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Assessing the sustainability of spatial development decisions

Changing social and economic conditions justify a rethinking of the theory and practice of domestic spatial development and planning. Despite the progress made over the last thirty years, sustainability problems have emerged for some development projects following the exhaustion of budgetary resources. This paper presents a model developed by the authors for the ex-post and ex-ante assessment of the sustainability of spatial development decisions and suggests an aggregate index for quantifying the model, which can be used to support the preliminary analysis for spatial development decisions.

Keywords: territorial development, territorial policy, sustainability, balance, growth.
JEL code: O20, R11

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1. Introduction

From 1867 onwards, the aim, instruments and methods of Hungarian spatial development underwent paradigm shifts in line with geopolitical changes (dualism, interwar period, Soviet influence, and the planned economy). It was based on substantive but mostly short-term objectives, which were modified by successive governments according to their own visions.
The majority of development interventions (from the beginning until the late 1980s) were sector specific. The First World War and then the Second World War broke the previously coherent economic space, and a significant part of development was outside the re-drawn national borders, causing irreparable social and economic losses. For a long time, these factors determined the scope of Hungarian territorial development.
The first freely elected government following the geopolitical shift after 1989 inherited a heavy burden. The growing territorial disparities were only partially compensated by governmental and local development (concepts, strategies, programmes, and projects). Disparities between territorial units (districts, counties) have increased in areas such as health, education, social and income conditions and environmental conditions.
Hungary's accession to the EU (in 2004) transformed the domestic territorial development policy. Substantial resources have been allocated to help peripheral regions to catch up. However, the usability and the multiplier effect of these funds varies. There are several reasons for this (e.g., economic structure, age structure, life expectancy, and education level). The fundamental problem is that applications (and therefore applicants) focus on quantitative output results (number of jobs created/retained, length of new road built, etc.) rather than on the sustainability or effectiveness of interventions. Parallel with this, the effectiveness of the EU aid system has been criticised in several ways in the EU member states. For example:

- The crowding-out effect, i.e., part of the development funds support investments that would otherwise be undertaken by the competitive sector;
- In some cases, the funds support prestige investments in local politics, the usefulness of which is doubtful;
- The spill-over effects of the resources allocated to investment are modest, because some of the investment goods are imported;

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- Despite the available resources, the spatial dispersion of GDP per capita (NUTS-3) has continued to increase in the countries that joined the EU after 2004 (known as the new member states) (Kocziszky & Szendi, 2023). This can be underlined by the fact, that despite the growth in economic output of the Hungarian counties, they are not able to break out from their own convergence club;
- Territorial aid has failed to achieve the overarching objective of improving the quality of life and well-being of the stakeholders. The latter is more than an improvement in the economic performance.

In the past 15 years, our experience in analysing and evaluating national spatial development strategies, programmes and projects has shown that some of the plans (about 20%) are not implemented or not implemented as envisaged, while others (about 15%) are difficult to sustain after the mandatory maintenance period. It is therefore appropriate to carry out an ex-ante sustainability assessment at the planning stage and an ex-post sustainability assessment after the implementation of the development. In this study, we recommend a methodology for such an assessment and present the results of the pilot application of our model.

2. Development policy considerations

The wellbeing of citizens can only be ensured by a set of values on which the society and the economic policy are based. This requires a sustainable market equilibrium and economic growth (Figure 1). Numerous examples in economic history show that growth without equilibrium is unsustainable in the long run (in the case of Hungary, an economic growth of 3.0-3.5% and inflation of 3.0+1.0% have been observed over the last two decades).

The global financial crisis of 2008, followed by the COVID-19 crisis (pandemic) in 2020 and the subsequent Russian-Ukrainian war, have created imbalances and growth problems in all EU countries. Governments responded to internal and external shocks with fiscal easing, leading to an increase in public debt, which subsequently pushed up inflation. The unwinding of this inevitably leads to monetary tightening in the economy, with higher interest rates on loans and deposits. This has led to a reduction in private and public consumption and investment. The resulting unfavourable trends have a negative impact on the convergence objective of territorial policies, as because of high inflation the real value of the planned investments has decreased. This is unfortunate because a well-functioning territorial policy helps to create harmony between balance and growth.

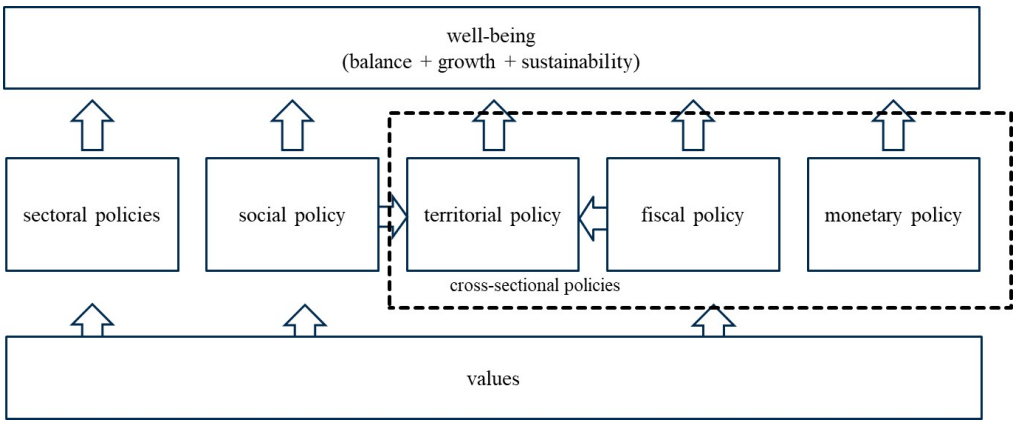

Figure 1: The role of territorial policy in strengthening balance, growth and sustainability
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However, unsecured economic expansion on credit is unsustainable. The allocation mechanism of territorial policy can help to resolve this contradiction.

3. The concept and pillars of sustainable territorial development

The experience of the past 30 years justifies a paradigm shift in spatial development practice. The value system underlying spatial development, based on neoclassical economics and neoliberal social thinking, needs to be revised.

