THE SPECIFICITY OF RISKS MANAGEMENT IN THE URBAN SETTLEMENTS HIGHLY INDUSTRIALIZED FROM ROMANIA. GALAȚI NATIONAL DEVELOPMENT POLE, AS A CASE STUDY

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Abstract: Economic development in the communist countries had in view the industrialization of big cities, this process being followed by the attraction of flows of active population from the neighbouring areas, emphasizing the pressure upon natural and social environment. The forced industrialization determined the rapid growth of the inhabitants' number, the attracted population being concentrated in crowded districts of workers, where high rates of criminality are registered today. This article aims to emphasize the importance of integrated management models of the unbalances registered in the relationships between the components of territorial systems highly industrialized. The identification of the specificities of the territorial management models was accomplished by detailed analyses of the environment and social risks, in a city which is representative for the difficulty of managing the risks generated by industrialization.

Key words: risks management, environment risks, social risks, management models

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INTRODUCTION

The integrated approach of risks within highly industrialized urban systems is a major preoccupation of the decision factors, due to the effects of the concentration of economic activities upon natural and anthropic environment.

The process industrialization in Romania in the communist period regarded a series of towns, relatively unitarily distributed, where industrial units with a large number of employees were built in a short period of time. A special category is represented by large cities, regional capitals, which benefitted of big investments from central level for the large production units. The purpose was to change these towns into regional development poles, able to promote information which was indispensable for the development in the settlements' networks they coordinate.

The industrialization process determined other activities, together contributing to the attraction of active population flows from the neighbouring areas, emphasizing the pressure upon natural and social environment in these towns. Forced industrialization determined the doubling of

the inhabitants' number in short periods of time, the attracted population being concentrated in crowded districts of workers, where high rates of criminality are registered today. Also, the concentration of industrial activities did not take into account the impact upon environment, an aspect which was disregarded during the communist period, an approach which today leads to major unbalances in the natural environment.

In this article we intend to emphasize the importance of integrated management models of unbalances, determined by the pressure exerted by the concentration of economic activities. We have had in view two work directions, the analysis of environment risk and of social risks, both of them considered to have as main cause of their amplification the forced industrialization from the communist period.

An important role in building the integrated risk management models is held by the perception of risk, the way risk is perceived at individual and institutional level, these aspects being decisive for the efficiency of these models (Ji 2009; Gierlach *et al.* 2010; Keown 1989; Vaughan and Nordenstam 1991; Flynn *et al.* 1994; Slovic 1997, 1987; Sivak *et al.* 198; Renn *et al.* 1992; Sjöberg, 1999, 2007).

MATERIAL AND METHODS

Along the time, a multitude of standards for risks management were elaborated, most of them consisting of three important stages: risks identification, evaluation and treatment (Cruz *et al.* 2006; Maroney *et al.* 2005; Marshall *et al.* 2004; Wei et al. 2009; Rasmussen *et al.* 2008).

When building the models of risk management, a special attention must be given to the individualising of the decisional component, which is extremely important for the optimization of decisional impulses oriented towards the system (Janssen *et al.* 2005; Linkov *et al.* 2006; Saaty 1987; Yatsalo *et al.* 2007; Xu et al. 2009), as well as the integration of specialised standards in the risks management system, as it is, for example, the Harmonised Global System of Chemicals' Classifying and Labeling (UN 2005; Skeaff et al. 2007; Alberty 1987).

A useful instrument in building the risks management models is the ISO standard 31000 (figure 1) and the ISO Guide 73, published in 2009, which establish 11 fundamental principles in the risks management:
- create and protect the value;
- risk management is an essential part of the organizational process;
- risk management is an essential part of the decisional process;
- risk management explains incertitude;
- risk management must be systematic and well structured;
- risk management must be based upon best quality information;
- risk management must be accurately represented;
- risk management must take into account the human factor influence;
- risk management must be transparent and comprehensive;
- risk management must be dynamic, iterative and responsible to change;
- risk management must be able to allow the continuous development of organization.

The principles of risk management underline the necessity of a systemic approach as an efficient way of reducing the unbalances appeared as a result of some major modifications at some components' level.

Industrialization is one of the most powerful decisional impulses given to territorial systems, which can determine the exceeding of the capacity of attenuating shocks at the level of the components directly or indirectly affected.

The analysis of risks management within highly industrialized towns regarded two components: *the management of environment risks and the management of social risks* (figure 2).

