Brazil	10	18	18	7	53 (51)	C
6* (3)	↓	China	10	12	31	0	53 (50)	C
8 (9)	↑	Japan	10	6	14	5	35 (25)	D+
9 (8)	↓	Indonesia	10	1	14	5	30 (25)	D+
10 (14)	↑	Canada	10	2	14	2	28 (15)	D
11 (11*)	-	Mexico	10	4	4	5	23 (17)	D
12 (10)	↓	India	10	0	10	1	21 (18)	D
13 (11*)	↓	South Korea	10	1	6	2	19 (17)	D-
14 (16)	↑	Russia	8	0	8	2	18 (12)	D-
15 (13)	↓	Australia	10	0	4	3	17 (16)	D-
16 (14*)	↓	United States	10	0	6	0	16 (15)	D-
17 (18)	↑	Turkey	10	0	2	2	14 (4)	D-
18 (17)	↓	South Africa	10	0	2	1	13 (10)	D-
19 (19*)	-	Argentina	6	0	0	0	6 (0)	F
20 (19*)	↓	Saudi Arabia	0	0	0	0	0 (0)	F

In the latest review, European central banks – such as Banque de France, Banca d'Italia, and Deutsche Bundesbank – rank highest in the list. The highest rated non-European central banks (Brazil and China) also have strong results in research and advocacy, and monetary and financial policy.

The performance and activities of the central banks are quite diverse. The next four points present the sustainability measures of the four biggest central banks – the European Central Bank, the Bank of England, the People's Bank of China and the Federal Reserve – sorted by the scores they achieved in the Scorecard.

## 1.4 The Big Four among the central banks

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### 1.4.1 European Central Bank

Out of the four largest central banks in the Scorecard, the European Central Bank (ECB) scored the highest, taking a leading role in green central banking. The ECB's performance was substantially supported by the fact that the ECB recognized the importance of climate change early on and implemented climate-related measures. The ECB has three core objectives which steer its work on climate change: managing and mitigating the financial risks associated with climate change and assessing its economic impact, promoting sustainable finance to support an orderly transition to a low-carbon economy, and sharing their expertise to foster wider changes in behaviour (European Central Bank, 2022).

Drawing on the results of the Strategic Framework Review published in 2021, the ECB recognized that climate change has a significant impact on price stability and adopted an ambitious climate action plan to address this (European Central Bank, 2021). In this context, the ECB will continue to consider how to integrate climate considerations into the monetary policy framework and will also enhance analytical capacity in macro modelling by taking into account the impact of climate change. The ECB also takes climate considerations into account in its risk assessment, hedging framework, and corporate bond purchases. In the area of analytics, it is developing new indicators on a pilot basis to monitor the ecological footprint, green assets, and physical risk exposure of financial institutions. Following the Review, asset purchase



and acceptance as collateral for private sector securities require companies to meet certain sustainability criteria, resulting in treatment different from other assets. In the context of risk assessment, the ECB has been conducting climate stress tests since 2022 to assess the Eurosystem's exposure to climate risks. The ECB also considers the risks arising from climate change when assessing collateral. In its corporate bond purchases, the central bank reallocates purchases by taking into account climate protection criteria.

The ECB established a Climate Change Centre in January 2021. The Centre is responsible for coordinating, shaping, and managing the ECB's activities in different areas related to climate change. The aim is to integrate climate change considerations into the daily work of the ECB.

### **1.4.2 Bank of England**

Ranked in fifth place in the Scorecard, the Bank of England (BoE) is also a pioneer among the major central banks, as it was one of the first to adopt a sustainability mandate in 2021 to support the government in the transition to a net-zero economy (Bank of England, 2021b). The goal of the BoE's climate strategy is to ensure its policies and operations contribute to making the economy, the financial system, and the BoE itself resilient to the risks of climate change, while supporting the transition to net-zero emissions. The BoE aims to increase the resilience of the financial system against climate change by proactively assessing the exposure to both physical and transition risks (Bank of England, 2021a).

The BoE aims to integrate a climate-conscious approach into its financial supervision. The Bank of England's Prudential Regulation Authority (PRA) was the first to adapt climate-related risks in its prudential supervision. In 2019, the PRA set supervisory expectations on climate-related financial risks on the management of banks and insurers,

covering governance, risk management, scenario analysis, and disclosure. Since 2022, the PRA has incorporated sustainability guidelines into its supervisory expectations and made climate-related risks a core component of its supervisory approach (Bank of England, 2023).

The Bank of England is currently exploring the integration of climate-related topics across various domains. From 2020 onwards, the BoE publishes its climate related disclosure to promote transparency in climate-related issues, while actively participating in climate change related international cooperations and aligning its climate strategy with the latest guidelines. Furthermore, in the July 2022 Financial Stability Report, the BoE considered the potential relevance of other environmental risks to its primary objective. They concluded that the BoE should seek to build its understanding of how environmental risks could pose a potential threat to financial stability.

The Bank of England pledged to reduce the carbon intensity of its corporate bond portfolio, and hence the BoE launched a Corporate Bond Purchase Scheme. The BoE aims to reduce the weighted average carbon intensity of its corporate bond holdings by 25 per cent until 2025 and by 100 per cent until 2050. After the BoE gained its remit to support the government's net-zero objectives, the BoE announced that it would modify the eligibility for its corporate bond portfolio to include climate-related criteria. The new framework intended to require firms to publish public climate disclosures, public emission reduction targets for higher-emitting sectors and also to exclude firms with any coal mining activities. However, the Scheme was not aligned with the Paris Agreement, and consequently it was associated with 3.5 degrees of warming in 2020, despite the BoE's efforts (Bank of England, 2020). In 2022, the BoE decided to start reducing its corporate bond holdings, and then decided to fully unwind its corporate bond portfolio by April 2024 (Bank of England, 2022; Mann, 2023).

The BoE also aims to reduce the carbon footprint of its physical operations: in 2020, it set a target to reduce its absolute greenhouse gas emission by 63 per cent from 2016 to 2030, covering Scope 1, 2 and 3 emissions. This level of reduction is consistent with the goals of the Paris Agreement (Bank of England, 2021a).

### **1.4.3 People's Bank of China**

Ranked as sixth among the G20 central banks, the Chinese central bank, the People's Bank of China (PBoC) has made several important steps towards sustainability, although its extensive support for coal somewhat lowered its scorecard position. China's aim is to reach carbon neutrality by 2060 (IRENA, 2022) and the PBoC is actively contributing to this goal by using a range of tools, including targeted refinancing operations, among other things. The PBoC's green finance strategy is organized around the following pillars: 1) green taxonomy and standards; 2) disclosure requirements and financial supervision; 3) incentive and restraint mechanisms; 4) the innovation of green financial products; and 5) market systems and international cooperation (Green Central Banking, 2021a).

Among other initiatives, two structural monetary policy tools established in 2021 are remarkable: the Carbon Emission Reduction Facility (CERF) and a special central bank lending for the clean and efficient use of coal, which was extended until the end of 2023. The CERF provides 60 per cent of loan principals made by financial institutions for carbon emission cuts at a one-year lending rate of 1.75 per cent (Green Central Banking, 2021b). The targeted re-lending programme with an initial quota of RMB 200 billion (USD 29 billion) to make coal use cleaner and more efficient amid efforts for green and low-carbon development was also increased by another RMB 100 billion (USD 14 billion) in 2022 (State Council, 2022). According to the latest available data, at the end of June 2023, over RMB 700 billion

(USD 97 billion) was provided through these two facilities, which supported eligible lending from financial institutions in the amount of nearly RMB 1 trillion (USD 139 billion). This has resulted in emissions reductions totalling over 150 million metric tonnes of carbon dioxide equivalents (IPSF, 2023). The CERF was expanded until the end of 2024 (PBoC, 2023). Although the CERF and the lending programme aim at reducing emissions, the categorization of coal as green and its support via special lending cost the PBOC many points in the Scorecard.

#### **1.4.4 Federal Reserve**

The significance of the Federal Reserve (Fed) extends globally, shaping not only the economic stability of the United States but also playing a crucial role in international financial markets. Up until now, the Federal Reserve has maintained a cautious approach with regards to embracing green initiatives. Additionally, their commitment to market neutrality resulted in the fossil fuel sector being two times overweight in the Fed's scheme of indicators for debt outstanding, equity values, and employment (InfluenceMap, 2020). All of this is reflected in its sixteenth place ranking in the Green Central Banking Scorecard, although there has been a slow shift in the Fed's approach to climate-related issues in recent years.