The neo-liberal market economy is insensitive to social problems, especially the demographic problems that have led to the ageing of societies in (especially European) developed countries. In the last two decades, especially in North America and Europe, this neo-liberal concept has deteriorated further under the influence of various ideologies (e.g., woke; so-called "parasites", see Saad, 2021). This is underlined by the fact that while the basic idea of the so-called Freiburg Memoirs (1942-43), edited by Dietrich Bonhoffer, was based on the social principles of Lutheranism and Roman Catholicism, the so-called Christian social values (Kluge, 1988) postmodernity movement that has been gaining momentum since the 1970s, has sometimes modified this.

On the other hand, economic output growth still relies on large externalities. The resulting linear (extraction-processing-consumption-waste) management chain is now not only threatening the production and consumption system, but also generating unmanageable amounts of waste. Meanwhile, the energy intensity and environmental burden of the real economy is still high and will remain so due to the current energy crisis and the steps taken to address it (e.g., restarting coal-fired power plants, etc.) (MNB, 2022). A problem similar to the energy crisis is the climate crisis, which is making it increasingly difficult to provide the population with healthy, non-GMO food that uses less fossil energy than at present.

The predictability of territorial development objectives, instruments and institutional arrangements must be created. Constant political and economic policy changes reduce both the quality of territorial development concepts, strategies and programmes and the resources invested in their implementation. Greater emphasis should be placed on the predictability and sustainability of developments and their regular monitoring. Sustainability and predictability do not mean "freezing" systems. On the contrary, a sustainable system is resilient, able to remain close to equilibrium over the longer term, or to return to a near-equilibrium state within a short time if it is pushed out of balance by internal or external forces.

Our model differs substantially from the three-pillar (economic, ecological, social) construction of the literature in that it takes values as a basis and proposes a four-pillar solution (Figure 2).

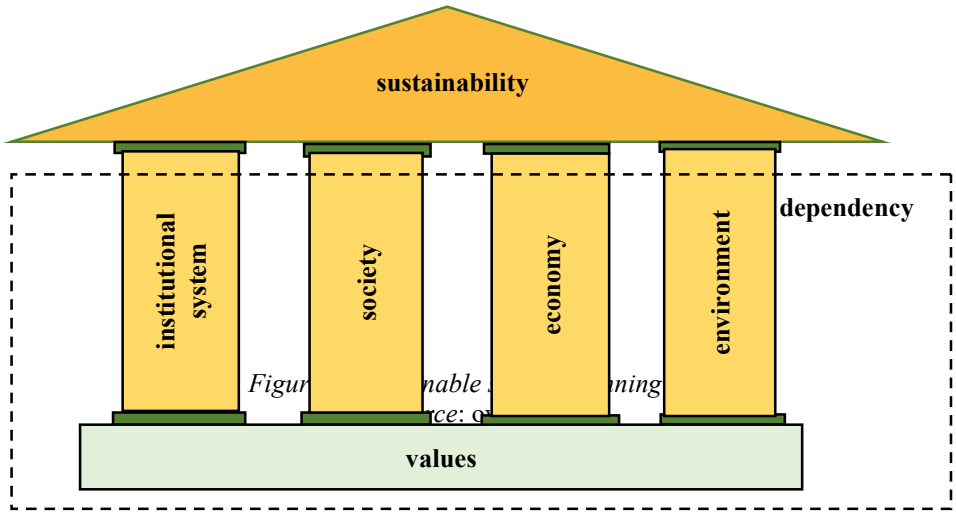

Figure 2: Sustainable spatial planning model
Source: own edition

Box 1: **Dependency theories**

Economic, geopolitical and cultural constraints are fundamental to the development of each region or country. Thus, the division of labour, technological and technical potential in the world economy creates peripheries, semi-peripheries and centres (core areas). The peripheries are characterised by cheap raw materials and labour, while the centres are characterised by the concentration of capital and knowledge. The semi-peripheries are dependent both on the peripheral regions and on the centres (Wallerstein, 2010; Kocziszky, 2021).
The political influence of a given geographical area affects its society (population, ethnicity, education, etc.) and its economy (imports and exports, weight of economic sectors, etc.), which has a significant impact on its room for manoeuvre and its capacity to assert its interests.
Dependency is not only a matter for nation states, but also for the subnational regions that form them. In their case, a distinction can be made between so-called internal (within a country) and external (globally) dependency, which is reflected in the development trajectory of the region. In other words, a region's room for manoeuvre is determined by its development path.

Territorial processes are not independent because no territorial unit (region) is closed. Their global and national embeddedness influences the institutional system of development, local society, the economy and the environment (Box 1).

3.1 Values

Spatial development is a question of values, because it is not all the same whether:
- the basic aim of spatial development is economic growth or prosperity;
- territorial redistribution is based on justice or utility;
- the criterion for territorial redistribution is economic efficiency vs. community needs;
- the principles for the use of resources allocated to the territorial level are return on investment or community needs.

The answers are determined, not least, by the community's perceptions of family, faith, natural resources and environment, social sensitivity, fairness and spatial justice, transparency, the importance of diligence and knowledge, respect for laws and legislation, and the preservation of the built and spiritual heritage. The dimensions of each of these value dimensions are significant independently and in their interaction (Figure 3). It is therefore worth taking them into account.

Family and faith: the sustainability of society and the economy depends not least on the stability of faith and the family. Spiritualism has an impact on individual and collective needs and wants. It is therefore a question of values, how and with what needs are met, and who has access to them, and under what conditions. The aim of sustainable territorial policy cannot be anything other than to serve the community, and the market is a tool of this.

