ABSTRACT

of doctoral thesis:

RESEARCH ON THE ANTHROPIC FACTOR INFLUENCE ON RURAL DEVELOPMENT IN NORTH BRĂILA TERRACE AREA

elaborated by: COSTEA ȘTEFANIA ELISABETA (ROȘU)
under the coordination of Prof. Dr. ION DONA

Key words: rural development, anthropic factor, Brăila county, rural communities from North Brăila Terrace area, Global Pollution Index (GPI), Sustainable Rural Development Index (SRDI), development stage and potential.

The doctoral thesis addresses a theme included in Romania's agricultural policy strategy, in which rural development and environment protection represent the main priorities.

Brăila county is the geographical area where the research studies were conducted, with in-depth research at the level of six rural communities whose administrative areas largely overlap one of the three hydro-meliorative systems of Brăila, namely North Brăila Terrace.

The conducted studies and research aimed to identify the main environmental, economic and social problems in Brăila county and at the level of the six rural communities from North Brăila Terrace: Cazasu, Romanu, Siliştea, Traian, Tudor Vladimirescu and Vădeni, and establishing the potential and the development trends of the investigated area.

The main objectives of the present dissertation were the following:

- evaluation of the rural development stage and potential of the six rural communities from North Brăila Terrace, which was based on the elaboration and construction of a Sustainable Rural Development Index (SRDI);

- global evaluation of environment quality situation, both at the level of Brăila county and in the six rural communities from the investigated area, which was based on the elaboration and construction of a Global Pollution Index (I_{PG});

- building a theoretical model of sustainable rural development based on the two indices.

The main objectives that were addressed have tried to respond to the goal established by: conceptual delimitation of rural development in the context of historical and theoretical evolution, both at European and national level; conceptual delimitation of the environment

and anthropic impact and the methods and techniques used for the environmental impact assessment; multi-functional analysis, at the level of Brăila county and in the communes from North Brăila Terrace, on a 10-year period; where the available data permitted, the analysis started in the year 2000.

The theme of the dissertation required the utilization of a complex methodology based on the juxtaposition of the quantitative research specific methods: primary data analyses – interviews with formal local, county, regional actors, farmers, representatives of agricultural associations, (BRAICOOP – agricultural cooperative, presidents of Irrigation Water Users Associations), observations; secondary data analyses – data collected from the Agriculture and Rural Development Directorate Brăila, Environment Protection Agency Brăila, Company of Public Utilities Dunărea Brăila, local councils of communes; qualitative research specific methods were also used: stadial comparative analyses at county, terrace and locality level in order to capture the moment, the time, the most statistically significant year for establishing the rural development level and potentiality of scientifically investigated communes: the year 2015. The most adequate statistical methods were the longitudinal methods (10-year series) and the cross-sectional methods – analysis of the group of communes from North Brăila Terrace and their in-depth hierarchization according to a set of indicators specific to sustainable rural development. The methodological originality of the dissertation resides in combining the research types (quantitative and qualitative), while its own contribution to the studies in this field of research is materialized in the development of a theoretical model enabling the measurement of the main correlations that exist in the rural development process. The model is conceived as a measurement instrument of the development level and of development potentiality identification, being easy to apply to any rural locality from Romania.

The present dissertation starts from two concepts, i.e. rural development and anthropic impact, and I considered it necessary to carry out two bibliographic studies, on the two themes.

Chapter I ***RESEARCHES ON RURAL DEVELOPMENT IN THEORETICAL AND HISTORICAL CONTEXT*** is a bibliographical study, and the consultation of both national and international literature permitted to capture the evolution of the rural development concept, both in historical and theoretical terms, starting from definition, concepts, characteristics and principles, scope and ending up with the analysis of the rural development concept at European and national level. The two programs specific for the Romanian rural space were analyzed, the strategic priorities, the related measures and expenditures, both for

the period 2007-2013 and for 2014-2020, as well as the objectives of the sustainable development of the rural area for the next period. The chapter ends with the author's brief conclusions referring to rural development.

