POSSIBILITIES OF OPERATIONALIZING THE CONCEPT OF SUSTAINABLE DEVELOPMENT IN THE SPATIAL AND FUNCTIONAL EVOLUTION OF TÂRGU OCNA TOWN

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Key words: spatial evolution (dynamic), natural favourability for habitation, social-economical favourability, urban environment, progressive view method, sustainable development

Abstract. In order to be able to put forward a set of realistic recommendations regarding a foreseeable effective and sustainable spatial evolution of Târgu Ocna, we are compelled to rigorously analyse the natural suitability of the local environment and the subsequent restrictions for habitation, as well as the social and economical internal and external – namely its position within the regional and national urban system – context, and other human induced characteristics. The analysis of the favourability and restrictions brought about by the local environment requires a thorough study of the geomorphologic features of the urban site, as well as the potential morphology-related risk elements, in relation to the geological structure and groundwater configuration, to the hydrological variations and local microclimates, as well as to the local types of soil and vegetation. Alongside the natural suitability for habitation stand the social and economical factors, which play a fundamental part in the appropriate functionality of the urban environment - above all, a highly man-modified environment -, due to their ability to alter/to amend the natural favourability of the site, on one hand, and to convert themselves into premises for development, on the other.

The social-economical favourability for development has been quantized by using a group of indicators, referring to the degree of accessibility to the road and railway network, the quality of the urban environment (the type of dwelling, the urban communications and public transportation, the availability of urban utilities and services, either educational, health facilities, commerce, leisure, banking or public administration), in relation to the town’s functions (residential, industrial, tertiary, tourism, agricultural). The integration of the two types of favourability may be fully accomplished by means of progressive view, which allows us to synthesize the complex results we have obtained so far into an useful instrument for the analysis of the current state as well as of the prediction of this small, yet very complex town’s future sustainable development. A further step has to be a comparative analysis between the results of this essentially geographical study as against the official local and regional planning papers, in order validate the latter, or,
otherwise, to help adjust these documents that constitute the foundation of urban
decision-making.

1. Theoretical aspects regarding the relationship between sustainable
urban development and the spatial dynamic of cities

The concept of sustainable development proffers the opportunity to re-
think the whole urban theory (including aspects such as the urban economy, social
life, and a prudent and conservative type of development) according to its
principles. By adding a new dimension to the investigative process of urban life,
the fundamental principles of urban sustainable development provide us with a new
and more complete perspective on the decision-making process.

The concept of sustainable development as applied to the spatial extension
of cities is very accurately summed up by the idea of „coherent city”, formulated
within the last few years1, which states that urban sustainability must rely, on one
hand, upon a good adaptation to the natural local environment (the urban site), and
upon the achievement of a good level of organic homogeneity of the urban social-
economical system, on the other.

From this point of view, a realistic approach of the concept of
sustainability requires the identification of effective manners to operationalize this
process, by adapting the actual „working instruments”, as well as the set of
indicators of spatial development, in order to be able to quantize the original
elements of the local spatial system, as pre-requisites for a comprehensive urban
management.

2. Târgu Ocna. Spatial evolution of the town through recent times

The town of Târgu Ocna, with a population of nearly 14 000 inhabitants and
a lower rank in the Romanian urban hierarchy, acts within the surrounding territory
as a pole with a local capacity of polarisation. While being one of the main cities of
the principality of Moldova during the medieval period (the 18th and the 19th
century), due to its level of economical development based on flourishing industry
(particularly mining) and commerce, Târgu Ocna has lost its position within the
urban system during the last century, which led to changes in the regional urban
hierarchy, so that nowadays Ținutul Trotușului (Trotuș County) is clearly
dominated in terms of polarisation by two nuclei: the city of Onești and the urban
group includind Moinești, Comănești and Dărmănești, respectively, both of which
are heavily industrialized, but at the same time facing important social and
environmental problems.

The two urban areas managed to monopolise most of the dynamical
industrial activities in the region, (which, at the same time, have the highest
environmental impact, namely, the chemical and petrochemical industries), as well
as the human resources qualified in these areas of expertise, both of these factors contributing to the relative stagnation of Târgu Ocna. Nevertheless, the decline of the town’s industry has enhanced another opportunity which relies on the judicious use of the local natural and historical potential, as well as of the recent social-economical context, all of which will help establish a well-balanced and cautious pattern of development.

The town’s site has proved very propitious for habitation, quality that has been proved not only by the establishment of ancient Dacian settlements at Titelca, Podei and Poiana-Tisești, but also by the continuity of habitation through the medieval period, demonstrated by the early medieval settlements in the area. Two of these villages - Stoienesti, on Vâlcele creek (1410), which was later known as Ocna, an Tisești, respectively -, documented to have coexisted during the same period, may be considered to have formed the initial nucleus of Târgu Ocna (Stoica, 2003), although they have evolved separately for a long period of time, due mostly to the presence of the natural boundary represented by the river Trotuş.