The Fed joined the Network for Greening the Financial System in December 2020, contributing to international cooperation on climate-related central banking issues (Federal Reserve, 2020).

The Federal Reserve examines climate risks from a financial stability and supervisory perspective. The Fed has not taken green steps in its monetary policy so far, and they view climate risk as purely supervisory and prudential issue (Brainard, 2021).

Federal regulatory agencies issued principles in October 2023 for climate-related financial risk management for large financial institutions. The principles are intended to address financial institutions with USD 100 billion or more in total assets and take into account both physical and transition risks. The principles aim to help large financial institutions to incorporate climate-related financial risks into their risk management framework (Federal Reserve, 2023).

## 1.5 The MNB's voluntary scoring

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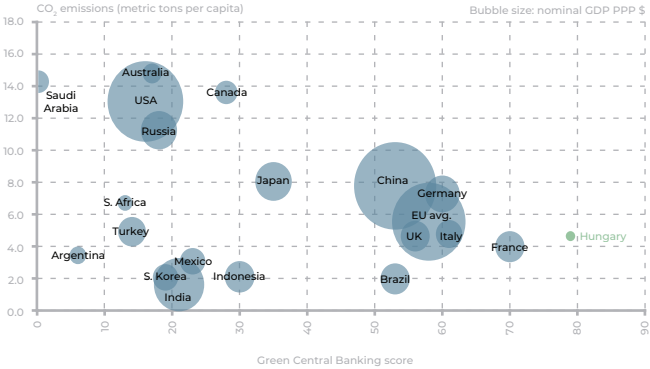
Despite not being a G20 central bank, using the publicly available methodology of the Green Central Banking Scorecard, the MNB took it upon itself to voluntarily assess its green policies and compare its performance to the G20 countries ranked in the Scorecard in order to see where it could further improve.

The results are striking: the MNB scored higher than any G20 country, due to its monetary and financial policy results. Its assessment was checked and validated by Positive Money, which conducts the research and analysis for the Scorecard.

The result reinforced the MNB's belief that the strategy of focusing on such actions is right, as the MNB scored higher than any other G20 country. As the analysis showed, some initiatives, such as the Green Preferential Capital Requirement programme, are very unique (Green Central Banking, 2024).

Figure 10 shows the scores of the central banks in the Green Central Banking Scorecard in relation to the respective countries' emission intensity and nominal GDP. Although far-reaching conclusions should not be drawn, it shows at least that some countries such as France and Hungary, excel both in green central banking performance and low environmental burden.

**FIGURE 10:** Central bank scores in the Green Central Banking Scorecard in relation to the respective countries' emission intensity and nominal GDP  
 Source: MNB calculations based on World Bank, Green Central Banking, 2024



The MNB is pressing forward on all fronts: besides fulfilling their core functions, all of the Bank’s units are on the lookout for opportunities to integrate green initiatives and have done so in the past. The following section describes the areas in which the MNB has excelled and presents a set of potential actions by which the MNB can further improve in the future.

## 2 THE MNB'S GREEN MONETARY POLICY TOOLKIT STRATEGY

### 2.1 The importance of green monetary policy instruments and the MNB's Green Monetary Policy Toolkit Strategy

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Without sustainability, the successful development of Hungary is not achievable. It is crucial to establish and maintain equilibrium for the state, businesses, and the environment alike. The banking system is a fundamental pillar of financial sustainability: it serves as a key intermediary and creator of financial resources and assets and plays a vital role in achieving balanced growth. In addition to a competitive and efficient banking system, the capital market, FinTech financing, and institutional investors are essential elements to ensure stable financing and growth across sustainable economic cycles (Matolcsy, 2022). The idea of environmental sustainability and climate protection is also embedded in the Fundamental Law of Hungary. As a constitutional right, the law declares that Hungary shall recognize and endorse the right of everyone to a healthy environment (Article XXI. (1)).

The MNB's policy-making scope is framed by its statutory mandates. The central bank's primary mandate is to achieve and maintain price stability. Without compromising its primary mandate, the MNB also aims to fulfil its other mandates, namely ensuring the stability of the financial system, and supporting the government's economic policies. As discussed in detail in the previous section, the



support of the government's environmental sustainability policy was recognized as an additional task in relation to this mandate by the National Assembly on 28 May 2021 (MNB 2021a). This has created the opportunity for the MNB to deliberately incorporate green considerations in the implementation of its monetary policy in consistence with the above aspects. It is important to emphasize that – in accordance with the hierarchy of tasks defined in the central bank law – the central bank can only support environmental sustainability without jeopardizing its primary goal of price stability.

The foundations of the central bank's pioneering approach were laid out in the Green Monetary Policy Toolkit Strategy announced on 6 July 2021 (MNB, 2021b). This strategic document provides a unified framework outlining possible directions for the MNB to integrate climate protection and environmental sustainability aspects into its monetary policy toolkit. The document highlights six strategic objectives for the MNB:

- 1) Contributing to a sustainable economic transformation,
- 2) Supporting the achievement of climate goals,
- 3) Enhancing climate awareness in the financial system,
- 4) Shaping consumer and societal attitudes,
- 5) Promoting the adoption of best practices,
- 6) Assessing the climate exposure of monetary policy tools.

Along with publication of the strategic document, two new programmes were announced in July 2021. As the new stage of the Funding for Growth Scheme (FGS), the Green Home Programme was launched to stimulate

mortgage lending with energy efficiency requirements by targeted refinancing operations. Furthermore, the Green Mortgage Bond Purchase Programme (GMBPP) aimed to lay down the foundations of a new market segment, while also indirectly supporting green mortgage lending in the Hungarian market. These initiatives focused on the housing market, which is of paramount importance both from environmental and conventional policy perspectives. These programmes are presented in detail in the following subsections.

Among researchers, there is now a broad consensus that energy efficiency is one of the most cost-effective tools for achieving climate goals, as it exerts its impact through energy savings and emission reductions, leading to numerous favourable cascading effects. (Koritár et al., 2021). Over the last decade, Hungary's energy dependence has stagnated at around 60 per cent and shown little decrease. It then surged to above 75 per cent in 2022 during the European energy crisis, which meant that more than three quarters of total energy use in Hungary came from energy imports in 2022 (MEKH, 2023). Improving energy efficiency will also reduce the country's energy dependence, which is coming to the fore as geopolitical tensions rise. Between 2010 and 2020, Hungary's energy dependence surpassed the mean of the other Visegrád countries by 13 percentage points on average, aligning with the EU average. Despite a more than 20 per cent reduction in energy demand per unit of output in Hungary between 2010 and 2020, the energy intensity of the Visegrád countries as a group was 1.8 times higher than the EU average in 2021 (MNB, 2022b).

Approximately 30 per cent of energy consumption in Hungary is linked to household consumption, with the majority – more than 70 per cent – arising from the heating and cooling of residential properties, and only 30 per cent related to transportation (MEKH, 2023). In light of this, it is not surprising that the first central bank measures

were directed at the housing market. A study from 2021 provides empirical evidence that there is a significant premium in the prices of Hungarian residential properties for their energy rating. Based on the authors' results, the price difference of the best energy certification categories is higher than 50 per cent, but moving up just one or two categories from the worst can already result in a tangible price difference (Ertl et al., 2021). This means that improving energy efficiency also creates added value financially.

Additionally, the recently increasingly researched Green Hypothesis suggests that the underlying green mortgages have a more favourable risk profile. According to the hypothesis, green mortgages secured by energy-efficient properties have lower credit risk than other loans. Two supporting arguments for the hypothesis: firstly, residents of green, energy-efficient properties are likely to have higher disposable income, and thus higher repayment capacity due to lower utility costs, reducing the probability of loan default. Secondly, in the long term the value of green properties is expected to be more resilient, due to increasing demand and stricter regulations, making the collateral for mortgages potentially enforceable at a higher value in the event of default. Various studies, including ones from the UK and Hungary, support this hypothesis, although there are challenges due to the numerous factors influencing loan repayment (Guin et al., 2022; Ertl et al., 2021).