Chapter II ***RESEARCHES ON THE ANTHROPIC IMPACT IN THEORETICAL CONTEXT*** is a scientific approach started from the environment concept, its definition and main factors contributing to its deterioration. The environmental impact was next addressed, starting from the concept, definition, types of environmental impacts and their classification. At the end of the chapter the main methods and techniques that were used so far for the evaluation of the environmental impact were briefly presented. The chapter addressing the utilized research methodology presents in detail the method selected for the environmental impact assessment. At the end of the chapter, the author's conclusions referring to the environmental problems are briefly presented.

Chapter III ***THE RESEARCH METODOLOGY USED*** is the chapter dedicated to describing the research matherials and methods used in this paper.

Chapter IV ***MULTIDIMENSIONAL ANALYSIS OF BRĂILA COUNTY*** is a study of Brăila county, mainly of its rural space, made at three levels, i.e. at environmental, social and economic level. The first part comprises general information on Brăila county, starting from the physical-geographical data, natural resources and climate data (temperatures, rainfall, weather phenomena). The aridity index was calculated on the basis of climate data in order to highlight the continentalism degree variation and the need to use irrigations in the increasingly arid and droughty weather of Brăila county.

In the part dedicated to the environment, on the basis of specific indicators, the quality of the main environmental elements was analyzed: air, water, soil, biodiversity in Brăila county, in the period 2008-2015. As regards air quality, in the investigated period, there were exceedances of the maximum allowed levels of nitrogen oxides and particulate matter concentration, due to the intense road traffic and to the activities from the energy sector. The Danube river is the main water source in the county (over 93% of total water captured) and it is used for agriculture, industry and population's consumption. The river waters were classified as "good" in terms of chemical status, in the investigated period, even though the annual average concentrations of organic substances determined in the control sections exceeded up to 25 times the permitted values. In Brăila county prevails the chernozem soils and more than 70% of the agricultural soils fall into quality classes II and III. The most serious soil degradation process is a combined process (salinization and sodization), which affects more than 30% of the country's area. There are areas vulnerable to nitrate pollution

from agricultural activities (40 localities). The country's biodiversity is characteristic to the steppe zone, and the area under forests and forest vegetation accounts for less than 6% of the county's area. The analysis of environmental factors was completed with the calculation of the global pollution index for the year 2015. Thus, for Brăila county, I_{PG} = 1.57 – value that reveals that the environment is subject to an anthropic impact, within acceptable limits. Out of this reason, the subsequent analyses took into consideration the influence of the anthropic factor on rural development, depending on the characteristics of local anthropic systems, correlated with the characteristics of the general framework specific to the county.

In the part dedicated to the demographic and social problems of Brăila county, and mainly in the rural communities of this county, an analysis of the demographic and social phenomena characteristic to the investigated area was made, starting with the year 2000. Population is steadily decreasing in most rural communities, with a negative natural population growth, due to the low birth rate in relation to death rate, and it is characterized by strong demographic ageing, due to young population diminution. The socio-occupational pattern is based on agricultural employment. In the year 2015, the population employed in agriculture accounted for 27.5% of total employed population, suggesting the excessive economic and social dependency on this activity, and at the same time reveals the maximum risk to which the rural communities are subjected. The unemployment rate, with a maximum value of 15% in the year 2000, affects the employed population, the most vulnerable group being the male population. The quality of life in the rural areas depends on the social infrastructure situation, whose objective and quantitative dimensions describe a social vulnerability specific to the rural area. At county level, the number of schools decreased significantly, the most drastic diminution of the school units being noticed in the rural area (in the year 2015 the number of schools in the rural area was 5 times lower than that in the year 2000). The healthcare infrastructure was present only in the urban area, the number of physicians, mainly of those in the public sector was diminished.

The county's economy, in the investigated period, was dominated by micro-enterprises, 87% of the total number of enterprises having less than 9 employees on the average, while the business sector structure was dominated by the local active units with trade activity (43% in the year 2015). The primary sector of the economy, agriculture, ranked 3rd in the economy of Brăila county, after trade and processing industry. The turnover of active enterprises in agriculture in total turnover of active enterprises in Brăila county oscillated from 9.8% in the year 2008 to 15.8% in 2015. The trade sector was the most competitive in

the county's economy, in the period 2008-2015 the turnover of active units in trade increasing from 44.9% (in 2008) to 62.3% (in 2015) in total turnover of active units.