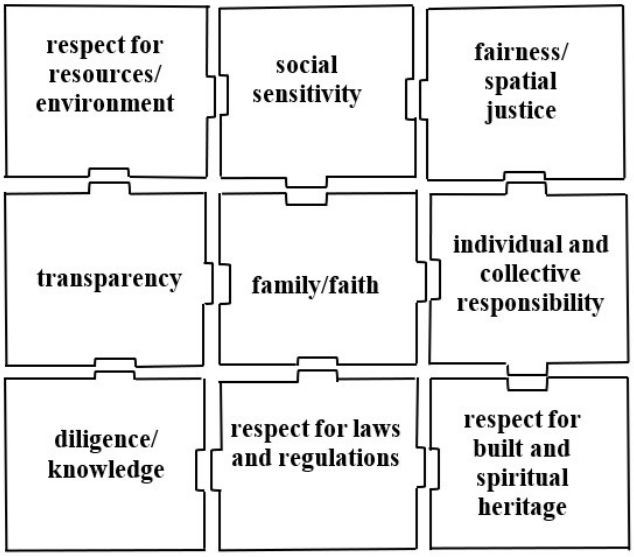

Figure 3: The values of sustainable planning
Source: own edition

Since the last third of the 20th century, the search for the relationship between faith and the economy has once again become an important research topic in economics, economic history and sociology (Botos, 2009; Krenzhof, 2007; Sárvári, 2019; Sebestyén, 2019). The way of approaching the issue naturally varies in space, time and disciplines (sociology, theology, economics, etc.), but the authors agree that faith has an important role to play in our understanding of work, performance, human well-being, compliance, and the relationship between the economy and the environment.
According to statistics, one of the consequences of secularisation across Europe is a deterioration in demographic trends, a decline in the willingness to have children, and a labour shortage that is becoming an increasing problem in the beginning of the 21st century. Research shows that the relationship to transcendence also influences people's relationships with each other, solidarity, and relationships with nature (e.g. Fowler & Dell, 2006; Hunt, 2015). A 2016 national survey in Hungary found that religiosity significantly strengthens family stability (Pusztai, 2019).

Social responsiveness: the social element in the value system depends on the extent to which society has succeeded in enforcing social norms alongside economic ones, sometimes at the expense of the latter. The market does not create enough social norms for the functioning of the economy.
Economically determined social relations are governed by the principle of achieving maximum return with the means available, or a given return with minimum expenditure. Society must therefore develop and implement a social order that meets the needs of the community (above all the objectives of social justice, social security and social peace). The higher the economic and social demands on the social order, the more successfully the value system is adapted to the simultaneous achievement of economic and social goals. In spatial planning and development, listening to and understanding the feelings and thoughts of others is a key element.

Solidarity, individual and social responsibility: humans are responsible for their actions and must be held accountable for them. The essence of solidarity is relationships and respect for the interests of a group and helping others.

Solidarity is motivated by the stark difference between people and different social groups (e.g., the elderly, the poor) on the one hand, and interdependence on the other. Solidarity is nothing other than the voluntary limitation of self-interest. Social solidarity implies the assumption of individual responsibility and state coordination, as opposed to the strict pursuit of "homo economicus" (an integral part of economic thought since the 18th century), which contradicts the requirement of solidarity. The aggregation of individuals pursuing self-interest (within a given institutional framework) is no guarantee of serving the common social interest.

Fairness, spatial justice: the question of fairness and unfairness arises in the context of distribution and redistribution, the functioning of markets and public regulation. Income inequality and wealth inequality because of unfair distribution have come increasingly to the fore in empirical economics over the last three decades (one reason being the growing wealth and income inequality of households).
Inequality leads to political and economic instability in the longer term. Therefore, fair taxation and fair taxpayer behaviour are of particular importance in the context of redistribution and redistribution mechanisms (it is no coincidence that there is extensive literature on this issue).
According to Rawls (1997), spatial justice is a fundamental requirement for the sustainability of society. The legal role of justice is to provide the right answers to social questions, and its social role is to ensure that everyone gets what is due to them.
Justice is therefore fundamentally an ethical question, a question of what obligations we have to others and what rights others have over us, whether the goods are distributed in accordance with society's expectations. This is based on the right to the use of goods, which requires a minimum income that is given to all members of society (regardless of the will of the person in question) and is beneficial and reasonable for all members of society. Justice means the reduction of social inequalities, equal rights, equal treatment, and freedom for all. Neither corrective nor distributive justice can be provided or restored by the market alone. The rule of law has the task of solving this.

> Fair and equitable spatial distribution is multiscale in nature, encompassing issues of distribution on a global scale between North and South, between developed and developing countries, as well as on a continental scale, and on various sub-national levels (between sub-national regions, between municipalities, etc.) This means that unequal spatial distribution of wealth and income is a fundamental feature of the spatiality of society. Inequality is one of the spatial manifestations of the social structure, which determines the organisation of space in a centre-periphery type and the differentiation or segregation of urban spaces. (Benedek, 2019. p. 111)

Diligence and knowledge: in the values of the last 200 years, knowledge has always played an important role as the basis of human existence, a characteristic of homo sapiens. Its importance should be stressed because knowledge not only serves the interests of the community; in many cases, but it is also counterproductive. Knowledge and information are the capital of the 21st century. Knowledge and skills play an important role in the development of territorial disparities. Sustainability depends on the continuous development of available resources, including knowledge potential. The motivation to acquire knowledge and diligence are linked to the values that are developed in the family. An economy without knowledge and diligence is unstable and its ad hoc results are felt only for a short term. This is no different in development policies. Lack of knowledge and diligence is one of the reasons for poor sustainability.
Respect for resources and the environment: man is not the governor, and not the owner of the nature around him. Respect for the environment means the conscious (and sustainable) use of natural resources. The emergence of modern industrial society has brought with it the need for constant economic growth, which has placed increasing pressure on the environment around us, through irreversible processes. The developments thus created are unsustainable in the long term because they consume our natural resources. Legal instruments are necessary to acknowledge

and sustain this relationship, but they alone are not sufficient. Respect for environmental values depends on education and teaching.
Work, performance: a sustainable market economy is inconceivable without work and performance. The relationship to work plays an important role in the quality of life of a community. It makes a difference whether the prosperity of a given community is envisaged in terms of work or profit. International and national research shows that job satisfaction is reflected in performance and income. It is no coincidence that the external appearance of settlements in close proximity to each other and the living standards of their inhabitants can vary considerably depending on the attitude of the inhabitants towards work.
Respect for heritage and traditions: respecting and preserving the values of the built and intangible/spiritual heritage is a surplus that helps to develop and expand resources. On the other hand, it has a permanent relationship with the environment, with social and economic spill-over effects.