The environment risks management presents a series of particularities due to the complexity of the environments affected by the concentration of human activities, a complexity which determines numerous incertitudes, too (Băbuţ *et al.* 2002; Băbuţ and Moraru 2006; Braghină *et al.* 2010; Moraru *et al.* 2000; Ianoş *et al.* 2009).
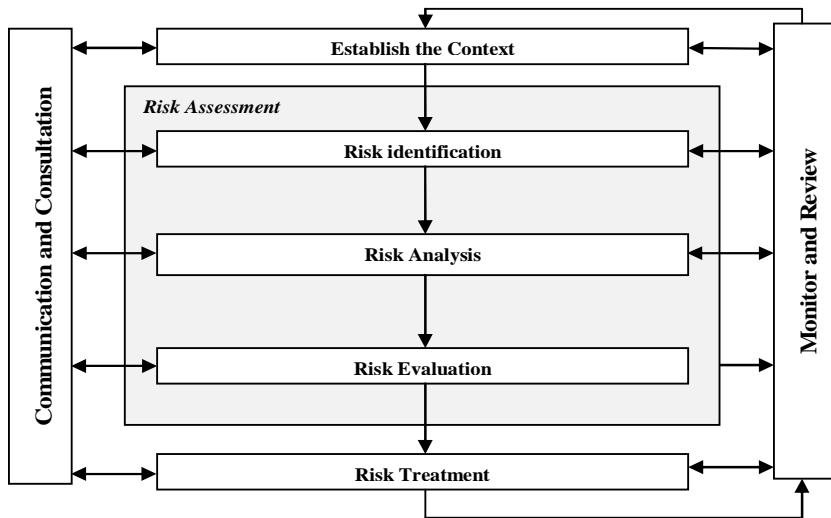
Figure 1. The risk management process from ISO 31000:2009

Figure 2. The risk management components within highly industrialized towns

The responsible approach of environment problems is an important task of the decision factors (Ianoş *et al.* 2009; Teodosiu C. 2007, Beer 2007, Syme 2006), within the complex process of elaborating the directions of integrated development of urban systems of regional importance (Gavrilescu 2009a; Robu *et al.* 2005, 2009; Naghibi and Shirmohammadi 2008; Naddafi *et al.* 2006; Ranad, 2007).

The strategic dimension of environment risk management supposes the identification of the way in which the development objectives of territorial systems may be affected (Po-Shin Huang and Li-Hsing Shih 2008; Tuzkaya 2009; Pollack 1994; Hooghe and Marks 2001).

When building the environment risks management models must be taken into account the amplitude of the existent and potential unbalances (Ianoş *et al.* 2009; Choi and Lee 2009), their efficiency being tightly connected to the participation of local community, by means of communications and consultations, in all the stages of the implementing process (Szigethy 2007).

In the present study the building of the risk management models was done by observations and analyses in the field, as well as by the data recorded by the Agency for the Environment Protection Galați.

The modelling of social risks management is a complex scientific demarche which supposes a careful analysis of the effects of industrialization upon social environment. The social environment knew a special dynamic following the economic development of these cities. The process of modelling the social risks was done by the analysis of the connections between rapid industrialization, the growth and concentration of the inhabitants' number and the development in geometrical proportion of some social phenomena such as criminality, the inhibition of civic attitude, corruption and the degradation of urban habitat (figure 3).
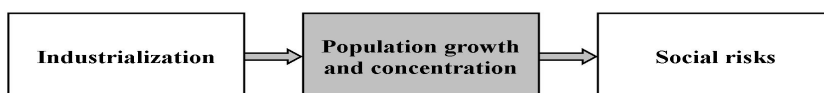
Figure 3. The determinants of social risks within highly industrialized towns

The elaboration of risks management models supposes a detailed analysis of the context in which the analysed territorial system evolved.