## 2.2 Green turnaround in the domestic housing market – Results of the FGS Green Home Programme

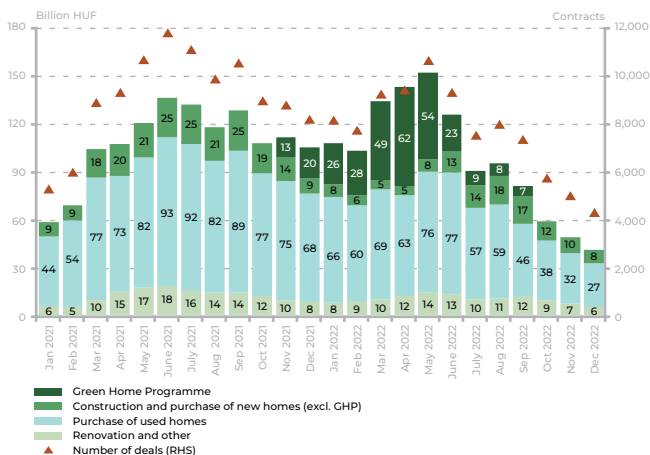
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In its strategy, the MNB set itself the objective of supporting a sustainable economic transformation. There is also a focus on increasing the climate-awareness of the financial system to achieve climate goals. The housing loan market was an appropriate starting point for the enforcement of environmental sustainability aspects. Neither the green aspects of mortgage loans nor the energy efficiency of the underlying residential properties were represented in the pricing frameworks. In the autumn of 2021, the MNB launched the Green Home Programme (GHP), as part of the Funding for Growth Scheme (FGS), with a volume of HUF 200 billion. As in previous phases of the FGS, in the GHP the MNB provided credit institutions with refinancing funds at a 0 per cent interest rate, which they could lend on at a maximum 2.5 per cent interest rate. The programme allowed loans to be granted for the purchase or construction of energy-efficient new flats and single-family homes for own housing, up to a maximum amount of HUF 70 million and a maximum term of 25 years (MNB, 2021b).

Favourable conditions and the widespread promotion of the programme played a significant role in the sharp increase in demand for Green Home Loans and a surge in loan applications in the first months of 2022. In the spring of 2022, nearly 90 per cent of the loan volume issued for the purchase and construction of new dwellings was already linked to the GHP (Figure 11). In response to strong household demand for green loans, the Monetary Council increased the overall amount of the programme by HUF

100 billion to HUF 300 billion at its meeting on 5 April 2022, while tightening the energy requirements<sup>3</sup> (MNB, 2022c). As a result of the continued strong demand for the programme, the increased allocated amount of the GHP was essentially exhausted by the end of spring 2022, and therefore only a small part of the related contracting was postponed to 2022 Q3.

**FIGURE 11:** New housing loans to households in the credit institution sector  
Source: Winkler, 2022



The refinancing programme was closed with almost full utilization. House buyers took out around 56 per cent of the contracted volume, totalling HUF 163 billion so far for the construction or purchase of houses (including detached houses, semi-detached houses, terraced houses) (Figure 12), 56 per cent of which were located in rural areas. The average loan amount for house-type properties was HUF 35 million. 44 per cent of the loans were linked to flats, 70 per cent of which were for housing under construction and 30 per cent

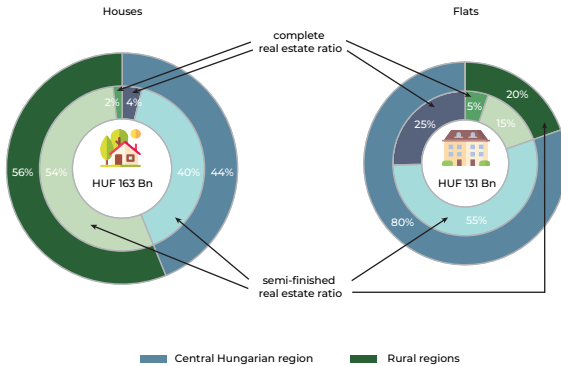
<sup>3</sup> In addition to the unchanged requirement for category BB, the upper limit for the primary energy use of a property has been reduced from 90 kWh/m<sup>2</sup>/year as set at the start of the scheme to 80 kWh/m<sup>2</sup>/year.

for completed flats. 80 per cent of the financed flats were linked to the Central Hungary region, and the average loan for flats was around HUF 34 million.

**FIGURE 12:** Distribution of the contracted volume under GHP by property type, stage of completion and region

Source: Winkler, 2022

Note: In the house category, detached houses and semi-detached/terraced houses were identified. Other types of real estate were not categorized.



In respect of energy efficiency, a significant portion of the real estate financed under the GHP outperformed the maximum 90 kWh/m<sup>2</sup>/year required in the programme, which was amended to a maximum of 80 kWh/m<sup>2</sup>/year from 19 April 2022. The energy rating of 85 per cent of the properties financed so far is already known, of which 81 per cent have an energy rating of BB, while 19 per cent have an energy rating more favourable than BB (Figure 13).

**FIGURE 13:** Distribution of properties financed under the GHP, by energy class

Source: Winkler, 2022

Note: Banks only need to report the energy rating of the property after the completion of the energy certification of the property.

Based on data provided up to 29 December 2023.



By launching the GHP, the MNB's aim was to promote the establishment of a green housing loan market and the enforcement of environmental sustainability aspects in the Hungarian housing market. The programme played a prominent role in the sector in 2022, helping around 8,600 households to build or buy an energy-efficient home with the help of favourable loans.

## 2.3 Facilitating the development of a green mortgage bond market in Hungary

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As part of the Green Monetary Policy Toolkit Strategy, the MNB launched its Green Mortgage Bond Purchase Programme in August 2021. The result of this pioneering initiative was the creation of the domestic green mortgage bond market and thus support for green mortgage lending. Green covered bonds, backed by energy-efficient properties, contribute to the modernization of the housing stock and help to achieve climate goals. Green covered bonds offer banks secure, long-term funding with lower risk than unsecured bonds. By issuing these securities, mortgage banks commit to refinancing a portfolio of green mortgages having at least the same volume as the funds raised through the securities, fostering a preference for energy-efficient property financing.

The fundamental goal of the Green Mortgage Bond Purchase Programme was to establish the domestic green mortgage bond market and promote best practices through targeted purchases. Within the programme, the MNB conducted transactions both in the primary and secondary markets. The primary market purchases aimed to stimulate and support the issuance of new securities, while the presence in the secondary market served liquidity and market maintenance purposes. In terms of magnitude, the central bank's presence was more pronounced in the primary market, where the MNB submitted bids for up to 40 per cent of the quantity to be issued. Within the programme, the MNB set the limit of ownership ratios at



50 per cent in the outstanding securities within a certain green mortgage bond series.

The MNB has established various requirements for programme participation to bolster the designated strategic goals. The MNB purchased only publicly issued Hungarian mortgage bonds, denominated in HUF with fixed interest rates and a minimum original maturity of 5 years. Participation required adherence to one of the two internationally recognized green bond standards – the Climate Bonds Standard by the Climate Bonds Initiative (CBI) or the Green Bond Principles of the International Capital Market Association (ICMA) – with externally certified compliance.

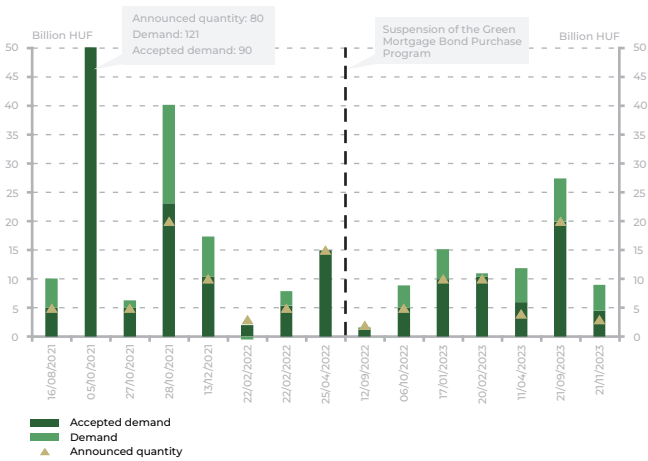
While the ICMA Principles and Guidelines encompass various types of sustainable bonds, the CBI Standard specifically targets the issuance of green bonds, green loans, and green debt instruments. These initiatives aim to define the nature, scope, and characteristics of the sustainable bond instruments globally, providing a framework for identifying, financing, monitoring, and reporting the impact of eligible projects funded by the proceeds.

