
Urban sustainable environmental development patterns in modern cities

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Abstract: Planning urban development and applying policies which fall into line with the principals of sustainability, constitutes the main goal of the modern cities. The current study aims at analysing the policies and the tactics of two European medium sized city regions to apply a sustainable sound pattern of development. Both cities are located in industrialised areas Bochum in the Valley of Ruhr in Germany and Modena in the region of Emilia-Romagna. Similarities can be detected such as the environmental threats and the common cultural and political context. The paper compares these cases and provides contrasts and similarities stemming from the two different developmental patterns. Both the analysis of each case individually and the comparison of the two cases demonstrate that only partial adherence to the environmental sustainability management model is to be observed. In addition, it seems that conditions favourable to innovative and cohesive socio-economic contexts do not explicitly imply environmental sustainable development.

Keywords: sustainable development; environmental state; socio-economic characteristics; urban management and policies.

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1 Introduction

As the urban population of the EU increases along with the environmental concern, shifts of power are taking place and the question that arises is how cities have responded or how they could have responded better to the expectations for a sustainable confrontation of their environmental needs (Kountouris, 2000).

This study in particular, focuses on the achievement of sustainable environmental development in medium sized urban units of the European Union by the investigation of two city regions: Bochum (Germany) and Modena (Italy). A survey of the broadest possible range of different socioeconomic and environmental evolution and distinctive management practices, constituted the selection criteria for these cities. In particular, this essay will attempt to:

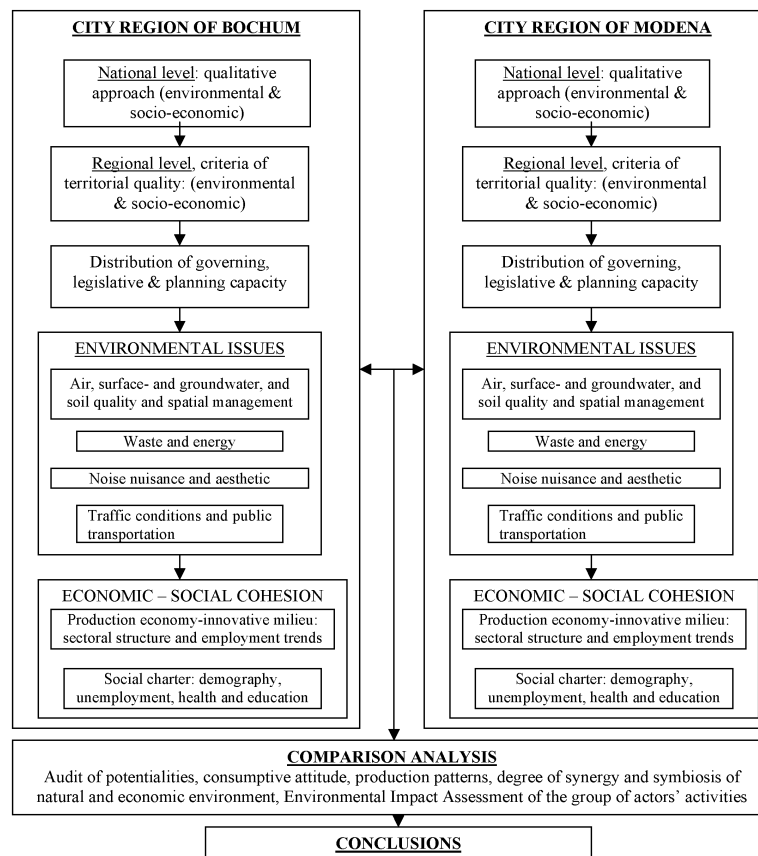
- investigate the evolution of the environmental state and management in each case study and assess the environmental impact of the management and policies
- question the concern of the local urban societies for the ecosystem's balance given that their developmental mode exerts consistent pressure on the ecosystem
- illustrate the plans and policies employed to address environmental needs and socioeconomic cohesion and to pinpoint the factors that could improve efficiency of the environmental management in each city
- reveal the general determinant factors that render local societies competent to attain integrated environmental management in accordance with the aims of sustainable development, through the comparison of the planning and management process and policy formulation and implementation of the two cases
- ascertain the truth of two statements: the first says that some stakeholders (industrial sector) cause heavier pollution due to emission of more dangerous pollutants than others, and the second claims that the involvement of the local actors is proportional to environmental monitoring.