The highest growth rate was documented in the 18th century, when the surface of the urban territory increased by almost 11 times due to the agglutination of two villages, Tisești an Gura Slănicului, as well as the extension of peripheral „districts” (Geoseni, Mosoarele, Poienile, Vâlcele), reaching a maximum extension of about 250 ha. By the beginning of the 19th century, the urban morphology had already been established in a way that was very similar to its present
characteristics, structured on a central area superposing the old salt mines, and along tentacle branches that followed the river valleys and the main road network.

During the following century the urban structure is further consolidated, and the urban fabric becomes progressively denser. An interesting fact is that, while there was a general trend of rapid spatial expansion in all of the Moldavian cities, Târgu Ocna underwent a territorial reduction in the Gălean area. The settlement officially became a town in 1846, following the nationalization of the estate (moșia) Tg. Ocna (Șandru, 1989).

The extension of the railways in the area, with two sectors already functional by 1898 (Adjud-Târgu Ocna in 1884, and Târgu Ocna-Palanca in 1898), led to a reconfiguration of the road network accordingly, so that the new buildings tended to be located as close as possible to this new major axis, on the lower terrace of the river Trotuș, in the proximity of the Cireșoară gorge (Mosoarile, Pâcurile, Poienile), often overlooking the fact that the water flow varies greatly over short periods of time.

During the 20th century, Târgu Ocna expanded its territory mainly towards the east, in the Gălean and Geoseni-Tăbăcari districts, and also in the area of Gura Slănic, due to the opening of a new balneary complex.

Generally speaking, this last century was marked by a complex process of urban restyling in some of the most important areas of the city, that included the
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central precinct, where this was achieved by the construction of blocks of flats for collective housing, and the area delimited by the Răducanu monastery (built 1694) and Costache Negri St., as well as by the reconfiguration of the internal street network and the creation of a new road transportation node at the foot of the Măgura Hill, linking Târgu Ocna to Slănic Moldova.

Beneath these indisputable stages in the evolution of Târgu Ocna, a thorough analysis of the town’s environmental potential and restrictions, of the social-economical internal and regional context of the town and its man-imposed characteristics, etc., is absolutely necessary, in order to be able to formulate a coherent strategy concerning the future spatial evolution of Târgu Ocna.

3. Natural and/or anthropic elements of favourability and restrictions influencing the spatial evolution of Târgu Ocna

3.1. Natural favourability and restrictive factors

A comprehensive analysis of this set of factors should be based on a thorough study of the local terrain morphology, including the morphology-related risk elements, in relation to the geological structure and groundwater configuration, to the hydrological variations and local microclimates, as well as to the local types of soil and vegetation. An important amount of geological and geographical data, as well as information provided by various technical studies or obtained during field observation, has been compiled and integrated in order to identify four main categories of natural favourability/suitability for habitation.

The town is located within a depression in the contact area between the Carpathians (Nemira Mountains and Berzunți Peak) and the Subcarpathians, where the marginal flinch overlaps the Miocene saltierous deposits, spreading on both of the river banks of Trotuș, especially in the sector where the valley broadens to more than 1km wide due to the junction with its tributaries Slănic, Vâlcele and Gălean.

As a consequence, all of the terraces become wider along this sector, the most important of them, considering its extension and adequacy for construction, being the 10-15 m terrace, carved in fairly resilient rocks (Tisești sandstones), that has supported the initial nucleus of the settlement, at the junction with Vâlcica creek. This terrace has a very good level of stability and a low slope gradient (1-2°), while being, at the same time, high enough to abase the inversions of temperature and their microclimatic effects. An exception are the areas located near the junctions with Vâlcica and Gălean, where the inclination of the terrain is higher due to the local colluvial deposits formed by build-up of the solid material carried by the creeks, and the soil tends to ram due to rapid oscillations of the groundwater level.
Another range of terrains, in terms of natural favourability for construction and habitation, progressively lower compared to the preceding one, includes the hillside slopes with moderate gradients (10-15°), especially the areas receiving a good amount of sunlight due to their orientation, and are less dynamic in which concerns the slope processes. This range also includes, in another subdivision, the secondary floodplains of the tributary valleys, aggraded due to accumulation by alluvial cones or colluvial deposits, which allows them to be exposed to floods, chiefly because the tributaries are not ................. These plains are generally relatively narrow, except for the junction sectors, where they become wider; the characteristics of the terrain, in addition to the mild microclimate and relative underground stability, increase their suitability for habitation. Other areas similar in which concerns their natural adequacy include the 5-6 m river terrace and the higher sections of the floodplain (2-4 m), which are very propitious due to their relatively flat surfaces and access to significant water resources, but are floodable and often undergo inversions of temperature.