3.2 Institutional framework for sustainable spatial development

The institutional system is a broad concept, encompassing the existing legal order, the distribution of functions that operate the system and its operational framework, the decision points and information network that affect society, and the conditions and legal framework for the operation of public and private property. The operationalisation of any operational system is value and policy dependent. Everyday life has always been, and still is, regulated by spiritual, political and economic institutions, which vary in space and time. The nature of regulation and the organisation and functioning of its implementation are fundamentally influenced by the values of society. This is no different for territorial development (regional) policy.
The institutional system of territorial development is sustainable if it ensures balance and predictability between the market and the public sector, and represents the public interest, i.e., neither market nor public interest can be strengthened at the expense of the other. It also ensures the values and conditions for distribution and redistribution.
The sustainability of the institutional system is closely linked to the legal and funding system and to the organisations supporting regional development. For all three, values are significant (Table 1).

a) A sustainable legal framework: the basic requirement for sustainability in spatial development is that it is legally determined, i.e., the way in which aid is granted and its organisation is determined by law. Given that the lead times for decisions on spatial development are generally longer than a calendar year, stability and predictability of rules are essential. Of similar importance is the predictability of the economic legal environment (e.g., tax laws, budget, etc.). Any drastic change in these in an unfavourable direction puts sustainability at risk.
b) Sustainable financing ensures, on the one hand, that the solvency of the actors is maintained in the longer term without harming the fulfilment of the commitments made. On the other hand, green finance (e.g., green loans, green bonds, etc.) is used to implement environmental and energy efficiency solutions (e.g., green energy, green buildings, greening water, and wastewater management, greening transport, improving energy efficiency) (ICMA 2021).
c) An organisation that supports sustainable territorial development is characterised by a stable, predictable operation, composed of a professionally competent staff, that believes that the development of settlements and territories helps to improve the living conditions and well-being of the people living there. It is also important for sustainability that stakeholders have confidence in the integrity of the organisation and that it operates in a lawful, transparent, and non-influenced manner.

Each of these three sets of factors has important links to ethics and the values of lawmakers, with their responsibility to serve the public.

Table 1: Sustainability indicators for the Spatial Development Institutions

No.	Name of indicator	indicators	sustainability condition	Data source
1.	the legal stability of the organisation supporting territorial development	laws modified during the period (number)	$OReg\ (t_1) \leq OReg\ (t)_0$	legal directory (directory of laws)
2.	permanence of the area eligible for territorial development funds	laws modified during the period (number)	$DReg\ (t_1) \leq DReg\ (t)_0$	legal directory
3.	frequency of changes to corporate tax legislation (T)	corporate laws modified during the period under review (number)	$T\ (t_1) \leq T\ (t)_0$	legal directory
4.	frequency of changes to personal income tax (IT)	income tax laws modified during the period (number)	$IT\ (t_1) \leq IT\ (t)_0$	legal directory
5.	changes to the rules in force concerning the property tax exemption (PTE)	modified laws on tax exemptions during the period under review (number)	$PTE\ (t_1) \leq PTE\ (t)_0$	legal directory
6.	changes to existing rules on public procurement	public procurement acts modified during the period under review	$PReg\ (t_1) \leq PReg\ (t)_0$	legal directory
7.	amount of foreign/external capital raised after completion of the development	working capital in the three years following the completion of the development (in M€)	$\sum_{i=1}^{3} C_i > 0$	KSH
8.	number of R&D patents	patents registered in the three years following the end of the project (number)	$\sum_{i=1}^{3} P_i > 0$	KSH
9.	number of R&D projects	R&D projects launched in the three years following the end of the project (number)	$\sum_{i=1}^{3} RD_i > 0$	KSH
10.	share of own resources supporting development	own resources involved in R&D projects launched in the three years following the end of the project (%)	$\sum_{i=1}^{3} RDs_i > 0$	KSH

Source: own edition

Note: t_0 = base year; t_1 = calendar year, KSH: Hungarian Central Statistical Office

3.3 Sustainable local and regional societies

A sustainable local and regional society is based on participation and autonomy, with a focus on community alongside social security.

> A sustainable society is built from the whole of the individuals and their communities into a system. The mutual generosity, the revival of the community sense in this structure is not a will from above, but the possibility of the individual's existential fulfilment, that is, the community's own. In contrast to the monolithic power structure that distributes binding commands to all, which has led to the impoverishment of reciprocity and the emergence of individual and group interests, in the structure of a sustainable society, reciprocity becomes the organising force of the community, where the local community manages its own affairs in a system of self-management. Decision making is shifted to the level of subsidiarity, central responsibility and the potential for error arising from schematisation is reduced (Gyulai, 2005. p. 6).

There are several key criteria for a sustainable society:

- Promoting sustainable demography, i.e., a healthy age structure of the population in the area, expressed as a change in the average life expectancy at birth, the total fertility rate and the ageing index. Population decline, an ageing population, life expectancy at birth, total fertility and ageing rates below the national average indicate sustainability risks.
- The sustainability of material and social security can be expressed in terms of the poverty rate of people living in the area, the share of households without employed

persons, the share of early school leavers, the gender and regional wage shares, and household indebtedness.

– Without the trust and active involvement of society, no development programme can be sustainable in the long term. The literature is unanimous in its assessment of the importance of trust, but the methodology for measuring it is not uniform. Confidence in development concepts that have been implemented (Annex 1 and 3) or are in the pre-implementation stage (Annex 2) can be measured by questionnaires. In addition to trust, it is important that the spatial development concept contributes to improving the sense of security (health, social, and material) of the community concerned (Table 2).