2 Methodology

The methodology of the study puts an emphasis on the endo and exogenous as well as on the dependent and independent factors. Environmental management and development patterns may vary between the cities (Kountouris, 2000). Therefore the cities will be examined from quantitative and qualitative point of view, which may range from deterministic models with well defined structures and techniques for environmental issues, to limited knowledge of the social aspects and actors concern and awareness. Despite of these differences, a commonly applied methodological framework for the two cities was a practical necessity. The framework needed to describe the complex and dissimilar urban units, is illustrated in Figure 1. This framework includes the scanning of the environmental and socioeconomic condition in each of the two cases through the application of the sustainable environmental management model (Allaert, 1999).

The results of each city are being presented as a comparison of the different issues. This comparison denotes the different aspects between the cities, facilitating the drawing of general conclusions concerning the determination of the optimum policies for each environmental issue and the pattern of activities that apply pressure.

Figure 1 Case-study methodology framework



Source: Based on Kountouris (2000)

2.1 Some definitions

The data used for the analysis of the case-studies are derived from the communal, regional and national, environmental, economic and social survey departments of each case. Data occurring at a national level are derived from the Statistical Office of the European Communities (European Union – Eurostat (Statistical Office of the European Communities), 1999, 2001). Additional contributions are provided by the in situ contact with experts of the survey and management departments in each city, which provided explanations of the acquired figures and the approximation-reduction of those figures to the city level when only regional or national data were available.

The integrated analysis of the environmental issues and socioeconomic aspect implies the consideration of long term scales (in terms of one to two decades) in order to show the evolution and reveal the trends (Allaert, 1999). For the purposes of this study, a time scale of ten years was chosen and the general period of data requirements was set between 1989 and 1999. This time span, however, is not strictly adhered to in every case due to data restrictions. Due to that, a more flexible evaluation of the interaction between the different types of information from the different cases is needed. In these cases, emphasis has been placed especially on the representation of data in the form of indices which are complemented with raw data in order to ensure that all trends are revealed and that assessments are precise.

If the definitions used for the socioeconomic aspects (employment, unemployment, Gross Domestic Product, etc.) are not referred to within the study, then they are the ones used by the Statistical Office of the European communities (European Union – Eurostat (Statistical Office of the European Communities), 1999, 2001).

3 Comparison analysis

The following comparison analysis is concisely illustrated in the comparison matrix of Annex 1 (Table 1). The reading of this study is significantly facilitated if a copy of this matrix stands next to the text.

3.1 Through the countries

The two countries, in which the city regions of this study are located, have a different economic, governing and administrative structure. As Hull (1996) claims, the investigation of the intranational variation of this structure may explain, to a certain extent, the difference in urban development policies.

Germany and Italy are highly industrialised countries; both are members of the G7(+1)¹ and great economic powers within the EU (Lange and Shackleton, 1997), whilst their economic growth has expanded with an annual rate of 1.6% and 1.3% respectively since 1992 (European Union – Eurostat, 2001).

The political and institutional system in Germany provides the States with governing and legislative power, reserving authority only on national affairs (foreign affairs, finances, defence, nuclear safety, etc.) for the Federal government (Lange and Shackleton, 1997). Although Italy is not a federal state, the governing power is decentralised down to the city level, which has governing and legislative autonomy, providing the regions with mainly institutional power (Miny and Knapp, 1998).

3.2 Through the states and regions

Bochum and Modena are located in the most industrially developed regions of their countries.

The State of North Rhine-Westphalia established a subregional development policy to promote the partnership between local and state authorities; however, control is retained by the state authorities. Subregional units attempted to gain institutional control and bring about procedural and organisational changes in the decision making, to preserve the industrial base. This development resulted in an economic structure characterised by a core of large and smaller industrial companies operating within a large network of private and public firms offering services. The role of the city regions in the strategic management and planning processes was long recognised but has only recently begun to emerge (Heinze and Schmid, 1997).

In Emilia-Romagna, management and governing is more decentralised; strategic management is mainly performed by the city regions, whilst the region plays an intermediate and consultative role. This resulted in a decentralised networking economy based on cooperatives and owner-run small firms organised in groups of specific interest (Ash, 1999).