In this chapter, a deeper analysis of agriculture in Brăila county was made, starting from a presentation of the irrigation system of the county, from its setting into operation up to the present moment, while focusing on the institutional analysis of factors involved in the irrigation sector. On the basis of statistical data supplied by the official institutions of the county, an analysis of the irrigation system at county level was made, of its effective utilization, of the areas cultivated with the main cereal crops and oilseeds, of the obtained productions and yields per hectare, under irrigated and non-irrigated system in the period 2010-2015. There are differences between the average yields obtained under irrigation system versus those under non-irrigated system in all the five investigated crops throughout the period; yet in certain crops these differences are noticeable, while in other crops they are extremely great. For instance, the average yields obtained in the sunflower crop under irrigated and non-irrigated system differ from 0.6 t/ha (2010) to 1.35 t/ha (2011), while the average yields in barley from 0.6 t/ha (2013) to 1.78 t/ha (2015). The average wheat yield obtained under irrigated system in the year 2015 was higher by 1.98 t/ha than that obtained under non-irrigated system. The greatest differences between the average yields under irrigated and non-irrigated system were noticed in maize and two-row barley. In the case of maize, in the year 2012, 6.66 t/ha were obtained under irrigated system, while 3.35 t/ha were obtained under non-irrigated system, hence the difference was 3.32 t/ha. Very great differences could be noticed between the average yields in two-row barley under irrigated system compared to those obtained under non-irrigated system, these differences ranging from 3 t/ha in the year 2010 to 4 t/ha in 2015.

In the agricultural output value of the Brăila county, crop production had the highest share, followed by livestock production. This chapter ends with the conclusions extracted from the analysis made at the level of the county.

Chapter V ***MULTIDIMENSIONAL ANALYSIS IN NORTH BRĂILA TERRACE AREA*** is also a study made at three levels, i.e. at environmental, social and economic level, in six rural communities – Cazasu, Romanu, Siliştea, Traian, Tudor Vladimirescu and Vădeni; the irrigation system of North Brăila Terrace lies on the administrative territory of these communities. The analysis begins with a description of the six rural communities, presenting a short history together with the description of their natural setting. The multi-dimensional analysis at the level of the six rural communities had a similary structure as that at the level of

Brăila county, namely: environment quality analysis, demographic and social analysis and economic analysis.

Within the environment quality analysis, air, water, soil and biodiversity were the main factors approached, for which the time period subjected to analysis was 2008-2015. According to the data analyzed for the *air*, in the investigated period the annual average concentrations of the main pollutants under monitoring at the two stations in the area were not exceeded, and the air in the six rural communities was in the category "good". As regards *water quality*, the surface water represented by the Danube river, the main supplier of water for all uses, for drinking water inclusively, had organic substances above the permitted levels, while the remaining surface waters exceeded the permitted chlorine and iron concentrations; the ground waters had a high sulfur and chorine content and were not categorized as drinking water. *Soil quality* in the six communes was influenced by the intense land reclamation works that led to deep transformations, stopping the natural bioaccumulation process of humus in soil in time, which led to the decrease of humus reserve in soil. To confirm and reinforce this statement, 5 soil analyses were presented, carried out at the request of the farmers holding the respective areas; the analyses were made in the Laboratory BRAICOOP in Brăila. The analyses taken on 0-25 cm depth revealed that in the analyzed samples the humus content varied from one field to another, the pH values indicated the presence of alkaline soils, with excess nitrogen in soil, while the mobile phosphorus and potassium were in poor supply. The analyzed agro-chemical indices were favourable for the field crops, yet an adequate fertilization for each crop in part was necessary for obtaining the desired yields, depending on the requirements. As regards *biodiversity,* sites included in Natura 2000 network are located on the territory of five out of the six communes, except for the commune Cazasu, where the anthropic activities, such as drainage, hunting, gravel extraction, together with a faulty management and agricultural practice represent the main threats with a critical impact upon ecosystems.

On the basis of the same methodology, a global assessment of the environment quality was made: at the level of Brăila county and of the sample comprising the six rural communities from North Brăila Terrace. Thus, on the basis of the illustrative method we constructed the diagram of the global pollution index (I_{PG}) at the level of the six rural communities. The global pollution index value at the level of the six rural communities was 1.48, which is a lower value than $I_{PG} = 1.57$ at the level of Brăila county. Both values indicate that the environment is subjected to an anthropic impact within acceptable limits.