Table 2: Sustainability indicators for the local society

No.	Elements	interpretation	indicators	sustainability condition	data source
1.	Sustainable demography	The given population (number of inhabitants) is consistent with nature's carrying capacity	permanent resident population (persons)	$Pop(t_1) \geq Pop(t_0)$	KSH
			average life expectancy at birth (years)	$LE(t_1) \geq LE(t_0)$	KSH
			total fertility rate (%)	$FR(t_1) \geq FR(t_0)$	KSH
			ageing index (%)	$AI(t_1) \leq AI(t_0)$	KSH
2.	Sustainable financial and social security	Community well-being	poverty rate (%)	$PR(t_1) \leq PR(t_0)$	KSH
			percentage of people living in a household without an employed person (%)	$HwE(t_1) \leq HwE(t_0)$	KSH
			early school leavers (%)	$ESL(t_1) \leq ESL(t_0)$	KSH
			gender wage gap (%)	$WG(t_1) \leq WG(t_0)$	KSH
			equal wage among regions (HUF)	$EW(t_1) \leq EW(t_0)$	KSH
			household indebtedness rate (%)	$DR(t_1) \leq DR(t_0)$	KSH
3.	Sustainable social trust and activity	Cohesion within society	satisfaction with the development (based on a value scale, %)	$SAT(t_1) \geq SAT(t_0)$	KSH
			sense of security (based on a value scale, %)	$SoS(t_1) \geq SoS(t_0)$	KSH
			number of active NGOs (number/person)	$NGO(t_1) \geq NGO(t_0)$	KSH

Source: own edition

Note: t_0 = base year; t_1 = survey year/current year

3.4 Sustainability of the regional economy

One key area of economic analysis is sustainable economic growth and development. As in other cases, it has been defined in many ways (e.g., Anderson, 1960; Erdős, 2003). Our understanding is that sustainable economic growth means sustained and financeable output growth that does not trigger inflation. Expanding the real economy is not an objective but a tool. This is worth emphasising because there is good and bad economic growth. That is, there is output growth that is in line with the needs of society and the resources available, and there is output growth that is not. Some activities meet real needs, others are geared to creating unjustified demand generated by producers-suppliers. Excess demand creates an incentive to acquire surplus goods, which generates new surplus demand (e.g., the increase in alcohol consumption and the need to care for alcoholics; the overconsumption of sweets and the need to care for the growing number of people with diabetes). The five elements of a sustainable economy are summarised in Table 3.

Economic output is only sustainable if it is not accompanied by a persistent financial imbalance (according to Matolcsy (2015), one of the biggest problems of the Hungarian economy was the persistent financial imbalance between 1974 and 2014). On the other hand, sustainable economic growth is green (carbon-free) growth, i.e., the growth of emissions is achieved with reduced and

more efficient use of resources. In an optimal case, the path of economic growth is therefore divorced from the path of energy use and emissions. Thus, the growth rate of economic output is greater than the ecological footprint and the use of non-renewable natural resources. In the case of absolute decoupling (green growth), output increases as the ecological burden decreases.
Criticism of economic output growth has intensified in recent years. Criticisms have been levelled at the unfair distribution of resources ("the poor get poorer, the rich get richer") and the scarce nature of resources, which does not allow for infinite growth. Much of the criticism is therefore based on the idea of measuring development rather than growth (GDP), which would make it possible to monitor quality of life (health, material well-being, quality of public services, demographic trends, state of the environment) (EESC, 2009; Kocziszky & Szendi, 2021).
It follows from the above that instead of measuring growth based on GDP, a more complex measure is needed, based on value added, activity rate, net self-financing capacity, investment rate and green purchasing rate (Table 3).

Table 3: Indicators of sustainability of the regional/local economy

No.	Name of indicator	definition	sustainability condition	data source
1.	value added (VA)	difference between output produced and inputs used in the process of producing goods/services (thousand Ft, %)	$VA(t_1) > VA(t_0)$ $\frac{VA(t_1)}{VA(t_0)} > 0$	KSH
2.	activity rate (ar)	economically active population (15-64) as a percentage of the total population of the same age (%)	$ar(t_1) \geq ar(t_0)$ $\frac{ar(t_1)}{ar(t_0)} > 0$	KSH
3.	net self-financing capacity (NSF)	NSF = turnover - purchases - accumulation (thousand Ft, %)	$NSF(t_1) \geq NSF(t_0)$ $\frac{NSF(t_1)}{NSF(t_0)} > 0$	balance sheet data of the beneficiaries
4.	investment rate (i)	value added to investment (%)	$i(t_1) \geq i(t)$ $\frac{i(t_1)}{i(t_0)} > 0$	KSH
5.	green public procurement rate (GPR)	number (value) of public procurements with environmental (green) aspects as a percentage of total public procurements (%)	$GPR(t_1) \geq GPR(t_0)$ $\frac{GPR(t_1)}{GPR(t_0)} \leq 1$	documentation analysis of the beneficiaries

Note: t_0 = base period; t_1 = reference period
Source: own edition

3.5 Sustainable environment

Human activity in shaping – destroying – the environment is not new, as historiographic research shows (Demeter et al. 2021). The development of modern manufacturing industry has led to a particular increase in the pressure on the environment. Economic growth has gone hand in hand with the provision of the environment and the depletion of natural resources, with the destruction of habitats and some species. These factors threaten sustainability and undermine the gains made in increasing prosperity.
Since the Club of Rome Declaration (1972), attention has focused on the sustainability of resources and the balance between the economy and nature, because the carrying capacity of the environment around us is of growing importance. The constant increase in emissions is leading to a loss of biodiversity, increased soil erosion and the depletion of some natural resources. Slowing down or even stopping this undesirable process is not a simple task, because on the one

hand the footprint of those involved is considerable, and on the other hand we do not have the secure knowledge yet that is essential for it. However, it is positive that international and national literature is now paying particular attention to the study of environmental pressures and environmental assessment (e.g., OECD, 2011; 2015; 2016; 2017; IEA, 2016; EEA, 2018; ECA, 2019; ICMA, 2021).

In the case of sustainability, the environmental burden meets international and national standards. Basically, the state of the environment can be covered within the following categories (Table 4):

- air quality (pollution, emission);
- soil quality (chemistry, sensitivity);
- water quality (surface water, groundwater treatment);
- waste management (generation, collection, transport, hazardous waste management, processing, recycling);
- nature conservation (protected areas);
- and conscious consumer behaviour.

Several indicator systems can be used to characterise the state of the environment (e.g., OECD, 2017; KSH, 2022; Eurostat, 2023).