The third range of terrains, less favourable for habitation, includes the 85-90 m river terrace, which displays an extensive broadening specially on the right side of Trotuș, is very stable and has a favourable microclimate. Unfortunately, the
The concept of sustainable development in the spatial evolution of Târgu Ocna and its surrounding area

Legend

Ranges of favourability for habitation
1. Highly favourable terrains
2. Terrains with an average favourability (a,b,c)
3. Terrains with low favourability
4. Unfavourable terrains (a,b)

1. **Rock terrace** (10-15 m), flat, very low slope gradient (0°-2°), permanent stability, extensive area, high enough to shade the effects of inversions of temperature; minimal restrictions in the junction areas, where the colluvial and alluvial accumulations and groundwater level oscillations may cause slight thawing.

2. **a. Hillside slopes with low slope gradient** (2°-5°) and moderate relief dynamics, average stability, maximum degree of suitability for habitation on acclimatic slopes.
   b. **Secondary floodplains**, often upgraded by alluvial cones, colluvial fans; cut-off lobe hillocks - terrains with very low slope gradient (2°-5°), mean width of 100-250 m, wider in the junction sectors, restrictions imposed by moderate floodability, low microclimate discomfort, significant variations of the groundwater level.
   c. **Low terraces** (5-6 m above) and higher sectors of the floodplain (2-4 m), flat, with important groundwater resources near the topographic surface, resources of construction rocks readily available; high risk of flooding, climatic discomfort due to local inversions of temperature.

3. **The 85-90 m flat terrace**, low slope gradient, stable, with water resources and rock deposits suitable for construction (cave alluvial deposits); adequate microclimate due to its position above the level affected by inversions of temperature; restrictions: low accessibility due to high energy of relief (vertical fragmentation 90 m and inclination of the access area between 15-25°) and very active relief dynamics, all of which severely restrict the lay out of roads and other types of infrastructure.

4. a. **The main floodplain**, flat/subhorizontal, with permanent water resources and construction materials readily available, maximum accessibility for roads, railroads, pipes, etc.; restrictions: highly floodable, the hydraulic level near the topographic surface, maximum discomfort caused by position under the temperature inversion layers.
   b. **High hillside slopes**, with inclinations ranging from 15°-35° to extremely steep slopes, including the forms of relief resulting from differential erosion, suitable for deforestation, with landscape value; restrictions: very low accessibility, extremely active relief dynamics (debris fall and slide, gully erosion, rock dumping, mudflows, etc.), maximum climatic discomfort on shaded slopes.
access to the area is restricted as a result of the highly inclined terrace scarps, which make it very difficult to lay out roads, as well as of the fragmentation of the adjacent slopes due to gully erosion, intensified on the account of the heavier rainfall on the slopes oriented towards the north-west and of the occurrence of friable rock deposits (alluvial deposits or alternative layers of friable sandstones with marl and clay).

The least naturally favourable range of terrains comprises the main section of the floodplain, which, although benefits from a high degree of accessibility (roads, railway), and important water resources and rock for construction material, is completely inadequate for the extension of the settlement due to the fact that it is easily floodable, the phreatic layers are located just above the topographic surface and the whole area is subject to inversions of temperature. Another area just as unsuitable for habitation are the high hillside slopes, with slope gradients up to 15-35° or steeper (including the forms of relief resulting from differential erosion), which are very important for the specific type of landscape they create, as well as for their degree of forestation, but are completely unpropitious for construction, due to their low accessibility and their active relief dynamics (debris fall and slide, gully erosion, block slumping, mudflows, etc.).

3.2. Anthropic alterations and amends on the natural favourability

The natural favourability (suitability) is perpetually modified, both in a positive, as well as negative manner, by amending and, respectively, altering the natural potential of the local environment.

In Târgu Ocna town and the nearby area the human activity has had a great impact on the local environment regarding the increase of the natural favourability by building a 1.25 km long breakwater alongside the Trotuş banks, thus reducing the floodability of the main floodplain and low river terraces, although not effective enough as to help prevent the extensive inundation that has occurred in 2005, when most of the town’s territory has been flooded. Other amends included the reforestation of the slopes and the maintenance of forests on some of the neighbouring hillsides (especially Mâgura Hill), which have determined the stabilisation of the slope deposits, providing the resilience of the area’s landscape potential.