3.3 Through the two city-regions

The city regions share a number of characteristics and parts of their respective approach to environmental policies and contrast mainly in their development patterns and management design (see concise illustration in Table 1 at the Annex of the current study). Both are medium sized, consisting of the main community-municipality and the suburbs (Kommunalverbund and Ruhrgebiet, 1997; Comune di Modena (Democentre), 1997). Their economic development is based on the industrial sector; however, they have both experienced a rapid development of the service sector. A diverse range of universities, higher educational institutes and research centres are founded within both city regions. The demographic expansion of the suburbs is combined with a dwindling (Modena) and stagnation (Bochum) of the population of the inner city. Another common characteristic of the two cities is that environmental studies were only introduced in the educational system during the last decade. The approach to the topic includes seminars and initiative activities, and relevant educational material is provided. Although increasing attention is being paid to environmental education, it still cannot be considered as a major part of the mainstream educational system (Bochum – Die Offizielle Homepage der Stadt, 1999; Provincia di Modena, 1999).

The two case studies also have distinctive features, which however, reflect some similarity of their roles in their respective national and regional context.

Bochum is a part of a larger agglomeration, where cities and towns come so close that boundaries are barely discernible and due to this proximity, the suburbs can only expand to the north and the south of the city region. The economic development of the city has been based strongly on mining and mining oriented industries. Currently, all mining activities have ceased, although the industrial sector has still retained its significance in the city region's economy (Industrie- und Handelskammer zu Bochum, 1997). The unemployment rate in Bochum is high and its geographic distribution heterogeneous. The economic and social links of the city regions of this agglomeration are strong and their development and environmental plans interrelated. In the framework of increasing

governing power, Bochum attempts to perform environmental plans of its own (Stadt Bochum: Bochum Planung, 1996). In these plans, the needs and the threats are outlined and visions for innovative development are being made, suggesting projects for the realisation of these vision. Nevertheless, on every occasion, the State agencies stress the demand to retain control over the environmental and development policies of the local level.

Modena is one of the eight urban centres of the highly economically and industrially developed zone of the region of Emilia-Romagna. These centres have distinctive boundaries and the suburbs of the city region form a ring around the community of Modena (Provincia di Modena, 1999). The city region has had autonomy in development and environmental management for many decades (Provincia di Modena – PTI (Plano Territoriale Infraregionale) –Vol. 1, 1994) and has achieved high levels of economic development mainly through entrepreneurship of small firms and cooperatives.

3.3.1 Comparing natural environment and environmental policy

In each city studied, the policymakers and the other socioeconomic actors seem increasingly conscious of the links between protecting and restoring the natural environment and achieving the aim of sustainability. However, due to residential, industrial and agricultural activities and the environmental attitude and perception, the environmental state remains, to a different degree for each case study, less than optimal. In particular, the expanding urban areas coupled with the consumption and production attitude of the actors constitute the major environmental threats.

In Bochum and Modena, the environmental plans include the expansion of the use of easy to understand indices in order to illustrate environmental quality. More particularly in Modena, the Prati-Index and EBI (Extended Biotic Index) are being used for the projection of the physico-chemical and biological quality of the surface water (Provincia di Modena, 1997). In Bochum the use of indices is limited to the SBI (Saprobic Biotic Index), which demonstrates the biological quality of the surface water (Umweltbundesamt, 1999).

In both cities studied, the extensive environmental prevention legislature satisfactorily covers most environmental issues with respect to emissions. Commonly indicated omissions are associated with the EU's directives harmonisation, and the monitoring obligation. An average lag of harmonisation is estimated at three years for Bochum and 2.5 years for Modena (Stadt Bochum: Bochum Planung, 1996; Silingardi, 1997).

Bochum and Modena complying with the suggestions of the 'Agenda 21', attempt to increase their environmental management instruments, methodological variety and information circulation within their locality, encouraging the actors to provision this attempt with innovative participation and utilise the communication capacity with other cities of their respective regions and of Europe. Concerning environmental prevention, these efforts are only partially being put in practice (Bochum – Die Offizielle Homepage der Stadt, 1999; Tiviroli, 1998).