In the present study, there are used the results of the researches done in Galați, as this town is representative for the rapid industrialization and for the effects of this process upon natural and social environment.
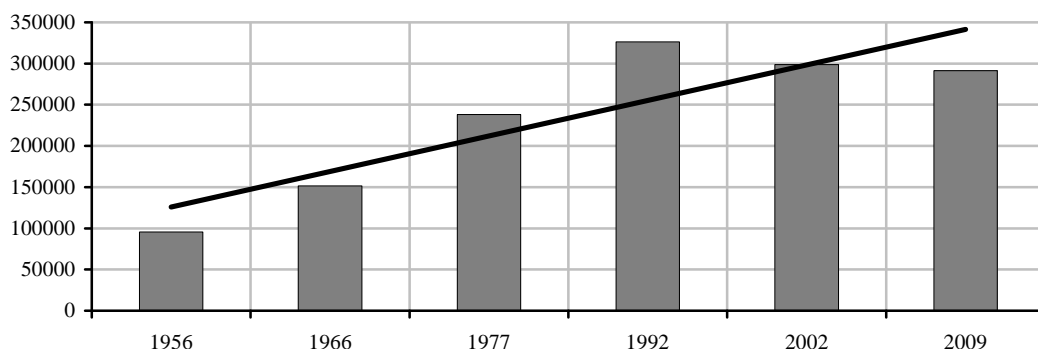
Figure 4. The evolution of the inhabitants' number

In 1965, the Iron and Steel Combine/ Factory came into operation, as one of the biggest in Europe at that time. This is the moment the town starts to attract manpower from all over the country, concentrated in crowded districts of workers. The economic development of industrial activities started after 1950, when a spectacular increase of the number of inhabitants happened.

RESULTS

The building of risks management model was done by the identification, analysis, evaluation and treatment of risk types, which constitute the two main categories specific for the highly industrialized towns: environment and social risks.

The analysis of environment risks was based upon the identification and quantification of the numerous interferences, with different intensities, of the decision factors, which led to profound mutations in the relation between the development level and the capacity of sustaining/ supporting the other components of the territorial system.

The environment risks were analysed depending on the natural and anthropic determinants, and for each category was identified the degree of restrictiveness for the development of the territorial system.

From among the risks with natural determination, the development of geomorphological processes and floods (fluvial and pluvial) distinguish in the studied area. The development of the geomorphological processes in Galați represents major restrictions for the implementation of development processes. Field researches identified important surfaces of land affected by geomorphological processes: *landslides, subsidences, failures/ collapses, surface erosion, lineal erosion. Landslides* are the most important geomorphological processes from this class, leading to important damages. In the studied area, the landslide risk meets along the Brateş sea front, nearby the railway which serves the Iron and Steel Combine/ Factory ArcelorMittal Galați (where the establishments serving the railway are affected). Superficial landslides were found on the Danube sea front, where they affect the walking area and in the Titighina area, along the road to Braila.

The prevention of landslides needs specific measures for development in the following areas: the Brateş Complex, the Danube sea front, the borders of the Cătuşa Lake, Tirighina, Micro 20.

Failures/ collapses are the most spectacular geomorphological processes from the studied area, being present on the Danube sea front, the borders of Siret (Bărboşi area), and on the loess border of the Brates lake (with a special spread in the area of the Brates Complex).

The Danube sea front presents, on its entire length, a major risk of collapse and landslide due to the geological structure, which cannot support the massive constructions erected here. On the sea front there were erected heavy monuments and residential structures, which will contribute in the perspective to the acceleration of landslide, subsidence and failure processes.

The limitation of these geomorphological processes is determined by the interdiction to build in the affected areas, and to start complex works of stabilization in the areas: the Brateş Complex, the Danube sea front, Tirighina, Micro 20.

The processes of *subsidence*, with different intensities, are frequently met due to the thick deposits of loess. The main affected areas are: the Danube sea front (the walking infrastructure is affected), the border of the Cătuşa Lake (where they affect the access bridge to the Iron and Steel Combine Galaţi and the establishments on the Cătuşa Lake), the south of the district Micro 20 and the border of the Brates Lake (where they affect large surfaces in the area of the Brates Complex).

Important surfaces of land are affected by the subsidence process along the Garofita street. On reduced surfaces the subsidence process affects the constructions and road infrastructure along the streets Al.I. Cuza, Mihai Bravu and Bourului.

The limitation of the effects of subsidence process is conditioned by the interdiction for buildings of large dimensions and executing some specific works of protection for the affected lands/ areas.

The surface erosion develops on large surfaces in the north of the town, in the area of the Cătuşa Lake, Seromgal, to the north of the Filesti district, to the east of the Bărboşi district, to the south of the Micro 20 and 21, the Jewish cemetery and in the area Traian Nord.