On the other hand, the deforestation process, that provided weighty amounts of wood, as well as land further used as pasture, has contributed to the diminishing of the natural favourability degree, due to the fact that this process has affected mainly the hillsides with high slope gradients, and where the superficial geological deposits, commonly consisting of alternative layers of rocks, have contributed to an increased yield of mass movement and areal erosion processes (for example in Tiseşti and in Vâlcele).
Irrational salt mining represents another type of activity which, by using inappropriate technologies for dissolving the salt, has caused crumblings and piping, thus inducing a negative impact on the natural favourability in Gura Slănic. As a result, forms of relief such as the Burlacu Hole have formed, due to the collapse of the mines ceiling, causing house demolition and permanent restrictions regarding the construction of dwellings and other buildings in those areas. This has created an undesirable discontinuity within an urban area which is of utter importance for the integrated development of tourism in the Slănic Moldova-Târgu Ocna area. Recent studies show that these terrains are currently more stable and will be able to support buildings of small weight and touristic equipments in the future. The area is now used for leisure purposes (the Măgura Park and the balneary sanatorium), although the local soil salinization generates restrictions.

The technology used for salt mining and the management of the sites after the completion of the mining process have a great importance in which concerns the extent of the impact. For instance, the classical method consisting in cutting the salt had a significantly lesser impact on the environment (causing only some landslides near the railway station). Moreover, the new functions gained by some of the old salt mines (such as the Sanatorium, the „St. Varvara” Church and the Salt Museum, built inside the mines) represent a successful type of complex management both for industry and for tourism and health.
One can assert that the diminishing of the natural favourability due to human activity has a greater weight compared to its positive effects. The future evolution towards a sustainable development has to be based on a better correlation between the social-economical development needs and the possibilities provided by the natural environment.

3.3. Social and economical favourable/unfavourable elements for development

The area where Târgu Ocna has formed and evolved as an urban settlement has been inhabited due, on one hand, to its own natural resources (salt, petroleum, construction materials, mineral springs, forests), and to the location in a nodal area that towards which all of the main roads in the Trotuș Basin converge, and its degree of integration in the regional system of settlements, on the other.

The roads have always played a central role in the spatial configuration of this system, to name only the most relevant: the „Salt road”, the road towards Ghimeș (centuries 16th-17th), the secondary roads along the valleys of the Trotuș tributaries (Slănic valley, as well as Gâlean and Vâlcica), the proximity of the road linking Moldova to the city of Brașov across the Carpathians (centuries 18th-19th), and later, the construction of the railroad and the lay-out of the national road 12A and the secondary asphalt roads.

Beyond this extremely favourable location within the Trotuș Basin, that took advantage of the position of convergence, there were other elements that influenced the town’s development, including the demographic potential of the local population, which has also proven to be very enterprising, the local tradition regarding tourism (mostly balneary), the elements of cultural heritage, etc.

Nonetheless, we must emphasize one of the local characteristics of the urban morphology, namely the low density of the buildings, associated with a similar distribution of economical activities, which is the result of a modest urban tradition, common to most of the cities in medieval Moldova (although, at the time, Tg. Ocna was one of the most dynamic among them), combined with the effects of the town’s stagnation during the communist era, when the state policies have boosted the growth of other urban centres in the region, such as Onești, and the urban group formed by Moinești, Comănești and Dârmănești. The average density of the population calculated for each of the urban districts of Tg. Ocna is often lower than the national average (in some cases even lower than the minimum limit value), as can be seen in the maps shown below.
The urban territory is structured around a central nucleus, and comprises a number of polarising districts (some of them quasi-urban), with residential, touristic, economical or mixed functions. Most of these districts, which are agglutinated to the urban core, display disperse, semi-rural or rural morphology (Vâlcele, Tiseşti, Mosoare, Poieni, Gura Slănic, Gâlean).

While the central zone of Tg. Ocna (located between the rail station and the Vălcica creek) has managed to develop as fully functional urban area, the adjacent areas form a semi-urban strip, with a dominant residential function and habitation in one or two-storied buildings for individual dwelling. The outermost districts of the town are mainly semi-rural, in Tiseşti and Gâlean, with individual dwellings lined up by the main roads or spread out between plots of vines and trees, or even rural, due to a characteristic, highly dispersed dwelling in the periurban districts Vălcele and Poieni.

The deficiencies regarding the degree of coherence (as well as cohesion) of the urban territory in Tg. Ocna are mainly a direct consequence of the low quality
of the road infrastructure - only 25% are asphalted, while the rest are coated with material of poor quality, and the vast majority of the avenues (except for the sectors crossing the central area) are too narrow, so that the traffic is restricted to two lanes, greatly affecting the traffic flow, specially at the two access entrances to the city. Moreover, some of the peripheral districts of Tg. Ocna become even more isolated due to the fact that the public transportation system has no coverage in these areas, as is the case with Gâlean, Vâlcele and Tisești.

Based on these assertions, we may state that the urban space has a variable degree of social-economical favourability, which greatly differs within this territory, according to the general characteristics of habitation and urban activities, that have been quantized by using a group of indicators, referring to the degree of accessibility to the road and railway network and the quality of the urban environment (the quality of dwelling, the urban communications and public transportation, the availability of urban utilities and services, either educational, health facilities, commerce, leisure, banking or public administration), in relation to the town’s functions (residential, industrial, tertiary, tourism, agro-cultural).