Table 4: Indicators of the sustainability of the local environment

No.	Element	Name of indicator	interpretation	sustainability condition	data source
1.	sustainable use of resources	renewable energy rate	share of renewable energy in total annual energy consumption (%)	$RE(t_1) \leq RE(t_0)$	documentation
		proportion of solid waste recycled	recycled solid waste as a percentage of total annual waste (%)	$SWR(t_1) \leq SWR(t_0)$	documentation
		treated wastewater rate	share of physically vs. biologically treated wastewater in total wastewater (%)	$\mathrm{WW}(t_1) \leq WW(t_0)$	documentation
		specific CO_2 emissions	CO_2 emissions per capita (t) change (%)	$CO_2(t_1) \leq CO_2(t_1)$	documentation
2.	responsible consumption	responsible use of goods, services, and natural resources	untreated municipal waste (%)	$MW(t_1) \geq MW(t_0)$	KSH
			food waste rate (%)	$FW(t_1) \leq FW(t_0)$	KSH
3.	green public procurement	green public procurement document rate	the percentage of suppliers with a green document from all public procurement procedures	$GPR(t_1) \geq GPR(t_0)$	documentation

Source: own edition

Note: t_0 = base period; t_1 = reference period

4. Measuring the sustainability of regional development

The holistic approach outlined above provides an opportunity for multi-perspective sustainability assessment and measurement, even though there is no agreed position on either the number of indicators or the way they are aggregated (Box 2).
The Aggregate Spatial Sustainability Index (ASSI) proposed in our report is defined in four steps (Figure 4):

- analysis of the matrix of value-added relationships;
- compiling a database;
- normalisation of the values of the indicators with a sign, formation of sub-indices;
- determination of an aggregate sustainability index.

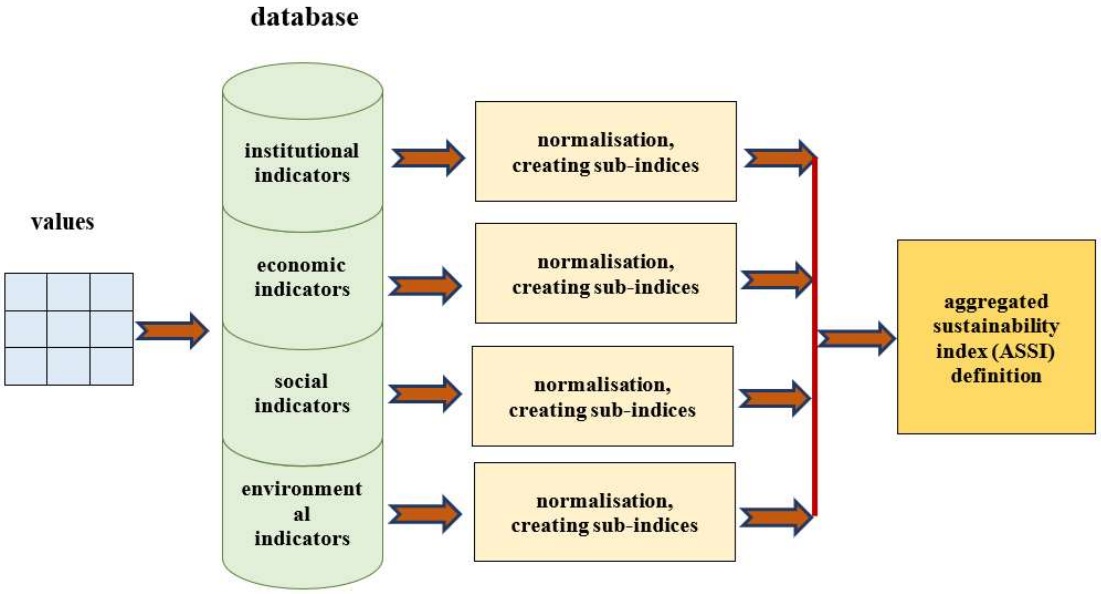

Figure 4*: Logical process of the Aggregate Spatial Sustainability Index*
Source: own edition

Box 2: **Sustainability indices**

Over the past decade, several indicators and measurement methods have been published for measuring sustainability. Some of these focus on environmental factors, while others aim at a more complex calculation (see Parapatits, 2019):

- There are 17 indicators based on the Sustainable Development Goals (SDGs) created by the United Nations in the Sustainable Development Report (SDR), which can be rated on a scale of 0-100 (ESD, 2019).
- The Sustainable Society Index (SSI) reflects also the UN approach but operates with a simpler set of indicators. The index examines a total of 21 indicators for three main categories (Technische Hochschule Köln), which are assessed using a scale of 0-10 points (Kowalski & Veit, 2020).
- In recent years, in line with the restructuring of monetary policy and financing systems, both national and commercial banks have paid special attention to monitoring sustainability. The index developed by the Magyar Nemzeti Bank assesses countries' sustainability based on four pillars (environmental, social, financial, real economy) and 108 indicators (Baksay, 2021). Sustainability assessment has also been integrated into the lending practices of commercial banks, which primarily focus on the sustainability of borrowers (K&H, 2023).

Table 5: Examples of composite sustainability indices

No.	Organisation	indicator groups	number of indicators	total number of indicators
1.	Magyar Nemzeti Bank: Sustainability Index (Baksay, 2021)	– environmental sustainability	6	27
		– social sustainability	8	
		– financial sustainability	7	
		– sustainable growth	6	
2.	Commercial and Credit Bank (K&H): Sustainability Index	– management attitude	8	48
		– environmental footprint	9	
		– social responsibility	8	
		– sustainability strategy	12	
		– management activity	11	
3.	UN Sustainability indices - SDG	– no poverty	13	225
		– zero hunger	12	
		– good health and well-being	21	
		– quality education	9	
		– gender equality	16	
		– clean water and sanitation	12	
		– affordable and clean energy	15	
		– decent work and economic growth	10	
		– industry, innovation, and infrastructure	7	
		– reduced inequalities	15	
		– sustainable cities and communities	19	
		– responsible consumption and production	14	
		– climate action	13	
		– life below water	6	
		– life on land	12	
		– peace, justice, and strong institutions	20	
		– partnerships for the goals	11	
4.	KSH sustainability progress indicators	– human resources	32	131
		– social resources	24	
		– natural resources	52	
		– economic resources	23	

a) Compiling the database

In selecting the indicators, our aim was to:

- be related to the sustainability of the development,
- be understandable and definable,
- be numerically available and able to be repeated at any time,
- allow international comparison.