To emphasize transparency and sustainability, participation conditions were extended to client disclosure and annual public reporting. The programme aimed to shape and encourage environmentally conscious consumer behaviour. Additionally, issuers committed to present annual reports on the issued green mortgage bonds, the characteristics of the underlying properties, and the environmental impact of the issuances. To support market transparency and liquidity, the conditions mandated the listing of mortgage bonds on the Budapest Stock Exchange and regular pricing. Compliance was also mandatory for mortgage bonds issued via refinancing agreements.

After the programme review on 5 April 2022, the MNB decided to suspend purchases due to changes in its monetary policy stance. Having successfully achieved its initial objectives of establishing the foundations of the new domestic market segment, the central bank's role shifted towards encouraging the issuance of higher-quality green mortgage bonds.

Since the Green Mortgage Bond Purchase Programme, the domestic green mortgage bond market has continued to develop in Hungary (Figure 14). The programme catalysed the issuance of green bonds, with significant participation from all five active domestic mortgage banks. Over HUF 238 billion worth of green mortgage bonds have been issued so far, representing 11 per cent of the entire HUF-denominated mortgage bond market. With an average value of 9.1 years, the typical initial maturity period for green mortgage bonds exceeds that of non-green issuances (7.2 years) and the European green mortgage bond market (6.4 years). Compared to similar peer groups, it appears that only Hungarian green mortgage bonds were issued with notably longer maturities (Bécsi et al., 2022). Despite strong demand, the investor base has not significantly diversified from non-green issuances, with domestic banks and the MNB remaining the primary buyers. The MNB, having purchased nearly HUF 61 billion worth of green mortgage bonds over the course of the programme, mainly on the primary market, continues to support the market through other measures.

**FIGURE 14:** Timeline of green mortgage bond issuances since the start of the Green Mortgage Bond Purchase Programme (GMBPP)  
Source: MNB, 2024



Looking ahead, increased participation from other investors is expected, driven by the growing role of green investment forms and the potential involvement of foreign investors. In addition to using active lending instruments, the central bank also supported the greening of the real estate market as a regulator.

The policy consideration of the Mortgage Funding Adequacy Ratio (MFAR) regulation is to ensure stable, long-term financing of residential mortgage loans within the banking system through mortgage-based funding. This regulation was implemented by the MNB starting 1 April 2017. The MFAR requirement stipulates that banks secure a minimum of 25 per cent of their residential mortgage loan portfolio using mortgage-based funds, such as mortgage bond issues or refinancing loans from mortgage banks. Funds backed by mortgages are regarded as a stable, long-term financing method with relatively low costs, due to their favourable risk rating. This enables

credit institutions to mitigate on-balance-sheet maturity mismatches on advantageous terms and address interest rate risk, particularly with the increasing prevalence of loans featuring longer interest rate fixation periods.

The MNB adjusted the MFAR regulation on 1 July 2021, aiming to foster the growth of the green mortgage bond market. This modification allows the MFAR to serve as a significant regulatory incentive for green mortgage bond issuances – with the preferential treatment of green mortgage bonds in the MFAR calculation – while maintaining the original financial stability objectives. The requirements for the green funds feature the same terms and conditions as those in the Green Mortgage Bond Purchase Programme.

The MNB's green initiatives can be delineated into two main categories. The measures presented earlier in this section are oriented towards promoting the green transformation of economic actors and processes. In the second category, one finds initiatives directed at the institutional operations of the MNB, with the overarching objective of steering the central bank's operations towards sustainability by integrating green practices into its operational processes.

## 2.4 Collateral management

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One integral component of the traditional monetary policy toolkit is the use of secured credit instruments, which play a crucial role in facilitating liquidity provision to the banking system, having significance in both expansive and contractionary monetary policy contexts. In recent years, there has been growing demand for the incorporation of environmental considerations into collateral management associated with central bank loan instruments, with increased emphasis by both central banks and the market. The MNB adopts a fundamentally proactive stance toward climate risk matters, a perspective that extends to collateral management as well.

To ensure the sufficient liquidity of the banking system, the MNB extends secured loans to its partner banks. While the interest paid on these loans serves as one channel of monetary transmission, the MNB can also incentivize lending activities within the banking system by offering preferential loans, as exemplified by the FGS. The acceptance of collateral serves the dual purpose of minimizing the MNB's own risk associated with lending activities and aligning the framework with the considerations of monetary policy, risk management, and operational efficiency. The MNB employs various types of collateralized credit instruments, managing them through pool-based, consolidated collateral management, and applying specific haircut values tailored to each type of collateral.

Within the collateral management framework of the MNB, the inclusion of green securities as collateral had already been established. However, in line with

the global central banking community, the MNB continuously evaluates potential amendments to the collateral management framework. This analysis led to the formulation of both immediate short-term measures and concrete longer-term objectives.

As part of the Green Monetary Policy Toolkit Strategy, the MNB launched a pioneering initiative by incorporating climate risk considerations into the collateral management framework (MNB, 2021b). This integration of sustainability aspects into collateral management has the potential to impact the functioning of the framework in various ways: (1) supporting sustainability goals; (2) improving risk management; (3) development of the market for green securities instruments; (4) establishing and consolidating reporting structures related to climate risks.

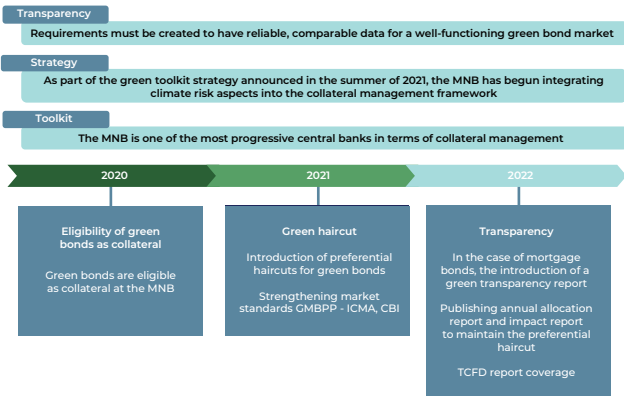
To prudently handle risks associated with collateral management, the MNB employs a conservative approach in delineating the collateral scope and implementing haircuts. The MNB adjusts the haircut value based on the market, credit or liquidity risk associated with a given asset class, with higher risks warranting higher haircuts. The integration of green aspects into the collateral management framework is effectively achieved through the application of preferential haircuts. In terms of monetary policy, these preferential haircuts for green securities can foster their issuance and contribute to market development. From a risk management perspective, green bond issuers may exhibit lower bankruptcy risk, and asset price volatility could be reduced, particularly in relation to more moderate transition risks, potentially enhancing their resilience in stress scenarios.

In September 2021, the MNB was one of the first central banks to implement a haircut discount of 20 per cent, capped at a maximum of 5 percentage points, specifically for green bonds. This adjustment was a proactive move to endorse the green bond market, while acknowledging

the favourable risk attributes associated with green bonds (Figure 15), (MNB, 2022d).

As a subsequent initiative to foster the growth of the domestic green securities market and promote industry best practices, the MNB opted for supplementary measures aimed at enhancing transparency in September 2022. Within this framework, the previously introduced discount haircut may be employed in the future, contingent upon the fulfilment of various transparency conditions. To incentivize non-green issuers, starting October 2022, the MNB extended preferential haircuts to non-green securities, provided their issuers have published a climate risk report. The objective of these transparency-driven advancements is to enhance the clarity of green financing mechanisms, consequently contributing to the development of domestic reporting standards. In accordance with this amendment, the issuer is required to: (1) publish an annual allocation and impact report on the issuer’s website; (2) for mortgage bonds, the issuer is obligated to publish a transparency report on its website and a climate risk report, commencing in the fourth quarter of 2022.

**FIGURE 15:** Timeline of collateral management’s greening  
Source: MNB, 2022a



## 2.5 The MNB's Charter of Sustainable and Responsible Investment

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The MNB published a Charter of Sustainable and Responsible Investment in November 2023 to integrate environmental sustainability considerations into foreign exchange reserves management as widely as possible (MNB, 2023). In the Charter, the Bank expressed its commitment to make reserves management more sustainable from an environmental point of view and set medium and long-term objectives for green reserves management without conflicting with conventional reserves management goals. In addition to functioning as a compass for foreign exchange reserves investment strategy in relation to integrating green considerations, the document can serve as an example for financial market participants and contribute to the development of the market.