The most favourable urban sector in relation to the social and economical context and potential for further development is the central area of Tg. Ocna, which is very well connected to the other urban districts, as well to the exterior, due to its access to the main four-laned boulevard, and also fully endowed with utilities, such as water piping, sewerage, electricity, central heating, gas pipes, etc. Within this urban zone, the buildings consist mainly of collective dwellings, made of durable construction materials (bricks and concrete), and public buildings, such as post offices, commercial centres, public administration and office buildings, etc., which grant a good degree of accessibility to these services for the local population. Another favourable feature of the central area is the density of parks and grass plots, as well as the monuments that make up an important part of the local cultural patrimony. Although highly suitable for the placement of tertiary and quaternary activities, this area has a few draw-backs, to name only the lack of public lighting along the secondary avenues, the heavy traffic caused by the absence of a ring-road, or the poor quality of the road and sidewalk coating in some sectors.

Fairly similar in which concerns the social and economical potential, the residential area surrounding the central precinct is quite different as regards the type of dwelling, which consists of individual houses or small villas (one or two-storied), while any type of industrial activity is absent. This area is characterized by a satisfactory level of accessibility to the main road and railway networks, and is partially endowed with urban utilities, lacking public lighting, and, in some spots, central heating and sewerage. The access to proximity services, such as commercial centres, may be described as fair, while the inner secondary avenues
have low-quality coating, and the sidewalks are generally exceedingly narrow or non-existent.

![Fig. 5 - The social and economical favourability for development in Târgu Ocna](image)

Most of the urban territory may be defined as **average** regarding its potential for development. This category includes the **quasi-urban areas** which have industrial, as well as residential functions, with easy access to the road network (although the coating of the secondary avenues and lanes is often damaged) and average urban utilities. The degree of access to proximity services is fair, but, unfortunately, this area is directly affected by the presence of some edilitary objectives (the wastewater treatment plant and the urban landfill). Lastly, an important feature, that distinguishes these districts from the previous categories, are the significant land resources that may be used for the extension of the urban habitat.

This category also includes the **periurban areas with no direct access to the main road** (national), which are extremely suitable for housing, characterized by a dense network of secondary avenues, which imprint a specific type of disperse structure of the habitat, and a good level of endowment with health and education facilities, such as hospitals, sanatoriums, schools and nursery schools. The access
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LEGEND

1. High favourability
   a. **THE CENTRAL PRECINCT** - good access to the main road network, including the sole four-lane boulevard, good quality of secondary roads and sidewalks, well endowed with urban utilities (water piping, sewage, electricity, central heating, gas pipes), building made of durable materials (bricks and concrete), easy access to services (post office, commercial centers, public administration), provision of collective dwelling, public lighting limited to main roads; heavy traffic due to the lack of a ring road, extensive grass plots and parks, numerous historical monuments and churches, the area is highly suitable for tertiary and quaternary activities.
   b. **THE RESIDENTIAL AREA SURROUNDING THE CENTRAL PRECINCT** - one or two-storied houses and villas, no industrial activities present within the area, good access to the road network and railway, well endowed with utilities, except for public lighting and partially central heating and sewerage, average proximity services, especially commercial, average quality of secondary avenues, narrow or nonexistent sidewalks, general scarcity of parks and grass plots.

2. Average favourability
   a. **URBAN AREAS** - individual dwellings, fair access to the main roads, average urban utilities (lack of sewage and central heating) and services, gas land available for construction, industrial activities untangling in the area, negative effects due to the presence in the vicinity of the waste-water treatment plant and urban landfill, low quality of secondary avenue economy.
   b. **URBAN AREAS WITH NO DIRECT ACCESS TO THE MAIN ROAD (UN DD)** - dense network of secondary avenues, a specific type of dispersed layout, presence of health facilities (hospitals, doctor's offices), average endowment with utilities, lack of heavy traffic, and insignificant proximity services (especially commercial services).
   c. **Semi-urban area located along the main road (UN ICA)** - well covered by public transportation, with average endowment with utilities, presence of agricultural activities (mainly animal farming), average type of habitat, located along the main road, low density of secondary avenues.
   d. **Semi-urban area with direct access to secondary roads (COUNTY AND DISTRICT)** - average endowment, spare land for construction prevailing agricultural function (animal farming); the habitat is commonly aligned along the main road or dispersed along the secondary avenues, low coverage by public transportation, as well as access to proximity services (commercial).
   e. **SPARE LAND AND AREAS WITH VERY DIFFERENT HABITAT WITH GREAT POTENTIAL FOR TOURISM** - high accessibility to the main road arteries, extensive grass plots and forested areas, with landscape value, low utility and services endowment.