The database contains 35 indicators (Table 6).

Table 6: Distribution of the sustainability model indicators

No.	pillar	number of indicators
1.	sustainable institutional system of the regional development	10
2.	sustainable regional/local society	13
3.	sustainable economy	5
4.	sustainable environment	7
	Total	35

Source: own edition

Of these, 29 indicators can be obtained from the database of the Hungarian Central Statistical Office (KSH), three indicators from questionnaire surveys and three indicators from the data provided by the stakeholders. Each indicator can be associated with one or more value element/dimension (Table 7).

b) Normalisation, formation of sub-indices

The conversion of different indicators into the same unit of measurement can be done by normalisation (DTF method), so that the data can be placed on a scale of 0-100.

Table 7: Relationship between values and sustainability indicators

No.	values	social sustainability	economic sustainability	institutional sustainability	environmental sustainability
1.	family/faith	– sustainable demography	– activity rate	– sustainable trust	– consumption
2.	social sensitivity	– sustainable material and social security – community well-being	– value added	– proportion of foreign capital	– green public procurement rate
3.	diligence / knowledge	– sustainable social activity	– value added – activity rate – net financing capacity	– number of R&D patents – number of R&D projects	– renewable energy rate – proportion of solid waste recycled – treated wastewater rate
4.	transparency	– sustainable social trust and activity	– green public procurement rate	– stability of the resource allocation mechanism – legislative stability	– green public procurement rate
5.	respect for resources/ environment	– responsible consumption	– green public procurement rate	– sustainable trust and activity	– responsible consumption
6.	fairness/spatial justice	– sustainable material and social security	– activity rate	– proportion of foreign capital	– renewable energy rate – responsible consumption

No.	values	social sustainability	economic sustainability	institutional sustainability	environmental sustainability
7.	individual and collective responsibility	– responsible consumption	– activity rate	– proportion of foreign capital	– proportion of solid waste recycled
8.	respect for laws and regulations	– responsible consumption	– green public procurement rate	– the stability of existing legislation	– specific CO_2 emissions – solid waste management – wastewater treatment
9.	respect for heritage	– responsible consumption	– responsible consumption	– responsible consumption	– responsible consumption

Source: own edition

The correlation used to convert a given indicator into a score when the higher value of the indicator is the more favourable (e.g., output, employment, etc.) is as follows:

$$X_{norm} = \frac{x_i - x_{min}}{x_{max} - x_{min}} * 100$$

If the higher value of the indicator is unfavourable (e.g.: environmental stress, unemployment, etc.), then:

$$X_{norm} = \frac{x_i - x_{max}}{x_{min} - x_{max}} * 100\,,$$

where: x_{max}= maximum value; x_{min} = minimum value. The advantage of this methodology is that it does not require a normal distribution of the raw data. The scoring tracks the variance of the values of the areas in the sample, and the value considered to be optimal varies from indicator to indicator. Thus, for each indicator it can be decided individually whether its minimum, maximum or even its sample average is optimal.
Based on the ratio scale values of the indicators belonging to the same group, four sub-indices (institutional, social, economic, environmental sustainability) can be defined by arithmetic averaging, as follows:

$$SI_j = (\sum_{i=1}^{n} x_{norm})/n_i\,,$$

where: x_{norm}= number of normalized indicator points, n = number of normalized indicators. The sub-indices are (for simplicity) arithmetic averages of the normalised indicator values. (The use of weights other than these requires further research.)

c) Definition and interpretation of the aggregate sustainability index

$$CSI_j = \frac{\left(\sum_{j=1}^{n} SI_j\right)}{m},$$

where: SI_j - j-th block sub-index, CSI - complex sustainability index.
The index basically has a benchmark role; it provides an opportunity to examine the expected (ex-ante), past (ex-post) or interim sustainability of a given regional development strategy, programme or project. The latter can be justified primarily by exogenous (e.g., changes in the geopolitical situation, disruptions in long supply chains, resource supply problems) and endogenous (e.g., inflation, changes in the legal environment) risks arising from interdependencies.

5. Testing the applicability of the model

The applicability of our model was tested based on the ex-ante sustainability analysis of the 2014-2020 plan of a district (so-called priority axis) in Borsod-Abaúj-Zemplén County in North Hungary.

The plan set out the following six objectives:

- improving economic competitiveness,
- improving the adaptability of the local society to the needs of the labour market,
- improving the accessibility of job centres,
- sustainable use of unique natural and cultural resources,
- promoting the production and local use of energy from renewable sources,
- improving the state and safety of the environment.

In the period considered, 300 projects received support (based on the data of palyazat.gov.hu) from the European Social Fund (ESF) and the European Regional Development Fund (ERDF). Of these, 74 projects supported the creation and maintenance of jobs. Their sustainability was assessed based on the documents submitted.

The calculation results show that the greatest change was observed in the sustainability of the district's economic indicators (54.6%). The impact of the projects on social (19.5%) and environmental sustainability (9.8%) was more modest, while the proportion of legislative changes (12.8%) was relatively high (Table 8).