In the Charter, the MNB set out objectives and guidelines for reserves management based on four pillars: measurement, investment strategy, transparency/active engagement, and monitoring. The MNB monitors relevant environmental sustainability factors, and criteria and, where possible, integrates them into investment processes, bearing in mind the triple objective (liquidity-safety-return) of reserves management. In addition to the expected improvements in data quality and availability, the commitments in the Charter also included a more comprehensive analysis of the climate impact of investing reserves and the active role the Bank plays in supporting market development. In the long term, the aim is to ensure that reserve portfolios are decarbonized as much



as possible, while taking account of the primary objectives and requirements of reserves management.

The specific way in which some elements of the Charter will be implemented will largely depend on future developments in data quality and availability. Accordingly, the MNB will closely monitor the development of sustainable and responsible investment practices, regularly review the commitments and objectives set out in the Charter, and, if necessary, supplement and amend such in the light of the changing market environment.

### **2.5.1 Green bond portfolio in foreign exchange reserves**

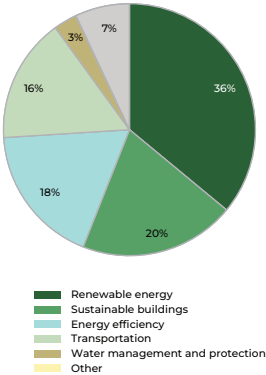
The Charter serves as the strategic framework for the incorporation of environmentally sustainable practices into reserves management. In consideration of this, the MNB has already taken the first steps to integrate climate risk aspects into reserves management activities.

The increase in environmental risks and the focus on economic policy put new financial instruments on the investment map, supporting optimal capital allocation, and one of the most dynamically developing asset classes is green bonds. In 2019, the MNB was one of the first central banks to start building a dedicated green bond portfolio with a target value of EUR 250 million. This portfolio can encompass green-labelled bonds adhering to international green standards and general reserves management guidelines, wherein the proceeds are directed towards specific environmentally beneficial investments, emphasizing energy efficiency. While neither the structure nor the size of the portfolio significantly impacts the financial performance of reserves management, the MNB actively works to meticulously understand the structure of this market segment in the course of its management activities.

After establishing the green bond portfolio, it is also crucial to track the positive environmental outcomes resulting from the investments. The MNB actively monitors the annual positive environmental impact stemming from green bond investments. Publication of this information serves the dual purpose of transparency and setting a good example, surpassing the conventional focus on financial performance. In 2022, the MNB achieved a significant impact with the portfolio, avoiding approximately 73,000 tons of CO<sub>2</sub> emissions—roughly equivalent to the annual carbon footprint of a small Hungarian settlement (Paulik-Tapaszti, 2023).

The elements of the green bond portfolio support multiple sustainable goals. The areas covered include renewable energy, energy efficiency, sustainable buildings, transportation, and water management and protection (Figure 16).

**FIGURE 16:** Distribution of the funded sustainability objectives of the MNB's green bond portfolio  
Source: Paulik-Tapaszti, 2023



Aligned with the statutory objectives of the MNB, encompassing both direct and indirect support for environmental sustainability, in 2023 the dedicated green bond portfolio was doubled to EUR 500 million pursuant to the decision of the Monetary Council. This expansion of the green bond portfolio seamlessly integrates with the MNB's Green Programme, as presented in Section 7, which is designed to mitigate risks associated with climate change and other environmental challenges (MNB, 2019). The programme further seeks to enhance domestic green financial services, increase the knowledge base related to sustainability, and further reduce the ecological footprint of financial entities and the central bank itself.

## 2.6 The MNB's Climate-Related Financial Disclosure

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### 2.6.1 Transparency as a key element in green transition

While there are various solutions for the green transition, measurement is without doubt an essential step in the process. Measurable data are necessary for building strategies, setting targets, and evaluating the impacts of actions taken. Creating and promoting transparency in the field of the green transition is one of the cornerstones of tackling climate change.

In 2022, the MNB published its first Climate-Related Financial Disclosure, leading by example among central banks and domestic financial institutions. The aim of the report is to identify, measure, and publish climate risks related to the MNB's operational activities and financial instruments as widely as possible in a transparent manner. In preparing the disclosure, the MNB relied primarily on the recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) established by the G20 Financial Stability Board. The MNB considered existing international practices and the specific characteristics of its financial portfolios as well, when measuring climate risks.

In the report, the Bank analysed the climate risk exposure of its financial asset portfolios according to the two main climate-related risk categories, namely transition and physical risks, broken down by portfolios, presenting indicators commonly used in international practice. The analysis was supplemented by its own estimates

and forward-looking analysis for some asset categories to gain a broader understanding of the climate risks and opportunities in the portfolios.

Based on the MNB's Environmental Strategy announced in 2020, the bank shifted to carbon-neutral operation from 2021. In implementing this strategy, the MNB

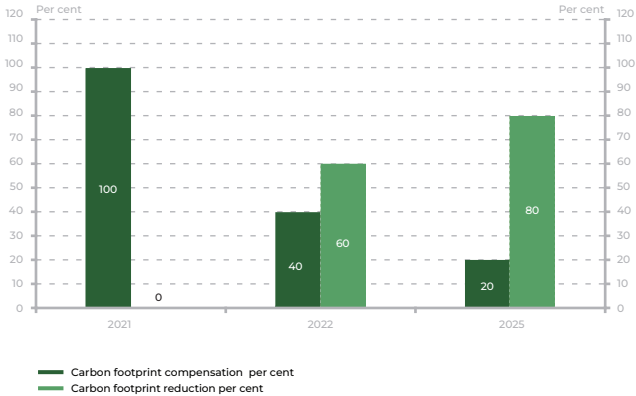
- 1) fully neutralized its 2020 carbon emissions related to its operational activities by offsetting these in 2021 through its participation in a domestic habitat restoration project;
- 2) installed a solar PV system in its Logistics Centre; and
- 3) ensured that 50 per cent of the electricity used in the office buildings serving the MNB's operations comes from renewable sources (MNB, 2020).

Additionally, the bank undertook to reduce its operational carbon footprint by 30 per cent by the end of 2022 (based on 2019). This commitment was already achieved at the end of 2021 as shown in Figure 17. Thus, renewing its commitment, the MNB pledged to reduce its carbon footprint by 80 per cent by 2025 (baseline 2019), which it plans to achieve mainly through the installation of photovoltaic systems and 100 per cent renewable energy for the electricity supply of its buildings (MNB, 2022e).

**FIGURE 17:** Analysis of the carbon footprint of the MNB's own operations

Source: MNB, 2024b

Note: The MNB set a target to reduce its operational carbon footprint by 30 per cent by the end of 2022. This goal was exceeded, with a 60 per cent reduction and the new target is 80 per cent by 2025, versus a 2019 baseline.



Climate-related financial disclosure is a relatively new task for central banks, but the MNB's report, with its wide scope, demonstrates that the challenge can be overcome, thereby providing an example for the participants of the domestic financial sector.

### 3 The MNB's Green Programme

The Green Programme of the Magyar Nemzeti Bank celebrates its 5<sup>th</sup> anniversary in 2024. Although the concept of environmental sustainability significantly appreciated after the Paris Agreement, five years ago it was still quite unconventional for a central bank to venture into this territory. The Magyar Nemzeti Bank however was among the first financial institutions globally which understood that climate change and environmental degradation have the real potential to negatively influence price stability, financial stability, and sustainable economic development. This insight highlighted that sustainability is related to the core mandates of the central bank. These mandates, with price stability as a priority, can only be ensured in the medium to long term, if sustainability becomes a part of the central bank's agenda. The first comprehensive agenda was the MNB Green Programme, which was approved by the MNB's Financial Stability Board in early 2019 (MNB, 2019). The Green Programme aimed to identify and strategically orientate the MNB's future sustainability-related actions in the domains of financial supervision and operational setup.

Five years ago, the Hungarian financial markets only sporadically showed signs of considering environmental sustainability. The landscape was difficult as the established supervisory techniques did not provide the MNB with visibility of the actual situation and the level of exposure to climate-related and environment risks. Nevertheless, the financial sector's exposure to high carbon risk industries could obviously be detected, both in the credit and capital

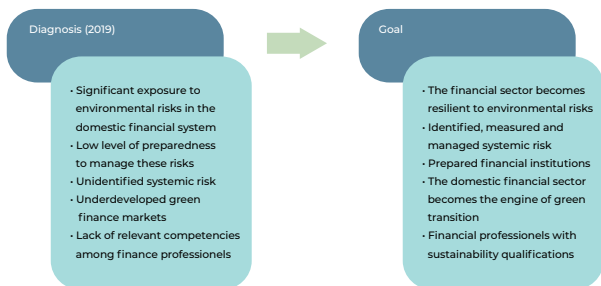
markets. Financial institutions lacked a fundamental understanding of sustainability risks in general and in relation to their own operations as well. For the same reason, the MNB was not in a position to reliably assess the systemic nature of this issue. Supply and demand for green finance instruments were non-existent. Meanwhile, the green transition as a new long-term trend, and the global and European development of sustainability regulations were already appearing on the horizon (Gyura et al., 2023).