The (lineal) erosion in depth represents another process specific for the studied area, the process of ravines forming being a phenomenon with a special development in the terraces of Siret (in the Tirighina area) and in the high border of the Brates Lake, areas where numerous settlements are put in danger.

The geographic position of the Galaţi town on the Danube shore and nearby the mouths of the rivers Prut and Siret determines the delineation of the floods risk, and numerous restrictions of development, as well as the assessment of some specific facilities. To all these, it is to be added the deficient organization of the drainage system, which does not take into account the morphology of the land and determines floods when large quantities of precipitations fall.

The Danube floods important surfaces on the sea shore area, where harbour facilities and the walking area along the sea shore are affected. The protection of these areas supposes the reconstruction of the dams system from the area of the naval building ground (between ICEPRONAV and the free area).

In the area of the Brates Lake, the river Prut menaces the fishing establishments, the railway infrastructure and the industrial area situated at the north of the Calea Prutului. In this area, complex works consisting of protection dams are necessary.

The pluvial floods risk is present in the area Valea Oraşului, where the drainage system is undersized and does not take into account the ground morphology and when it rains heavily there are floods which determine important material damages. Complex works for the drainage system and surface drainage system reconstruction are necessary in the area.

The water pollution is one of the biggest problems identified at the level of highly industrialized urban systems in Romania. The development of industrial platforms in a relatively short time and the way of perceiving the environment risks determined the surface waters pollution by overflowing industrial waters (Alam *et. al.* 2007; Obire, *et. al.* 2008; Kar, *et al.* 2008; Juang, *et al.*, 2008; Pejman, *et al.*, 2009; Sârbu, *et. al.* 1995; Jafarzadeh *et al.* 2004; Massoidi *et al.* 2007; Alamgir and Ahsan 2007; Braghină *et al.* 2010).

The river Danube is polluted in the area of Galaţi town by the affluent Siret and by at least 5 mouths of the town collectors (house sewage and impurified house water) and the mouths/ discharges of industrial units in Galaţi city.

According to the Agency for Environment Protection Galați for the Siret river, the main pollution source from Galați is the Iron and Steel Combine/ Factory ArcelorMittal, which escapes waste waters directly in the town, by means of the Cătuşa and Mălina Ponds. This river's quality is intensely modified by the discharge of some waters polluted by arsenic, phenols, cyanides, oil substances, zinc, chlorides, magnesium or iron, the latter affecting not only the water's chemical formula, but also the ecosystem's biocenosis (Tables 1, 2).

Table 1. Repartition of river lengths on quality classes, for the year 2009
(**Data source**: Basinal water Administration Prut-Bârlad Iaşi)

Hydrographic basin	Repartition of sections on quality classes – physico-chemical indicators									
	I		II		III		IV		V	
	km	%	km	%	km	%	km	%	km	%
Prut	-	-	132	65,03	23	11,33	48	23,64	-	-
Siret	-	-	18	29,03	-	-	35	56,45	9	14,52

Table 2. Economic agents which recorded exceedings of maximum allowed limits
in the evacuated waste waters
(**Source**: The Agency for Environment Protection Galați)

Economic agent	Physico-chemical indicators with exceedings of MAL
S.C. Apollo S.A. - soap	CCO, CBO$_5$, sulphides, recoverable substances
S.C. Apollo S.A. - detergents	sulphides
S.C. Avicola S.A.	-
S.C. Malț S.A. – bear	-
Depoul C.F.R.	-
S.C. Elnav S.A.	-
S.C. Combariper S.A.	tital suspensions
S.C. Galacta S.A.	recoverable substances
S.C. Plase pescăreşti S.A.	CCO, CBO$_5$, sulphides, total suspensions
S.C. Hortigal S.A. – garret	pH, CBO$_5$
S.C. Hortigal S.A. – fizzy drinks	suspensions
Ratu – Depoul 1	suspensions, recoverable substances
Ratu – Depoul 2	total suspensions
S.C. Intfor S.A.	total suspensions
S.C. Mehind S.A.	total suspensions
S.C. Mencrom S.A.	-
S.C. Porto Franco S.A.	total suspensions
S.C. Imp S.A. – Atelier 1	pH, CCO, CBO$_5$, suspensions, recoverable substances.
S.C. Imp S.A. – Dunăreana	pH, CCO, CBO$_5$, suspensions, recoverable substances.
S.C. Imp S.A. – Atelier 2	-
S.C. Gama S.A.	total suspensions
S.C. Trefo S.A.	-
S.C. Galfirtex S.A. – Unit. A	CBO$_5$, suspensions, sulphides
S.C. Fam S.A. – Sector 1	sulphides
S.C. Fam S.A. – Sector 2	-
S.C. S.F.T.E.X. S.A.	-
S.C. Vinificare – drinks – bottle filling	CCO, CBO$_5$
S.C. Vinificare – drinks – storage	CCO, CBO$_5$, suspensions, pH.
S.C. Prutub S.A.	pH, CCO, CBO$_5$, suspensions , recoverable substances
S.N.G.	-
S.C. Intertrans S.A. Autobaza 1	suspensions
S.C. Transgal S.A.	suspensions, recoverable substances
S.C. Transcom S.A.	-
S. I. Coca Cola S.A.	pH, CCO, CBO$_5$, suspensions
S.C. Salbero S.R.L.	CCO, CBO$_5$, suspensions