Table 8: Quantification of sustainability indicators (%)

social sustainability		**economic sustainability**		**institutional sustainability**		**environmental sustainability**	
Name of the indicator	**Value**	**Name of the indicator**	**Value**	**Name of the indicator**	**Value**	**Name of the indicator**	**Value**
poverty rate (%)	2	value added (%)	127	legal stability of the organisation supporting territorial development (%)	24	renewable energy rate	0
percentage of people living in a household without an employed person (%)	0	activity rate (%)	8	frequency of changes to corporate tax legislation (%)	8	proportion of solid waste recycled	31
early school leavers (%)	0	net self-financing capacity (%)	124	change in the rules in force on the property tax exemption (%)	16	treated wastewater rate	0
equal wage among regions	15	investment rate (%)	12	change in public procurement rules in force (%)	12	specific CO_2 emissions	4
satisfaction with the development (based on a value scale, %)	82	green public procurement rate (%) during project implementation	0	amount of working capital raised after completion of development (%)	3	responsible use of goods, services, and natural resources	24
				share of own resources supporting development (%)	14	green public procurement documentation rate	0

Source: own edition (Note: base year)

6. Summary

The improvement of the situation of disadvantaged, peripheral regions has always been a major or minor part of the economic and social policy of the state over the last 150 years. To prove this, the first part of our research report reviews of the practice of spatial development in Hungary between 1867 and 2020. In doing so, we concluded that geopolitical changes (1867, 1920, 1945, 1989) induced paradigm shifts in the goals, instruments, and institutions of domestic spatial development. After 1989 (not least due to the harmonisation of legislation in preparation for our accession to the European Union), the practice of spatial development in Hungary was raised to the level of regional policy, which gave the opportunity to develop more complex, holistic spatial development goals, strategies, and programmes.

The solutions adopted in this spirit have contributed, sometimes more effectively and sometimes less effectively, to reducing disparities between territorial units. There are many reasons for this, both economic (e.g., lobbying interests overriding economic rationality) and methodological (e.g., failure to assess the impact of territorial interventions). Territorial development does not seem to be able to break out of its partial objectives favouring economic growth.

In the second part of our research report, we outline an integrated, sustainable spatial development model to address this problem, based on a community value system that provides the opportunity to preserve and maintain intergenerational values.

Sustainable spatial and urban development is based on four pillars:

- on society,
- the local economy,
- the institutional system and
- relies on the environment.

Ex-post and ex-ante analysis of these pillars is an important prerequisite for a paradigm shift in spatial and urban development. That is why we have:

- defined the indicators needed to measure and analyse the sustainability of each pillar;
- proposed threshold values for the analysis of individual indicators;
- determined the method for aggregating the individual indicators, and then
- proposed an index to assess the sustainability of spatial and urban development plans.

The index can be used for ex-post and ex-ante development plans with a range of values between 0 and 100. The index's basic purpose is to inform decision-makers, draw conclusions and support possible corrections.

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Annexes

Annex 1: Questionnaire to assess satisfaction with the spatial development strategy, programme or project

Nature of development:	□ strategy □ programme □ project
Place of implementation (county):	
Nature of realisation:	□ implemented
Respondent gender:	□ female □ male
Age of respondent:	□ Under 20 years □ 21-30 years □ 31-40 years □ 41-50 years □ 51-60 years □ 60 years or older
Education level of the respondent:	□ Less than 8th class □ 8th class (primary school) □ skilled □ secondary school leaving exam □ tertiary level
Respondent's labour market status:	□ inactive (childcare, retired, etc.) □ student □ unemployed □ employed

Please give one answer per line for each of the following questions, where:
0 points = the question is not relevant or there is no noticeable impact
3 points = the impact of the activity is medium
6 points = the impact of the activity is good
9 points = the impact of the activity is outstanding

No.	Question	response rating			
		1	3	6	9
1.	Do you think the development was in line with the community's interest?				
2.	Do you consider the communication on the effectiveness of spatial development to be reliable?				
3.	Do you trust the organisation issuing the communication?				
4.	Do you consider the information you received during the implementation to be credible?				
5.	Do you consider the organisation managing the implementation credible?				
6.	Do you consider the public procurement procedures carried out during implementation to be credible?				
7.	Do you think the implementation process was free of conflict?				
8.	Do you think the result of the development is workable?				

Source: own edition

Annex 2: Questionnaire to assess the feasibility of a spatial development strategy, programme or project

Nature of development:	□ strategy □ programme □ project
Place of implementation (county):	
Nature of realisation:	□ implemented
Respondent gender:	□ female □ male
Age of respondent:	□ Under 20 years □ 21-30 years □ 31-40 years □ 41-50 years □ 51-60 years □ 60 years or older
Education level of the respondent:	□ Less than 8th class □ 8th class (primary school) □ skilled □ secondary school leaving exam □ tertiary level
Respondent's labour market status:	□ inactive (childcare, retired, etc.) □ student □ unemployed □ employed

Please give one answer per line for each of the following questions, where:
0 points = the question is not relevant or there is no noticeable impact
3 points = the impact of the activity is medium
6 points = the impact of the activity is good
9 points = the impact of the activity is outstanding

No.	Question	response rating			
		1	3	6	9
1.	Do you think the development concept is in line with the interests of the community?				
2.	Do you consider the spatial development concept to be credible?				
3.	Do you consider the staff conditions for implementation credible?				
4.	Do you consider the timetable of the spatial development concept to be credible?				
5.	Do you consider the material conditions available to implement the idea credible?				
6.	Do you consider the expected results credible?				
7.	Do you consider the management supporting the implementation credible?				
8.	Do you think the idea can be implemented without conflict?				

Source: own edition

Annex 3: Questionnaire to assess perceptions of security in spatial development

Nature of development:	□ strategy □ programme □ project
Place of implementation (county):	
Nature of realisation:	□ implemented
Respondent gender:	□ female □ male
Age of respondent:	□ Under 20 years □ 21-30 years □ 31-40 years □ 41-50 years □ 51-60 years □ 60 years or older
Education level of the respondent:	□ Less than 8th class □ 8th class (primary school) □ skilled □ secondary school leaving exam □ tertiary level
Respondent's labour market status:	□ inactive (childcare, retired, etc.) □ student □ unemployed □ employed

Please provide one answer per line for each of the following requests, where:
0 points = the question is not relevant or there is no noticeable impact
3 points = the impact of the activity is medium
6 points = the impact of the activity is good
9 points = the impact of the activity is outstanding

No.	Question	response rating			
		1	3	6	9
1.	Do you think the development has improved the safety of healthcare?				
2.	Do you think the development has contributed to improve the safety of the infrastructure?				
3.	Do you think the development has contributed to improve public safety?				
4.	Do you think the development has contributed to improve your personal social security?				
5.	Do you think the development has contributed to improve the social security of the community?				
6.	Do you think the development has contributed to improve road safety?				

Source: own edition