Diverse urban histories have produced a different pattern and extent of pollution, and a different population density and land use. In Bochum in particular, the scattering of polluted soils in highly populated residential areas makes it difficult to purify them. The relations between policies towards environmental quality and sustainability are complex. In Modena for example, the use of waste in the production of electricity makes recycling the first priority whilst prevention constitutes the first priority for the other

three cities. Differences within the cities relate not only to the concentration levels of pollutants, but also to the sort of pollutants occurring in the mediums with respect to the impact of the different activities. Surface water in Modena for example, shows high concentrations in BOD and COD, but in Bochum, it is Atrazine, a multiple toxic substance, that evens for concentrations with the MAC (Provincia di Modena, 1999; Umweltbundesamt, 1999).

3.3.1.1 Water quality and policy

Groundwater

In Modena, the systematic scanning of the groundwater shows a high concentration of nitrogen, boron, iron and manganese. A regular audit of the activities' impact reveals that the concentrations of the former are predominantly derived from agricultural and livestock activities whilst the remaining are attributed to natural causes. According to the groundwater policy, the byproducts of both agriculture and livestock will be treated as urban waste (Provincia di Modena, 1997, 1999).

The groundwater quality in Bochum is a complicated issue due to its strong correlation with the soil pollution. The former medium has not been subjected to an intensive investigation, but from the available data and from the studies of soil quality, it may be concluded that groundwater quality is less than optimal, mainly affected by industrial activities. Groundwater policy in Bochum is linked with soil policy as analysed further on in this chapter (Umweltbundesamt, 1997, 1999).

Surface water

As the regular monitoring of the surface water in Modena demonstrates, the physicochemical quality is less than optimal, due mainly to the high levels of BOD, COD, NH₄, NO₃, NO₂, P and Pb. Agricultural, residential and possibly industrial activities have been reported as emitters. The surface water policy is oriented towards the control of the emission of these activities and the broadening of the use of simple indicators such as EBI and Prati-Index, which illustrate the quality of the medium. This policy resulted in an amelioration of the medium, currently characterised as moderate and improving with respect to both the physicochemical and the biological qualities Provincia di Modena, 1987, 1997).

The surface water quality in Bochum is subjected to systematic scanning, which reveals that the medium has been affected by residential, agricultural, industrial and former mining activities, as high concentrations of heavy metals and pesticides are detected. Nevertheless, both the physicochemical and the biological quality show signs of improvement. The surface water policy aims at a more effective control of the emission and a decline in the use of pesticides through alternative earth cultivation. The expansion of the use of simple indicators (similar to SBI currently in use) that reflect the quality of the medium is also a goal of this policy (Landesumweltamt Nordrhein-Westfalen, 1998).

3.3.1.2 Air quality and policy

In both case studies, ambient air is largely affected by the rapid expansion of the urban space occupancy, the increased traffic and the industrial activities.

In Modena, the scanning of the air quality is systematic. The pollutant that most frequently shows high concentrations is TSP, which is predominantly attributed to

industrial and residential and partially to agricultural activities. High concentrations of NO_x^2 and ozone also occur within Modena, mainly caused by the use of cars and some industrial activities. The air quality policy is mainly oriented towards measures affecting traffic (broadening the use of unleaded petrol and public transportation and curfew in the city centre) and tightening of the environmental requirements in terms of emission of these pollutants in industry and agriculture (Osservatorio Geofisico, 1999; Provincia di Modena, 1999).

The ambient air is subjected to intensive monitoring in Bochum. The air quality is a complex issue in the area due to the proximity of the urban centres. The pollutants that mainly show high concentrations are NO_x , ozone and the hydrocarbons. The extended use of combustible fuels for transport and residential activities and the industrial emissions are the main sources of these pollutants. The promotion of unleaded technology for vehicles, the reduction in the use of coal for domestic heating and a series of stringent requirements concerning emission from industry are the aims of the city's air policy (Landesumweltamt Nordrhein-Westfalen, 1999).

3.3.1.3 Soil quality and policy

Different activities have a different impact on the soil quality of each city. In Bochum for example, predominantly mining related activities caused the deterioration of soil quality, whilst in Modena, agricultural activities have had the most serious impact on the quality of this medium.

In Modena, the systematic monitoring of soils started only recently in 1996; estimations show high concentrations in nitrogenous and phosphorous compounds attributed mainly to agricultural and livestock activities. Soil policy aims at reducing the emissions of these activities and treating their byproducts in a more efficient way (Provincia di Modena, 1997, 1999).