The potential failure or success of the green transition raised numerous questions. What risks do the physical effects of climate change and other environmental anomalies pose to the stability of the Hungarian financial system? How can the green transition impact economic and financial performance, i.e. the value and risk of loans and investments, and thus the capital situation of financial institutions? Even if we realize that prevention is the best risk management approach, how can the actors of the Hungarian financial system be encouraged to green their balance sheets and thus support the necessary green investments? (Gyura et al., 2023).

The Green Programme aimed not only to answer these questions, but also to enable the reliable identification, measurement, and management of climate-related and environmental risks and to build resilience in the Hungarian financial sector against such risks. The knowledge and will to cope with these challenges needed to be built up, and the potentials of the financial sector to drive and lead these changes needed to be explored.

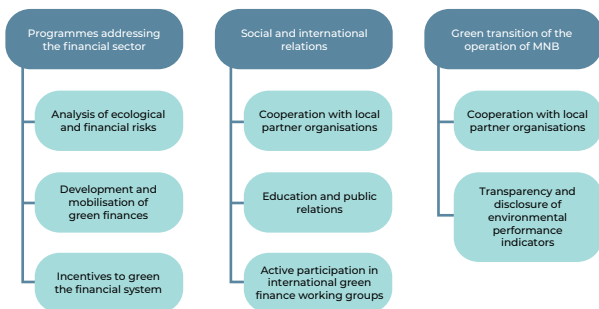


**FIGURE 18:** Starting situation and main goals of the MNB Green Programme  
Source: Gyura & Kolozsi, 2022



To address these deficiencies, the MNB's Green Programme was built on three pillars. In the first pillar, the MNB – as the financial regulator and supervisor – took measures to improve the resilience of the financial sector, to identify its exposure to environmental risks, and to develop domestic green finance markets. In the second pillar, the MNB focused on green finance capacity building, engagement and international collaboration and invested in the development of the green ecosystem. In the third pillar, the MNB aimed to reduce its own environmental impact and established high level transparency practices.

**FIGURE 19:** Pillars of the MNB Green Programme  
Source: MNB, 2019



## 3.1 Programmes addressing the financial sector

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### 3.1.1 Analysis of ecological and financial risks

Sustainability risks have a special nature that traditional financial mindsets and techniques can only handle with difficulties. Climate change and irreversible, large-scale, life-threatening degradation of the environment is a process for which we have almost no historical observation. From a historical perspective, climate change is not unprecedented, but a reliable dataset tracking these effects on societies is not available. Moreover, the pace of the current change and the complexity and connectivity of today's economies and societies cannot be compared to anything before. Nevertheless, just because something has never been happened before does not mean it is impossible. Consequently, the MNB moved to apply innovative research approaches and to develop new tools to assess climate and environmental risks in Hungary.

These new analyses include an assessment of the greenhouse gas (GHG) intensity of the corporate portfolio of credit institutions, to measure the transition risks that can arise from regulatory, supplier network, investor, and consumer changes stemming from the economy's efforts to transition to carbon-neutral operations. Based on the methodologies published by the MNB (Bank Carbon Risk Index, Climate Risk Grid), credit institutions are able to carry out climate risk assessment for their own portfolios (MNB, 2023a). In addition, the MNB is continuously developing its GHG intensity calculation to make use of actual and granular data even more. These tools assist the MNB in measuring and tracking the amount of credits granted to

sectors with high transition risks which provides a proxy for the transition dynamics for each credit institution, helping to identify priorities for supervisory reviews.

Additionally, the MNB introduced climate stress tests to identify climate risk hot spots in the Hungarian banking sector. The first long-term climate stress test was conducted in 2021, concluding that a successful green transition would benefit Hungary's overall economic performance. In 2023, this was supplemented with a short-term stress test that modelled the potential impact of a carbon price shock, highlighting that the climate risk profile of the banking books is an important risk management perspective. While long-term climate stress tests model macroeconomic relationships along different transition pathways, short-term exercises can be useful to identify institution-specific transition risks as part of the micro prudential supervision (MNB, 2023a).

Another long-term climate stress test was prepared for the asset-side of the insurance sector in the course of 2023. Transition risks may have a negative impact on the prices of securities held by insurers. The conclusion of the stress test was that in the long run, the value of the government securities portfolio, which accounts for the vast majority of insurers' portfolio, will be highest in the case of an orderly green transition (MNB, 2023a).

Beyond climate risk, the MNB also launched a research project to map and assess financial risks resulting from biodiversity degradation and to develop financial supervision methodologies for the management of such risks. The project started in September 2022, and in addition to the MNB, experts from the OECD and the European Commission are also participating in the project, which will be implemented through the financing of the EU Technical Support Instrument and will end in 2024 (MNB, 2023a).

### **3.1.2 Development and mobilization of green finances**

Hungary's sustainability turnaround will require significant investments and financing options need to be provided for this. Prior to 2019, environmental sustainability as a criteria or purpose in lending or investment barely appeared in the domestic financial system. Before the Green Programme, it was not usual at all for banks to lend to green projects with dedicated green loans on favourable terms. Similarly, in the insurance or capital markets sustainability-themed investment products were present only sporadically and with very small stocks. Starting from this, the idea arose relatively quickly that the MNB would also use regulatory tools to encourage green financing (Gyura et al., 2023).

Since early 2021, the MNB has been operating its Green Preferential Capital Requirement Programme, which is a first-of-its-kind capital regulation in the world. The programme is dedicated to directing capital flows into environmentally sustainable economic activities and managing the banking sector's exposure to transition risks. This programme supports the growth of green financial products in two schemes:

- 1) it supports the financing of the energy efficiency improvements of the Hungarian residential building stock; as well as
- 2) green corporate and municipal lending, i.e. loans for renewable energy production, the installation of energy storage equipment, the development of electricity transmission network, greening district heating systems, loans for electric mobility including the development of the charging infrastructure, the acquisition of stakes in green companies, ecological agriculture, sustainable commercial real estate, and energy efficiency investments.

The programme also covers green bond exposures and other exposures originated under green lending frameworks (MNB, 2023b-c).

The programme allows voluntarily participating banks to release a part of their regulatory capital requirements after their green loans in the second pillar of the banking capital regulation. Even today, the application of modified capital requirements on the basis of sustainability risks qualifies globally as a bold policy approach, but the MNB's experience was positive in the first three years of the programme. Not only because the volumes qualifying for the programme rose dynamically to HUF 737 billion by end-September 2023, but also because it serves as a relatively strong green finance standard in Hungary. Beyond its quantitative results such as steadily increasing volumes, diversifying utilization, and the contribution to CO<sub>2</sub> emission avoidance, it has a beneficial impact on qualitative developments such as the establishment of proprietary green financing frameworks by the credit institutions themselves. All of these results prove that financial institutions are able to internalise the green agenda when appropriate and responsible regulatory leadership is present.

Another area where Hungarian financial institutions are supported in their sustainability agenda by the MNB is the formulation of sustainability related supervisory expectations. The MNB published the first issue of its climate and environment risk related guide – the so-called Green Recommendation – for credit institutions in April 2021. Further to this, the MNB conducted a prudential review in the following months when banks were expected to run a self-assessment process and create a green action plan. At that time, Hungarian banks achieved a compliance rate of around 25 per cent, which was a low but regionally typical level of preparedness. Later, having built on a more precise view of possible future legislative developments and with the purpose of harmonization with relevant European

banking regulation items, the MNB issued a second release of the Green Recommendation in August 2022 (MNB, 2022). This new guide included a detailed elaboration of the expectations and set three consecutive deadlines to comply with these expectations. The MNB has treated compliance with the Green Recommendation as priority ever since then, and therefore from early 2023 onwards, it was integrated into the comprehensive supervisory reviews (MNB, 2023a). This practice is again still not yet widespread among financial supervisors.