3. Least favourable/completely unfavourable areas
   a. **DEEPLY RURAL AREAS** - relatively isolated, habitat consists of wide or half-timbered dwellings, prevalence of agricultural activities, restricted access to main roads, existing roads are narrow, with degraded coating, lack of most urban utilities, deficient as regards the access to services.
   b. **AREAS WITH PERMANENT RESTRICTIONS FOR CONSTRUCTION DUE TO LAND DEGRADATION due to human activities (salt mining by water injection), waterlogged piping lowland areas, low quality of paths and grass plots, excessive endowment, average urban, permanent restriction for construction, tourist use possible, provided that specific requirements are met.
to urban utilities is average, which is not the case when it comes to proximity services, especially commercial, that have proven to be deficient.

The semi-rural zones have been included in the same category, although they have fewer urban features compared to the areas depicted before. The Poieni district, located along the main road (DN 12A), is favoured as regards the degree of accessibility, but the quality of habitation is somewhat lower, due to its relative isolation with respect to the central urban nucleus and the location beyond the Cireșoaia gorge, that prevents the extension of the urban utility piping across.

Other semi-rural areas only have access to secondary roads (county and district roads), and thus suffer from isolation (due to the fact that public transportation is not available in these districts), and poor access to proximity services, mainly commercial. Instead, they are better endowed with urban utilities and are spared the inconvenient of heavy traffic.

This category also includes the spare land and the areas with very disperse habitat, with great potential for tourism, located in the vicinity of Măgura Park, characterised by extensive grass plots and forested plots, highly accessible, but, for now, poorly endowed with utilities and urban services.

The last category comprises the least favourable to completely unfavourable zones of Tg. Ocna which either display a deeply rural morphology (adobe or half-timber dwellings) and functionality (prevalence of agricultural activities), and lack access to the main roads and most of the urban utilities and facilities (health, educational, commercial), or have permanent restrictions for construction due to land degradation, as a result of the technology used for salt-mining by water injection that has generated effects such as suffosion/piping in the Gura Slănic area.

4. The geographical favourability for urban sustainable development in Târgu Ocna

The aim of this study is to examine the natural suitability and the social-economical favourability for habitation and development, respectively, in order to be able create a well grounded basis for further applied approaches aiming for an urban sustainable development. Consequently, the integration of the data provided by the two analyses into a single synthetic picture becomes very useful. The methodological basis of such an integration is provided by the progressive view method in cartography (Ungureanu, Irina, 1995). Conceived as a spatial synthesis of the environmental performance, the method superposes various types of variables – i.e. layers of information –, in our particular case, the natural suitability and the social-economical favourability, further identifying the means of integrating the elementary variables into complex ones, so that fewer classes with result as opposed to a simple juxtaposition.
By applying this method on the data we have acquired so far concerning the pre-requisites of a sustainable urban development in Târgu Ocna, we may obtain a new spatial pattern which reflects the favourability or, on the contrary, the lack of favourability of the urban territory.

As regards the opportunities provided by the complex natural and social-economical system for a sustainable urban development, we have been able to identify three range of favourability. The first category comprises areas of old urban habitation located on the rocky, smooth and stable Trotuș’ terrace, which has proved very suitable for constructions. The second category of favourability includes the industrial sectors located in the peripheral and semi-rural areas, with an average natural suitability for habitation.

The process of urban restyling by functional diversification and improvement of the accessibility and quality of services is a mandatory requirement, that aims to harmonize these districts with the central precinct by enhancing the territorial coherence as an important premise for a sustainable development. The least favourable areas – in terms of natural suitability, as well as
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<th>Ranges of favourability</th>
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<td>I. Highly favourable areas</td>
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<td>II. Areas with an average favourability</td>
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<td>III. Areas with low favourability</td>
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**LEGEND**

I a. Areas displaying highly favourable natural conditions due to their location on the rock terrace, occupied by the central precinct with collective dwellings, functionally diversified and well endowed with urban utilities.

I b. Areas located on the outskirts of the town, with highly favourable natural conditions for habitation and direct access to the main road (DN 12 A), with spare land available for construction, but an average endowment with utilities.

I c. Semi-rural areas located on the Trotuș rock terrace, favourable for construction, with direct access to the secondary roads, plenty of spare land for urban expansion, but somewhat disfavourable due to low utility and service endowment.

II a. Areas surrounding the central precinct, located in restrictive natural conditions (the 5-6 metres altitude low terrace and the higher sectors of the floodplain), bearing significant potential for social and economical development, on the condition that urban utilities are provided along with some internal restructuring.

II b. Semi-rural areas located on terrains with average natural favourability on the low Trotuș terrace or the secondary (often upgraded) floodplains of its tributaries, offering opportunities for a balanced development provided that they are well equipped with utilities and diversified functionally.

II c. Areas with appropriate location with respect to a future tourist development, which can be capitalized mainly by constructing light buildings, setting up parks and grass plots, restoring the mineral springs and the walk streets for promenades, etc., but having temporary or permanent interdiction for building.