The concentration of industrial activities in large platform localized nearby urban settlements makes the air to be polluted by a series of noxes, in many situations the maximum allowed limits being exceeded (Giri *et al* 2007; Chinery and Walker 2009). Depending on the

punctual functionality of space, there were identified several types of risks of air pollution in Galaţi: the risk of pollution by sulphur dioxide, nitric oxides, ammonia, heavy metals, emissions of aromatic polycyclic hydrocarbons (APH), emissions of poliphenochlors (PCB), suspension powders and unpleasant smells.

The risk of pollution by sulphur dioxide is determined by the combustions in the energetic industry, transforming and process industry, as well as by road traffic. The decrease of industrial activities within the last years determined the decrease of the emissions of SO_2, although the risk of pollution remains in the area of the Iron and Steel Combine/ Factory ArcelorMittal and of the garbage deposit Tirighina. These areas have also got a high risk of pollution with nitric oxides when the value exceeds the level of 13 ppm.

The risk of pollution with ammonia and poliphenochlors (PCB) is due to the operations of garbage depositing and treating, the main source of pollution being the garbage deposit Tirighina.

The risk of pollution with heavy metals and aromatic polycyclic hydrocarbons (APH) is very high in the area of the Iron and Steel Combine/ Factory ArcelorMittal, as the main activity which generates these risks is the obtaining of cast iron and steel.

The risk of pollution with suspension powders and unpleasant smells is high, the maximum allowed limits being frequently exceeded in certain areas. As regards the risk of pollution with unpleasant smells, this is obvious in the area of the garbage deposit Tirighina, where their exploitation is not made on cells and it is not covered with passive materials every day. Also, a high risk of pollution with unpleasant smells was identified nearby the Brates Lake, due to a non-organized deposit for animal wastes (cattle corpses), which are in an advanced putrefaction state.

The risk of soil pollution is due to specific activities of the Iron and Steel Combine/ Factory ArcelorMittal, the garbage deposit Tirighina, and of the farms nearby the town, where the risk of pollution with NaCl, urea, biostimulators and germs may contribute to the decrease of soil permeability or they may infiltrate, reaching the ground waters level.

Epidemiologic risks are very high in the area of the garbage deposit Tirighina (figure 6) and the non-organized deposit of animal garbage nearby the Brateş Lake (figure 5).

Figure 5. Animal corpses spread on large surfaces nearby the Brateş Lake

Figure 6. The garbage deposit Tirighina (nearby which commercial spaces were built)

Social risks in highly industrialized towns in Romania present a series of characteristics determined by the concentration in a short time of a large number of inhabitants which came from rural areas nearby. Most of these inhabitants could not integrate in the new system with different cultural, social and economic valences. The concentration of population with a low education level in the communist districts from the suburbs determined a series of social effects as: criminality and corruption, the inhibition of civic attitude and the degradation of the urban habitat.