A similar Green Recommendation was issued for the domestic insurance companies in late 2023 on the identification, management, and disclosure of climate change and environmental risks, as well as on the integration of environmental sustainability aspects into business activities (MNB, 2023e). Insurers obviously have a key role to play in the transition to a low-carbon and sustainable economy, while their solvency is exposed to significant risk if the transition fails and physical risks are exacerbated. The MNB's new supervisory expectations will enter into force from 2025 in consideration of keeping the domestic insurance sector on a sustainable track.

Capital markets are also exposed, and the transition to a climate-neutral economy will also require significant private investments. Consequently, the use of sustainable investment products is inevitable. Within the framework of the Green Programme, the MNB developed several tools to support regulatory compliance, visibility, and the utilization of the sustainable investment products. When the new European regulation on sustainable finance disclosure was introduced, the MNB issued a management circular to ease its domestic implementation. In order to support the uptake of green bonds, the MNB issued a Green Bond Issuance Guide as a technical support for the development of frameworks for Hungarian issuers (MNB, 2023a). The MNB has also been pursuing a strict but constructive policy in

the regulatory approval procedures for new sustainability-related investment funds. Additionally, since mid-2023, the MNB's capital market comprehensive supervisory process covers the control of compliance with the relevant European risk management and disclosure regulation.

Compared to other EU countries, Hungary still lags behind in terms of both the penetration and awareness of these products. For the sake of better transparency and marketing of green retail investment products, the MNB setup an online platform for green financial products available in Hungary. The Green Financial Product Finder focuses on investment funds, asset funds underlying life insurance policies, and voluntary pension fund products with ESG and sustainability features. This online tool enables consumers to find the most suitable investment product according to their sustainability preferences (MNB, 2023a).

### **3.1.3 Incentives to green the financial system**

In addition to strong regulatory and supervisory measures, the Green Programme aimed to mobilize the reputational factor and to reward financial institutions that demonstrate excellence in environmental sustainability. The MNB grants awards to the best green bank, the best green insurance company and pension fund, and the best green investment fund, which are celebrated at the MNB's annual Green Finance Conference (MNB, 2023a).

## 3.2 Social and international relations

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### 3.2.1 Cooperation with local partner organizations

The expansion of cooperation with local partner organizations involved broadening existing partnerships on the one hand and establishing new relationships on the other. Even before launching the Green Programme, the MNB had multifaceted professional relationships with the Banking Association and the Ministry of Innovation and Technology, and these were supplemented with sustainability cooperation and regular consultations. However, cooperation with the green civil sphere meant new relationships: the MNB corresponds with civil organizations dealing with environmental protection and professional organizations orchestrating business communities. These partnerships covers advisory and consultation in relation to the MNB's policymaking and execution of the Green Programme (Gyura et al., 2023).

Carbon emission neutralization is another key area where the MNB ranks among the frontrunners. Not only because the MNB has supported exemplary reforestation and habitat-restoration projects in partnership with World Wildlife Fund Hungary, but also because the MNB is taking responsibility for education on this subject. As a member of a special working group initiated by the Business Council for Sustainable Development in Hungary, the MNB issued a special study on carbon offsetting in September 2023, providing guidelines and good practices of the voluntary carbon markets. In the international field, the fulfilment of voluntary corporate climate goals through nature-based solutions is already a widespread practice (MNB, 2023f).



This market is expected to become more and more popular in Hungary as well, and this publication aimed to facilitate this process.

### **3.2.2 Education and public relations**

Green finance is a young and dynamically developing field, and one of the main challenges is the availability of expertise. Demand for experts with green financial knowledge is increasing year after year on the labour market (Sárvári, 2022). The MNB's Green Programme places particular emphasis on strengthening green aspects in the financial knowledge of young people, including not only sustainable finance education, but also PR activity on lifestyle aspects. Within this framework, the central bank's educational activities focus on supporting green finance courses that match the training profile of partner institutions. The MNB maintains an active education-focused cooperation with the Budapest Metropolitan University, the Neumann János University, the University of Szeged, and the University of Debrecen. In relation to the education of practicing professionals, the MNB participates in the qualified green finance expert course of the Budapest Institute of Banking (MNB, 2023a).

In addition to educational activities, the MNB maintains research-related partnerships with the Budapest University of Technology and Economics. As part of this cooperation, green finance and green economy workshops have been offered at the university since 2019, to explore areas where the financial world can contribute to the realization of green economy goals. These research groups focus mainly on green energy, green mobility, resilient and sustainable water management, as well as on carbon removal technologies and crediting. As one of the highlights of this cooperation, the MNB partnered with BME Zero Carbon Center (ZCC) to advise a fast-track green transition for Hungary within the framework of two special action plans.

The Green Gas action plan recommended the implementation of four programmes that could result in the cost-effective replacement of a total of 2 billion cubic meters of imported natural gas in the second half of this decade (compared to a 2021 baseline). The Green Power action plan would enable Hungary to already achieve the renewable electricity production goals that were originally set for 2040 by 2028. External shocks of the past two years, such as the Covid crisis and the post-Covid recovery, the war in Ukraine and in the Middle East have all highlighted the strategic and urgent nature of this issue, and for this reason the MNB and the ZCC also provided special insight for the broader public through dedicated series of articles and a green power-themed conference.

The international green finance conference organized by the MNB every year since 2019 is also important venues for international cooperation, with contributions from many world-renowned leaders and experts. This conference is also the occasion for awarding the MNB Green Finance Science Awards.

### **3.2.3 Active participation in international green finance working groups**

Since the launch of the Green Programme, the MNB has been working together with partner organizations as a member of the Network for Greening the Financial System at the global level, while at the EU level the MNB is participating in the new sustainable finance committees of the EU supervisory authorities, the European Banking Authority, the European Securities and Markets Authority, and the European Insurance and Occupational Pensions Authority. A unique relationship has also been established with the European Bank for Reconstruction and Development (Gyura et al., 2023).

In June 2023, the MNB launched its technical assistance programme called “Stability and Innovation”, promoting the sharing of the MNB’s good practices and the strengthening of its international relations. The programme offered four seminars last year, the topics of which concern both traditional central bank functions and challenging innovations. The technical assistance programme started with the seminar of “Green and Sustainable Finances – Introducing the MNB’s Green Programme”.

### **3.3 Leading by example – The environmental footprint of the MNB’s operation**

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#### **3.3.1 Reduction of the MNB’s carbon footprint**

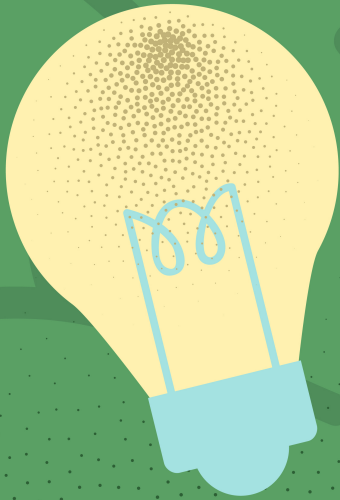
In order to reduce the environmental footprint of the MNB’s operations, the Bank operates an environmental management system, highlighting two main improvement areas: reducing the environmental footprint of the MNB’s buildings and reducing the carbon footprint of the cash supply chain.

The MNB’s buildings use renewable energy in an ever-increasing extent, both by installing solar power units and by purchasing such energy from the market. The main ways of narrowing the carbon footprint of the cash supply chain are to increase local banknote and coin recycling by credit institutions and to reduce the transport tasks within the supply chain on the cash processing side. As cash processing activities are handled by licenced market players, the MNB orientates their sustainability transformation through a dedicated Green Recommendation as previously mentioned.

Operational greening was successfully achieved within the framework of the Green Programme and the medium-term environmental strategy. Between 2019 and 2022, the MNB cut carbon emissions arising from its own operation by 56 per cent and fully offset its residual emissions through domestic habitat restoration projects. The MNB intends to reduce its in-house footprint further and has set a target of a 75 per cent cut by 2025 (MNB, 2023d).

### **3.3.2 Transparency and disclosure of environmental performance indicators**

The MNB acts with the best possible transparency in sustainability matters. The MNB was among the firsts in the financial industry to publish a transparency report in line with the TCFD standards (MNB, 2023d) and it also publishes an annual dedicated Green Finance Report (MNB, 2023a) to provide a comprehensive overview of developments in international and Hungarian green finances.