III a. Areas located near the central precinct, unsuitable for building due to flooding risk of the main Trotuș's floodplain, may be valorised as recreation areas if endowed appropriately with grass plots.

III b. Peripheral districts located on the main floodplain or on steep slopes, can be used sustainably by conserving the natural forest and river meadow environment, in order to maintain the landscape quality.

III c. Areas unsuitable for urban development: steep slopes, active relief dynamics, isolated areas or terrains undermined due to the effects of salt mining by water injection.
regarding the social and economical favourability for development – are those facing the most significant natural restrictions, sometimes induced by human activities (active relief dynamics, deforestation, easily flooded lands or steep slopes), along with coping with repulsive social and economical elements such as isolation or permanent interdiction for construction.

The fact that these sectors are included in the low favourability range does not necessarily mean that they may not be used in a manner that is consistent with the principles of sustainable development, but instead it emphasises the need to adopt non-intrusive measures which will help maintain or regain their (semi-)natural character and thus increase the system’s own capacity of self-regulation.

The two analytical frames (fig. 3 and fig. 5), as well as their synthesis (fig. 6) convey the graphical expression of the territorial variability specific for different areas of the urban territory. They also confirm the existence of some areas which preserve some natural features (an average level of anthropisation), which have evolved according to the social and economical dynamics in their turn greatly influenced by the antiquity and the permanence of habitation, by the functional fluctuations common to the small urban settlements and by the social and economical uncertainty of the last decade.

5. Premises of sustainability of the future urban planning

The analysis of the sectors with different natural favourability (that can be used in different ways) and with different socio-economic potential (but improvable), allows for the substantiation of a trajectory in which concerns the evolution of the city, not necessarily facile, but hopefully realistic.

Among the useful measures for following this trajectory it is worth mentioning:

1. An urban restructuring (a rethinking/ revitalisation of the inner city) through an increase in the building density, especially on the upper rock terrace of Trotuș River and the secondary floodplain of Gâlean creek, through the amendment and modernisation of the street network (especially by creating a ring-road for the heavy traffic, by broadening the main boulevard up to 4 traffic lanes, as well as broadening and modernising secondary streets, such as M. Eminescu, V. Alecsandri, N. Arbănaș streets, by laying out pedestrian esplanades on Victoriei Street, the old city centre, and setting up traffic lights at the crossroads), by the functional diversification of some urban areas (e.g. the Eastern industrial zone placed at the entrance into the city from Onești), and by the rehabilitation of some objectives with patrimony value (such as the Costache Negri Memorial House, nowadays the Central Pavilion of the City Hospital, the Saint Nicholas Church, the Monument of the Heroes from WWI, the Răducanu
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Church, the Princely Church, the House of Culture and the Railway Station built by the architect Anghel Saligny).

2. The modification (designed to have a positive impact on the human health) in the location of some industrial areas (e.g. the Coșna Furniture Company, located in the Trotuș Valley, in the vicinity of Măgura Park), as well as of the wastewater treatment plant and landfill site (the latter closed in 2005), placed along the same valley.

3. The complex planning and endowment of some areas with potential for spatial-functional continuity in the Târgu Ocna-Slănic Moldova area, by setting up a protected area with halophile vegetation, anthropic micro-relief and supervised tourist routes.

4. The endowment for touristic activities of the 85-90 m terrace alongside the Trotuș, in Tisești, and of the contiguous hillside slope (both suitable due to their amenities, comprising the microclimate, the landscape and the potential for practicing winter-sports), as well as the restoration of the mineral springs in the Măgura Park.

5. The establishment of new green plots, especially in the industrial areas, but also the restoration of the existing and damaged ones, as well as of those in the Trotuș Valley or within the Măgura Park.

6. The stimulation/ revitalisation of cultural activities, by at least polarising the activities that aim for the valorization of the ethno-folkloric patrimony within the neighbouring areas.

It is necessary to take into account the fact that many of these measures are and will continue to be promoted through the elaboration and implementation of new integrating territorial planning strategies over short, medium and long term, with clear objectives, which are to be implemented through efficient measures.

Among the critical characteristics of the above mentioned evolution trajectory, worth mentioning are: the weighty amount of investments necessary for the rehabilitation of the transportation network (and especially of the secondary avenues), of the water supply and sewerage systems (which are out of date and inefficient), the modernisation of the wastewater treatment plant (currently under-dimensioned and non-reliable), as well as of the waste management system and public lighting; the financial and communication constraints imposed by the re-systematisation of the previous road network (often disorganised and inefficient, constantly in need of costly maintenance) and also by the re-systematisation of the inner city (lacking spatial coherence, overly spread out in a tentacle pattern, and thus quality segregated, especially due to the distances to the administrative city centre, increased even due to the inefficient public transportation); the resilience of the preferential administrative “voluntarism” (with investments directed preferentially to the central areas, or to certain urban districts).
The spatial identities generated by the level of favourability considered both separately, but also in an integrated manner, outline the complex premises (both natural and social-economical) that act as potential reserves (resources) in the sustainable urban system that Târgu Ocna aims to be. These premises become operative in the urban evolution according to the decisions of the public administration, whose outcome regarding the urban planning process is the General Urban Plan (G.U.P.).