In Bochum, soil pollution is one of the greatest environmental concerns of the city region. Soils containing high concentrations of heavy metals caused by industries related with mining, were scattered throughout the city region. Although the potentially polluted sites have not been completely investigated, the existing measurements show high values in the concentrations of heavy metals. The soil policy is oriented towards an integrated inventory and classification of the polluted soils, and pollution scattering and seepage avoidance. The high population and building density of the area and the restoration costs make the soil purification process unfeasible (Bezirksregierung Arnsberg, 1997; Landesumweltamt Nordrhein-Westfalen, 1999).

3.3.1.4 Land use and spatial policy

The rapid expansion of the areas occupied by residential use is a characteristic common of Bochum and Modena. This expansion is combined with a dwindling of the land used by agricultural activities in both cases. The areas reserved for nature range between 18.9% (Modena) and 26% (Bochum); although comparison is inaccurate due to the variation of the definition of greenery and space reserved for nature, between the cities. In the environmental plans of the cities it is recognised that the spatial organisation and the rationalism of the land use constitute an essential objective towards sustainability. However, the spatial evolution of the two cities renders the previous goals difficult to realise. The active suburbanisation in both cities and increasing the use of land associated

with residential activities (housing and road infrastructure, for example), affects the hydrological balance (Landesumweltamt Nordrhein-Westfalen, 1999; Provincia di Modena, 1997, 1999).

3.3.1.5 Waste management and policy

Waste management and policy receives different approach in the two cities. In Bochum, prevention (avoidance) has priority over recycling, and recycling has priority over incineration and landfilling. Waste treatment includes incineration, biological treatment and landfilling. Bochum has managed a reduction in waste production with the industrial sector achieving a higher rate than the residential, an enhancement in recycling and a decrease in landfilling (Bezirksregierung Arnsberg, 1999). In Modena, the waste treatment policy is oriented towards the production of electricity through incineration and biogas, an increase in recycling and a decrease in landfilling. The first and last targets have been achieved whilst recycling is catching on at a low rate (Provincia di Modena (Settore Difesa del Suolo e Tutela dell'Ambiente), 1994; Provincia di Modena, 1999).

3.3.1.6 Energy consumption and policy

A common goal of the energy policies of the two cities is the decrease of the energy consumption, providing incentives to enhance the use of renewable sources, both needed to comply with the requirements of the 'Kyoto protocol' for reduction in the greenhouse gases -especially the CO₂. Despite these targets, in Modena the total energy consumption increases, whilst in Germany the total energy consumption decreases, but the consumption of electric energy increases (Regenerative bzw. Erneuerbare Energien von Internationalen Wirtschaftsforum, 1999; Provincia di Modena, 1999).

In Germany, energy production is mainly based on nuclear disintegration and combustion of carbohydrates, whilst Italy and Greece do not exploit nuclear energy; they meet their needs by combustion of fossil fuel (Regenerative bzw. Erneuerbare Energien von Internationalen Wirtschaftsforum, 1999).

The energy policy in Modena has emphatically promoted and subsidised innovative and conventional uses of renewable sources of energy, such as natural airconditioning in houses, use of bicycle and solar energy (Provincia di Modena, 1999).

3.3.1.7 Noise pollution and policy

Although, noise pollution is a characteristic of modern urban life, it does not receive the required attention in the two case studies.

In Modena, noise pollution is systematically monitored and the measures (traffic restrictions, sound screen and infrastructure of reduced noise) applied in the city region yield a reduction in the average noise level (Provincia di Modena, 1999).

The increasing complaints expressed about noise, reflect the increase noise nuisance in Bochum. The transfer of the noise producing industries to the industrial zones and the sound screens installed in the highways crossing the city are the two major measures implemented in accordance with the noise policy (Stadt Bochum: Bochum Planung, 1996).

3.3.1.8 *Aesthetic compensation and landscape changes*

The increase of urban green space is characteristic of Modena, whilst in Bochum, a slight decline has been reported. The urban green policies are connected with the spatial planning of each city.

In Modena, human activities have changed the landscape significantly; the current legislation prohibits human interventions. In Bochum, the main changes to the landscape were brought about by mining activities; currently, any intervention in the landscape requires permit by the respective agency and the performance of impact assessment study (Landesumweltamt Nordrhein-Westfalen, 1999; Provincia di Modena, 1997, 1999).