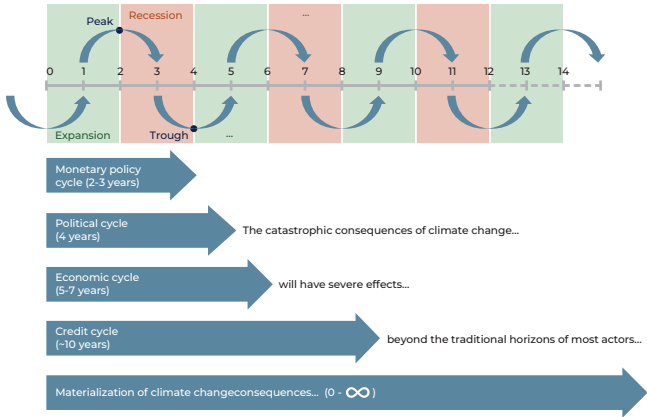


### One booklet to sustain it all

Over the last three to four years, the global economy has faced an overall polycrisis, including the economic shocks caused by the coronavirus pandemic, the Russian-Ukrainian war accompanied by an energy crisis, the Israeli conflict in the Middle East, and episodes of high inflation. All of these crises occurred in a relatively short period of time, demanding full attention and quick action both from societies and decision-makers. However, in the midst of crisis management it is often easy to overlook the large, underlying processes, which may then remain unaddressed somewhere down the line. This is a phenomenon called the tragedy of the horizon, where the traditional horizons of most actors do not match slowly evolving, large-scale trends with long-term consequences (Carney, 2015). In this booklet, sustainability means looking at the entire horizon and thinking about the consequences of (policy) decisions in advance. We should aim to achieve well-being by preserving our resources for the long run. Consequently, sustainability can only be achieved if we holistically aim for it in all major areas: society, economy, finance and the environment.

**FIGURE 20:** Tragedy of the horizons

Source: Author's compilation, based on the speech of Carney, 2015



As discussed in the second section, our century is being shaped by several large volume trends, called megatrends (Sharma, 2022), which tend to evolve slowly, but steadily. In this booklet, I highlight four major trends to bring this issue closer to the reader: worsening demographic trends, declining productivity, high levels of debt, and the lack of balance between economic growth and environmental sustainability.

Firstly, the demographic trends reflect ageing societies across the developed world, which is expected not only to lower GDP per capita, but also to increase the dependency ratio. Secondly, the higher proportion of elderly causes a technological slowdown and slows productivity growth, among other effects. Thirdly, the shortsighted management of the 2008 global financial crises triggered massive increases in public and private debt. In the longer run, this has introduced hidden systemic risks for the financial system and highly indebted countries. Lastly, economic



activities exploit environmental resources far more quickly than they can regenerate. This accelerates climate change and all of its acute consequences such as rising sea levels, declining crop yields, and health damaging summer heatwaves.

We can say with certainty that none of these trends are sustainable. Ultimately, these unsustainable trends bring us to the question covered in Section III: How can we embark on a path of sustainable convergence?

The first and most obvious answer is that we have to renew how we think. The new intellectual turnaround needs to put sustainability at centre stage. To achieve this turnaround, there are several principles on which we need to reevaluate our thinking: building vision, multidisciplinary, applying the Pareto Principle, sustainable competitiveness and measuring progress. As the great philosopher Seneca said, "If a man knows not to which port he sails, no wind is favorable." Thus, we first need to have a clear and measurable vision of what we want to achieve. Secondly, economics should start to build on the results of different fields of social or nature sciences, e.g. considering health science findings might help to design policies nudging people towards healthier choices. The third applicable principle is based on Pareto's initial idea: 20 per cent of the resources yields 80 per cent of the results. Although we already apply this principle, e.g. when making our homes more energy-efficient, we need to extend it to all possible areas. The fourth principle emphasizes the inseparability of competitiveness and sustainability, which will keep us thinking long term. Lastly, when creating the metrics of progress, it should, at all costs, include environmental, social and financial sustainability, in addition to economic development.

It is good and well that we know the principles which can reform our thinking towards sustainability. But the principles beg the question of where to apply them.

Where do we have so called breakout points to escape from our old ways and achieve the desired sustainable socio-economic path? As mentioned earlier, in the second part of Section III, there are five crucial breakout points.

The first one is the capital-technology-knowledge-talent foursome: if we connect and utilize them wisely, we can advance. Reversing the megatrend of slowing productivity growth is the second breakout point, where technological innovation and smart capital can be our greatest friends. In case of the third breakout point – the digital transition – datasets play a key role, as data has become the base of production and value creation. For example, data can help us understand the complex climate and biological ecosystem of our planet. Moreover, switching to digital solutions, such as smart devices can save us much energy and mitigate emissions. In this way, digitalization supports the fourth breakout point, the green transition. To foster the green transition, we can apply sticks and carrots, namely disincentivizing, e.g. taxing harmful polluters, while directly incentivizing green investments or greening the financial market. Lastly, we need to reverse the unfavourable demographic megatrend of aging populations. To do so, we need to rethink the family support systems – even though Hungary already provides state support for families' housing, it lacks other incentives such as ensuring part-time jobs for mothers or sufficient daycare places. If we match these breakout points correctly with the principles of intellectual turnaround, I have no doubt to that we can achieve a new sustainable economics and maintain it in the long run. Their combination is of course different for each country.

In the case of Hungary, the MNB is already applying the Pareto principle in the financial system. By introducing its green measures, it intends to mitigate the risks stemming from climate change, which pose a threat to price stability, MNB's primary objective. For example, one might want to think about how severe summer droughts cause

considerable damage to farmers, potentially resulting in non-performing agricultural loans and GDP loss. Amongst other things, the MNB has introduced a green monetary policy toolkit strategy, including a Green Mortgage Bond Purchase Programme, and the Bank has also launched a comprehensive Green Programme consisting of actions such as the Green Preferential Capital Requirement Programme. We are proud of our green financial system practices and want to further improve them. To see where we can improve, we tested our sustainability policies with the methodology of the Green Central Banking scorecard and achieved remarkable results, scoring higher than any G20 country. This gives us further motivation to stay proactive and lead by example: we will keep promoting transparency and disclosures and continue to promote the development of the Hungarian green financial markets. We are also glad to see via the scorecard that many central banks aim to perform well (Green Central Banking, 2024).

When I look back on the progress we have made so far and see how our thinking has started to change – decision-makers, central bankers, societies – I feel hope. And I see this hope in our future heading towards sustainability. The media regularly cover climate change events, and the body of research is growing day by day, augmenting our understanding of mitigation practices. Policymakers are pushed to discourage pollution, and ESG is on a soaring uptrend on the financial markets. And the list goes on and on. While the road ahead of us won't be without obstacles and we have to use different principle-breakout point pairs, I am optimistic that we will reach an era of new sustainable economics. With this booklet, I wish to provide guidance to help us tackle the challenges on the road ahead, to help break unfavourable megatrends, and to find the appropriate combinations of principles and practices. The theses of the new sustainable economics are now available for everyone, and just like knowledge or data, it will only grow if you share their message.

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## II THE NEED FOR SUSTAINABILITY, ITS LIMITS, AND THE GLOBAL MEGATRENDS

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### III HOW CAN WE ACHIEVE GLOBAL SUCCESS ON THE PATH TO SUSTAINABLE CONVERGENCE

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## IV THE MNB'S GREEN MANDATE AND HOW IT IS CONVERTED INTO ACTION

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Gyorgy Matolcsy has been serving as the Governor of Magyar Nemzeti Bank, the central bank of Hungary, since 2013. He is also a member of the Fiscal Council of Hungary. Prior to that, he was Minister of National Economy between 2010-2013 and Minister of Economic Affairs between 2000-2002. Between 2002-2010 he was director of the Institute for Growth and of the Privatisation Research Institute from 1995 to 2000.



He was a member of the Board of Governors at the European Bank for Reconstruction and Development (EBRD) representing the Hungarian Government between 1991 and 1993. In 1990, he served as political state secretary and the personal economic advisor to Prime Minister Jozsef Antall. He began his career in the Ministry of Finance in 1978, then he joined the Financial Research Institute as scientific researcher in 1985. As the economic and finance minister of the Orban government, he was instrumental to the turnaround of the Hungarian economy by introducing a tax reform and completing the most successful fiscal consolidation within the EU. As the governor of MNB, he solved the credit crunch of the financial system and also swept out the CHF denominated FX loans of Hungarian households.

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