The *demographic and social analysis* at the level of the six rural communities from North Brăila Terrace, carried out for the period 2000-2016, revealed the following: according to the number of inhabitants in the year 2016, the communes Cazasu, Traian and Vădeni were medium-sized communes, the commune Tudor Vladimirescu was small-sized, while the communes Romanu and Siliştea were very small-sized communes; in the investigated period, in the communes Cazasu, Romanu, Siliştea, Traian and Vădeni the male population prevailed, while in the commune Tudor Vladimirescu the feminine population prevailed; throughout the investigated period, in the six communes the natural population growth was negative, a similar trend to that at the level of the entire county; the healthcare services were poorly represented, and the number of physicians was insufficient in relation to the number of inhabitants. The analysis of the technical infrastructure revealed that the six communes were connected to the drinking water supply network, which had gradually extended since the year 2000, yet there were great production losses in the drinking water supply to the population, which reached more than 75% of total water production in the commune Romanu in the year 2015. The natural gas supply network was present in 4 out of the 6 communes, and the sewerage system and the thermal energy distribution network were absent in all communes.

The *economic analysis* of the six rural communities in North Brăila Terrace area was made for the agricultural and non-agricultural sectors. Thus, the number of active enterprises, the number of employees working on those enterprises and turnover lay at the basis of the analysis of the non-agricultural sectors of the six rural communities, and the same set of indicators referring to those involved in agriculture, hunting and related services lay at the basis of the analysis of the agricultural sectors. Thus, the communes with the highest number of active enterprises were Vădeni and Cazasu, where the highest number of employees was also noticed, and the communes with the highest number of active enterprises engaged in agriculture, hunting and related services were Traian and Tudor Vladimirescu. In 2010, in the commune Traian, 71.3% of the number of employees worked in the active enterprises engaged in agriculture, hunting and related services, while in the year 2015 their share reached 81.7%. The highest turnover of active enterprises was found in the commune Vădeni, while the highest turnover of active enterprises engaged in agriculture was found in the commune Traian

In the economy of the six communes from North Brăila Terrace, in the period 2010-2015, the active enterprises in two sectors, i.e. agriculture and trade, prevailed, hence the primary and tertiary sectors of the economy. Thus, the active enterprises engaged in agriculture prevailed in the communes Romanu, Siliştea, Traian and Tudor Vladimirescu,

while the enterprises engaged in wholesale and retail trade prevailed in the communes Cazasu and Vădeni throughout the investigated period.

In the six communes from North Brăila Terrace, agricultural land prevailed in the land structure, with over 93% in the commune Traian, and the commune with the lowest share of agricultural land was found in the commune Cazasu (76%). By the non-agricultural use of land areas, in the commune Cazasu the land under constructions prevailed, while in Romanu, Siliştea and Traian the areas under waters and ponds prevailed; in the commune Tudor Vladimirescu the degraded and non-productive land areas prevailed, while in the commune Vădeni the land under forests and forest vegetation prevailed.

In this chapter, an analysis of agriculture was made starting from a brief description of the irrigation system, and depending on the availability of data on the irrigated and non-irrigated areas and on the obtained yields, the analysis was divided into two periods: 2008-2011 – period for which the data refer both to irrigated and non-irrigated areas and to the obtained productions under the two systems and 2012-2015 – period for which there is no data divide between irrigated and non-irrigated systems; the main investigated crops were the following: wheat, barley, two-row barley, maize and sunflower, having in view that the areas under these crops prevailed (more than 90%) in the arable areas of communes. The commune Cazasu had the largest share of irrigated area (40%), while in the remaining communes this share oscillated around 15-20%, so that the areas under irrigated system were much smaller than the areas cultivated under non-irrigated system. In the year 2011, in the commune Cazasu, the wheat was cultivated on 229 ha under irrigated system and on 417 ha under non-irrigated system; in the same year, in the commune Siliştea, wheat was cultivated on 405 ha under irrigated system and on 1432 ha under non-irrigated system, maize on 340 ha and on 1547 ha respectively, while sunflower on 340 ha and 1547 ha respectively. The obtained yields per hectare for the main investigated crops (wheat, barley, two-row barley, maize and sunflower) were noticeably higher in the irrigated crops versus non-irrigated crops. Thus, in the year 2009, in Cazasu, there were 2 t/ha differences between the irrigated and non-irrigated maize yields, while in the commune Romanu in the year 2010, the difference between the yield per ha in the maize crop under irrigated and non-irrigated system was 7 t/ha. In spite of these high yields, there were years when the potential average yields of the area were not exceeded and were not even reached. For instance, in the commune Romanu, throughout the investigated period the yield obtained for the wheat crop under irrigated system ranged from 3.3 to 4.5 t/ha, under the potential average yield of the area estimated at 5 t/ha. In the commune Traian, the yield per hectare of wheat cultivated under irrigated system ranged from