3.3.1.9 *Traffic and transport*

Traffic conditions are a common concern for both cities and the traffic plan of each city reveals that the linkage between solving the problem of traffic and achieving the aim of sustainability is perceived.

The daily commuting in Modena and the large proportion of cars per inhabitant is partially compensated for by the increased use of the public transportation. The traffic plan of Modena promotes the use of public transportation, emphasising on the accuracy of the timetables and on the replacement of the fleet with ecofriendly vehicles (Provincia di Modena, 1999).

Due to the large amount of commuting, the daily flow of vehicles leads to traffic problems in Bochum. The applied transport policy has significantly increased the use of the mass transport means (e.g., bus and urban railway), however the simultaneous increase in the numbers of private vehicles negates the previous improvements. The traffic policy of the city suggests alternative working attitudes such as: work at home in order to achieve traffic improvement (Stadt Bochum: Statistisches Jahrbuch, 1999).

3.3.2 *Comparing economic development, social cohesion and planning*

The diverse range of development patterns of the two economies has resulted in a variety of socioeconomic structures. The distinctive and welldefined economic models of the case studies ensued from a series of political, cultural, historical, natural and geographical differences that influence and diversify the planning practice and decision making process in each city.

In demographic terms, Modena is the smallest city region of this study which followed the typical path of suburbanisation and subsequent demographic dwindling of the central urban area (Community of Modena) (Camera di Commercio Modena (Dipartimento Economico), 1997; Camera di Commercio di Modena (Servizio Statistico), 2001; Comune di Modena (Democentre), 1997).

Modena's economic model is based essentially upon the consolidation and expansion of its small firm business system around three vectors:

- the growth of small manufacturing firms and industrial districts, which initially occurred within the main city, but rapidly expanded into the city region's rural areas. Knitwear, mechanical and electrical engineering, ceramics and artisan firms organised as unions, associations and cooperatives constitute a characteristic networking business formation

- the emerging service firms sector which support this network and a series of specialised educational institutes that cover its increasing needs for specialised personnel
- the gradual industrialisation of the rural areas around the main city, where small farms and firms, often grouped together as cooperatives, were transformed into agrofood industries (Camera di Commercio Modena (Dipartimento Economico), 1997; Camera di Commercio di Modena (Servizio Statistico), 2001).

Changes have been identified in the growth of the sectors; the most characteristic is the rapid expansion of the service firms and the decline, in terms of contribution to employment, of the agricultural and industrial sector. These changes however, do not alter the synergy and entrepreneurship of the model, neither do they negate the dynamics of these two sectors' production, as revealed from the increasing exportation rate of the city region.

The reference point of Modena's development model, which is a product of the city region's autonomous management and planning, is a series of social practices and conventions, such as: family business, co operative spirit, reorientation of the local workforce skills according to the market needs and social tendency of organising in groups, encouraged by the main political ideology of mass participation in politics and decision making. The successful application of this model resulted in high added value and restricted unemployment to low levels (Camera di Commercio Modena (Dipartimento Economico), 1997; Camera di Commercio di Modena (Servizio Statistico), 2001).

Bochum is the larger of the two case studies in demographic terms. Despite the demographic expansion of the suburbs, the city region has managed to maintain a constant population of the urban centre (municipality of Bochum) (Stadt Bochum: Statistisches Jahrbuch, 1999; Bezirksregierung Arnsberg, 1997; Kommunalverband Ruhrgebiet, 1997).

The economic development of the city was initially based on the exploitation of natural resources, in particular, the coal and a series of related, mainly steel, industries. The economy of Bochum passed through structural changes in the industrial pattern, new machinery and electrical engineering together with electronics and high technology products industries largely replaced the dominant steel industries. The industrial sector of Bochum comprises mainly of large industrial units-the top twenty industries employ between 1,000 and 20,000 people each. The sector progressively experienced losses in workforce occupancy, whilst private and public service firms together with the educational and research institutes enhanced their employment capacity, to become the main employers of the area. The educational institutes and research centres gathered in Bochum provided the necessary wide retraining of the workforce and the technological knowledge required for these new industries and service firms.