By studying the functional zoning of the city, as well as the planning regulations established by the G.U.P. as opposed to the synthetic index of favourability resulted from our study, we may note obvious similarities, as well as noticeable discrepancies. We have analysed three sampling areas within the urban territory of Târgu Ocna in this comparative manner, displaying the results as follows.

Fig. 7 - Gura Slănic area: (a) sample extracted from the map Urban regulations for Târgu Ocna (Source: G.U.P. Târgu Ocna, 2000); (b) sample extracted from the Map of the geographical favourability for development

In the Gura Slăníc area the main impediment for urban development is the interdiction to build within an extensive perimeter, to which the local soil salinization adds another inconvenient. Nevertheless, this district has an average favourability for development on the condition that advantages such as the location
near the main roads and the proximity of the Slănic Moldova balneary resort and the appealing landscape are efficiently capitalised. By cautiously endowing this area with buildings of small weight, negative phenomena such as the natural or human-induced geomorphologic processes may be prevented, allowing the district to become very attractive in terms of leisure and touristic potential.

![Tisești](image1)

**Fig. 8 - Tisești:** (a) sample extracted from the map Urban regulations for Târgu Ocna (Source: G.U.P. Târgu Ocna, 2000); (b) sample extracted from the Map of the geographical favourability for development

Regarding the Tisești area, the set of regulations established by the G.U.P. recommend the development of this district mainly on the top of the lower terrace of Trotuș, but taking into account the restrictions concerning the high flooding risk. Also, the inclusion of the ancient Dacian site, in particular, and of the whole Tisești hill, in general, as leisure area and belvedere spot in a tourist route, along with the Gura Slănic district might be of some interest, further contributing to an increase in the territorial coherence and gaining of more urban features of this relatively isolated semi-rural area.

The Gâlean area is highly favourable for urban development on the condition that the urban street network is reconfigured along with the lay-out of a ring road. Some touristic equipment have already been located in this district, as well as a number of small industrial businesses, but the opportunities are definitely more significant, especially in the most naturally suitable sector superposed upon the contact area between the alluvial cone and the rock terrace. The G.U.P. takes notice that a restructuration of this area is mandatory, but fails to specify which could be the most suitable manner to achieve that goal, while an important percentage of the terrains in this district continue to be used for agricultural purposes.
Conclusions

A comparative analysis of the development path built up and interpreted in our study as opposed to the trajectory recommended by the planning documents drawn-up as instruments for the decision-making process (such as the General Urban Plan for Târgu Ocna) shows a number of similar approaches, but also some unrealistic regulations which neglect (sometimes completely) the actual territorial context, either by omitting the importance of the natural environment, or by leaving relevant elements belonging to the natural and social-economical potential out of the predicted urban evolution.

The similarities, as well as the differences highlighted by the comparison above mentioned hold a conclusive value for both the fundamental geographical study we have undertaken, and its applied component, oriented towards the operationalization of the sustainable development principles in Târgu Ocna municipality.

The similar approaches and standpoints are primarily focused on sketching a spatial evolution path that takes into account, on one hand, the position within the territorial system of the middle section of the Trotuș valley, by fully acknowledging the complementarity of the urban territory with the contiguous rural space and the neighbouring towns (especially Slănic Moldova), and its environmental (with an emphasis on the natural risks) and social-economical potential, on the other, aiming to valorise some of the favourable districts of Târgu Ocna for a future urban extension (Gâlean and Măgura), to set up temporary or permanent restrictions for building (in Gura Slănic), but mostly to reshape (by modernization) the urban habitat in order to enhance the territorial coherence.
The dissimilar standpoints and angles comprise either sectorial approaches, following patterns that are rather „technical” and lack a systemic view over the development of the urban organism quite common when it comes to administrative documents (for instance, the obsolete division into functional zones of the city, according to which the industrial activities should be agglomerated within a compact industrial district, contradicting the more modern ideas, which promote diversity and functional complementarity), or the lack of viable alternatives regarding the urban evolution (e.g., the microclimatic and touristic potential of the high river terrace in the Tisești district that has not been mentioned accordingly in these official documents).

To sum up, our analysis highlights the fact that the path recommended by the administration should take into account, at least in terms of completion, the trajectory identified as viable in this geographical study, so that the future evolution of Târgu Ocna may become as realistic and adequate as possible in which concerns the real potential of the town and the necessities derived from its internal functionality and its interactions with the regional system of settlements.

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