4.2 to 4.5 t/ha, in sunflower from 2.8 to 6.8 t/ha, in barley from 3.8 to 4.5 t/ha, in two-row barley from 2.2 to 3.5 t/ha and in maize from 2.3 to 6.5 t/ha and. Taking into consideration these yields, we can say that the potential average yields of this area were reached only in the sunflower crop.

In the period 2012-2015, the areas cultivated with the five crops had quite oscillating evolutions in all communes, yet they prevailed in total cultivated areas. Thus, in wheat, the yields per hectare ranged from 3.2 t/ha in commune Vădeni to 5.5 t/ha in commune Traian, in barley from 4 t/ha (Tudor Vladimirescu) to 4.8 t/ha (Traian), in two-row barley the yields per hectare oscillated at around 3.5 t/ha in all the investigated communes, while in sunflower they ranged from 1.7 t/ha (Siliștea) to 2.7 t/ha (Traian). In maize, the crops were highly different, oscillating from about 4.4 t/ha in the commune Vădeni to 7.2 t/ha in the communes Romanu, Siliștea, Traian and Tudor Vladimirescu.

At the end of the chapter a theoretical model was constructed based on the Sustainable Rural Development Index (SRDI) to evaluate both the development stage of the six rural communities and the development potential for the next period. For the elaboration of this index, a series of analysis criteria were considered, composed of 18 indicators, grouped by 5 criteria, the year under investigation being 2015. The novelty in building this index consists of: differentiated analysis of the economy of the six communes, both for the agricultural sector and for the non-agricultural sector; the environment component represented an independent criterion; data extraction for the indicators from the componency of the index can be achieved from the official statistics available on-line, and thus they can be updated each year. Although the index was constructed only at the level of the six rural communities, it can be completed and adapted if appropriate and used as a model for all the communes on Romania's territory to evaluate their development stage and to obtain a typology of their development potential.

The SRDI values obtained at the level of each commune resulted in the following hierarchy: the commune Vădeni ranked 1st, this place in the hierarchy being due to the human resources and the agricultural and non-agricultural economy; the commune Cazasu ranked 2nd, this place in the hierarchy resulting from the living conditions (social and technical infrastructure criterion), the human resources and non-agricultural economy; commune Siliștea ranked 3rd , commune Traian 4th, strongly supported by the non-agricultural economy; commune Romanu ranked 5th and commune Tudor Vladimirescu ranked 6th.

By grouping the values obtained by SRDI, three intervals/levels were obtained and if each of them were assigned a certain development level (high, medium and low), the six

communed could be grouped as follows: communes with high development potential: Vădeni and Cazasu; communes with medium development potential: Siliștea, Traian and Romanu; communes with low development potential: Tudor Vladimirescu.

The last part of the present thesis is a chapter with conclusions and recommendations, in which the main objectives of the study made it possible to identify certain development solutions, which should equally take into consideration the economic, social and environmental development level of the communes from North Brăila Terrace. The design of viable solutions for the sustainable development of the communes in the investigated area valorized the main socio-demographic and environmental opportunities, to which the specific economic potentiality was added. From this perspective, the rural area consisting of the six communes from North Brăila Terrace is considered as a dynamic territory, defined by obvious rural modernization trends focusing on the emergence of alternative economic development, on environmental respect and protection and social growth.