The development plan of Bochum attempted to address the declining contribution of the industrial sector, the decreasing added value, the stagnant investments and to put a check on the increasing unemployment-currently at 13.2%-, implementing a series of projects such as business and industrial parks and diverse specialised education. However, the efforts to enhance the intercommunication and revitalise partnerships of the firms, have not met with full success. In the core of Bochum's economic model, is embedded a social system of increased care about the life standards of the inhabitants,

complemented with support towards the large section of under utilised workforce (Stadt Bochum: Statistisches Jahrbuch, 1999; Bezirksregierung Arnsberg, 1997).

4 Conclusions

As the comparison analysis of the Bochum and Modena cases demonstrate, the elements of the environmental sustainability management models employed in designing and pursuing local environmental management, vary largely between the two cities. However, in none of these cases did the application of urban management models result in a full subscription to the ideas of sustainable development. In addition, in both cases, human activities exert consistent pressure on the ecosystem and the state of the environment is considered as either less than optimal or its amelioration progresses slowly. Moreover, in some of the cases, new types of pressures are manifested (for example the spatial expansion of the residential areas in both city regions, the new airborne pollutants such as TSP in Modena and the relatively newly appeared pesticide, Diuron in Bochum). Rather, it may be argued that sustainable development has provided an opportunity for the cities to enhance their capacity in management, an increased concern for the ecosystem's balance, and an emerging integration of environmental management in development planning. The assessment of the determinant factors that affect environmental management and the indication of the institutional, economic and social conditions that stimulate their activation will reveal the conditions required from a management model to broaden the scope and accomplish the aims of sustainable environmental management.

Although it may be argued that these two case studies represent a very limited number of cases within the EU, their peculiar development patterns and the variety of exerted environmental pressure, provide a base for drawing some conclusions concerning how best to exploit local management opportunities and to link environmental strategies to implementation tactics.

This comparison of the two case studies also reveals that there is little evidence to support the general perception prevailing in Europe that currently some groups of actors are more responsible than others for environmental deterioration. What could be said with a lower degree of uncertainty is that the past activities of these groups bequeathed certain pollution to the present times, and affected irreversibly in some cases, the mediums -the case of heavy metals emitted from mining related industries in the soil of Bochum. On the contrary, it seems that under the current urban development pattern all stakeholders may either favourably contribute to, or adversely affect, the balance of the ecosystem depending on their production and consumption culture. In turn, there is more evidence to support that there is a correlation between the activities of some groups of actors and the emission of particular pollutants, which have a more serious impact on the ecosystem than others. For example, the main emitter of the group of heavy metals is considered to be the industrial sector, whilst the emission of the group of pesticides is predominantly attributed to agricultural, and in respect of gardens and parks to residential, activities. However as Kountouris (2000) argues, all pollutants can cause irrecoverable losses to the functions of the ecosystem in long drawn out substantial concentrations.

In general terms, when comparing the environmental policies and measures applied in these two case studies, a similarity can be distinguished between them as well as with the aims of sustainability and the EU policies (as referred to in Kountouris (2000).

All normative frameworks include a wide set of requirements in the form of commands and regulations that seek to reduce certain environmental impacts. Complementary to this, a series of levies and permits can be found in both cases-the emission limits for firms for example. These frameworks however, are not flexible and rapid in implementing the EU directives.

Another point drawn from this comparison is that environmental scanning and audit seems mainly related to the degree of the local stakeholders' involvement in the functioning of the society, and only partially to the economic stature. In particular, Bochum is a city of high economic stature, but its environmental state is not fully investigated; whilst a more integrated scanning is to be found in Modena that has based its development on the entrepreneurship of its actors. Subsequently, it may be said that the degree of involvement of the local actors, which also effect the network market functioning and the innovative *milieu* (Kountouris, 2000), seems proportional to the capacity of the local society to perform development planning without interventions of the higher level authorities and institutional structures-the case of Modena. The latter has to be further investigated and commented upon in another study. Correlation between the socioeconomic structure and environmental prevention in terms of implementation of policies and requirements, cessation of emissions and other forms of impact, is not evident from the comparison. In Modena for example, a city with established socioeconomic cohesion and a synergistic model of development, the quality of some of the mediums is less than optimal, since stakeholders do not fully comply with the policies' goals. This can be translated into saying that integrated development and socioeconomic cohesion do not explicitly imply sustainable development, and additional determinant factors that interfere with, and accomplish, sustainable planning are to be sought.