In the present study, the authors tried to make a quantifying of two social processes. These processes knew an important ampleness within the last years: criminality (of all types) and corruption, perceived as normal within these spaces.
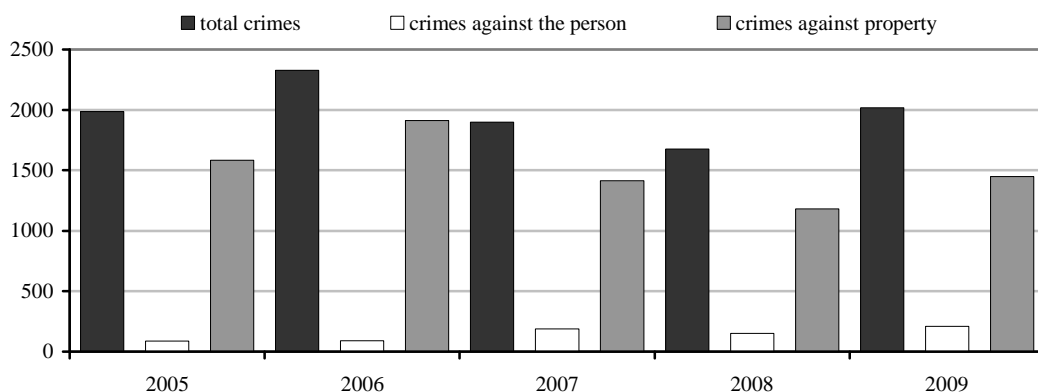
Figure 7. The evolution of infractions' number
(**Source**: The Police of Galați City)

Figure 8. The risks map in Galați

In Fig. 7 is shown an evolution of the number of infractions between 2005 and 2009, a representation which emphasizes the general tendency of decrease in the number of infractions during the analysed period, but the interviews with the local police showed a reality which is not at all comforting. The decrease of the number of infractions after 2006 is due to the leaving abroad of the persons with penal/criminal records, and the increase of the number of infractions after 2008 is explained by the authorities by the forced or voluntary return of those persons. The increase of the

infractionality after 2008 may be explained by the difficulties of reintegration of those persons, which returned from countries like Italy and Spain, due to the economic crisis.

The researches done in Galați showed that over 90% from the total number of infractions were committed by the population of the districts of workers developed once with the forced industrialization (figure 7).

The detailed risks analysis allows accomplishing the management models (graphical and cartographical), these instruments being especially useful for the decision factors, as they provide them a table of the control variables towards which decisional impulses are oriented.

Consultations and public communications

Establishing the context	**Identifying the risks**	**Analysing and evaluating the risks**	**Treating the risks**
Objectives Ensuring an optimate urban environment for inhabitance and development **Stakeholders** - local authorities - local community - economic agents - population **Criteria** - the impact upon population's health - restrictions for development	The risk of fluvial and pluvial flood The risk of pollution with city wastes The risk of air pollution The risk of surface waters pollution The risk of soil pollution	**The risk of fluvial and pluvial flood** Likelihoods: very high Consequences: development restrictions Rank risk: 1 **2. The risk of pollution with city wastes** Likelihoods: high Consequences: polluted environment, development restrictions Rank risk: 2 **3. The risk of air pollution** Likelihoods: very high Consequences: polluted environment, development restrictions Rank risk: 3 **4. The risk of surface waters pollution** Likelihoods: very high Consequences: polluted environment, development restrictions Rank risk: 4 **5. The risk of soil pollution** Likelihoods: high Consequences: polluted environment, development restrictions Rank risk: 3	**The risk of fluvial and pluvial pollution** - investments for the reconstruction of the dams system and of the system of collecting pluvial waters from the area Valea Orașului **The risk of pollution with city wastes** - building some centres of garbage sorting and of some ecological deposits **The risk of air pollution** - investments for the reduction of the emissions on industrial platforms - organising a diffluence system for the urban and transit traffic. **The risk of surface waters pollution** - building some stations of waste and industrial waters treatment **The risk of soil pollution** - building some stations of waste and industrial waters treatment

Monitoring the specialised institutions

Figure 9. The specificity of the risks management model in the town Galați

DISCUSSION

The risks management in the highly industrialized towns in the communist period is a complex process determined by the ampleness of the unbalances resulted from some decisional impulses, which had as an objective the transforming of some towns in Romania into economic centres able to transmit development in the regional settlements network.

The concentration of oeconomic activities and population in a relatively short time determined major unbalances at these territorial systems' level, the capacity of attenuation of the other components being overrun.

In these conditions, the risks management models are useful instruments in the decisional process, their efficiency being conditioned by the integration of numerous specificies of highly industrialized towns. The efficient risks management is conditioned by a double approach: the existence of an efficient institutional system and a quantification and ranking of environment and social risks.

The integrated approach of risks in highly industrialized towns constitutes the favourable context for applying decisional systems, by means of which the optimate treatment for territorial unbalances may be applied.

Aknowledgements

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