Further investigation is required on whether the formation of a managerial model that can be generally applicable in all European cities is a feasible and necessary task. Additionally, it is high time to express explicitly, what sustainable development means in terms of a specific path of actions to be undertaken by a society, which cares about the rational use of its resources.

References

- Allaert, G. (1999) 'Sustainable urban development and the need for better managerial, organisational and coordinative capacity', *3rd International Symposium for Urban Planning and Environmental Management*, 5–9 April, Pretoria, Republic of South Africa, RSA.
- Ash, A. (1999) 'The Emilian model: institutional challenges', *European Planning Studies*, Vol. 7, No. 4, pp.389–405.
- Bezirksregierung Arnsberg (1997) *Jahrestatistik*, Bezirksregierung Arnsberg – N.R.-W., Arnsberg.
- Bezirksregierung Arnsberg (1999) *Regionalisierte Strukturpolitik im Umbruch, Zum Stand der Regionalisierten Strukturpolitik in Bezirksregierung Arnsberg*, Bezirksregierung Arnsberg – N.R.-W., Arnsberg.
- Bochum – Die Offizielle Homepage der Stadt (1999) Date: 25/04/1999, <http://www.bochum.de/>, reference to the published report.
- Camera di Commercio di Modena (Dipartimento Economico) (1997) *L'Evoluzione della Struttura Economica Modenese, Fotografata dal Censimento Intermedio, 1991–1996*, Camera di Commercio di Modena, Modena.

- Camera di Commercio di Modena (Servizio Statistico) (2001) *E-ELLE 2000: Indicatori Statistici dell'Economia e del Lavoro*, Servizio Statistico, Modena.
- Comune di Modena (Democentre) (1997) *The Modena's Story (1945–1996)*; Democentre, Modena.
- European Union – Eurostat (Statistical Office of the European Communities) (1999) *Social Portrait of Europe*, Eurostat, Brussels.
- European Union – Eurostat (Statistical Office of the European Communities) (2001) *Yearbook 98/99, A Statistical Eye on Europe*, Eurostat, Brussels.
- Heinze, R.G. and Schmid, J. (1997) 'Industrial change and meso-corporatism, a comparative view on three German states', *European Planning Studies*, Vol. 5, No. 5, pp.597–617.
- Hull, A. (1996) 'Strategic plan-making in Europe: institutional innovation', *Planning Practice and Research*, Vol. 11, No. 3, pp.253–264.
- Industrie-und Handelskammer zu Bochum (1997) *Jahrbericht 1996*, Industrie-und Handelskammer zu Bochum, Bochum.
- Kommunalverband Ruhrgebiet (1997) *Städte-und Kreisstatistik Ruhrgebiet 1996*, Bring & Co KG, Essen.
- Kountouris, K. (2000) *Environmental Sustainable Development in Medium Sized-Cities of Europe; the Cases of: Bochum, Modena, Patras and Ghent*, University of Ghent, Ghent, Belgium.
- Landesumweltamt Nordrhein-Westfalen (1998) *Jahresbericht 1997*, Landesumweltamt Nordrhein-Westfalen, Essen.
- Landesumweltamt Nordrhein-Westfalen (1999) *Luftqualität in Nordrhein-Westfalen: LUQS-Jahresbericht 1997*, Landesumweltamt Nordrhein-Westfalen, Essen.
- Lange, T. and Shackleton, J.R. (1997) *The Economy of German Unification*, Berghahn Books, Providence, UK.
- Miny, Y. and Knapp, A. (1998) *Government and Politics in Western Europe: Britain, France, Italy, Germany*, Oxford University Press, Oxford.
- Osservatorio Geofisico – Servizio Meteo Osservazione e Previsioni (1999) Date: 24/06/1999, <http://www.ossgeo.unimo.it/>.
- Provincia di Modena – PTI (Piano Territoriale Infraregionale) – Vol. 1 (1994) *1. Orientamenti Strategici – 2. Politiche di Settore – 3. Politiche d'Area*, Assessorato alla Programmazione e Pianificazione Territoriale, Modena.
- Provincia di Modena (1987) *Relazione Sullo Stato dell'Ambiente nella Provincia di Modena*, Aggiornamento 1A-Vol. 1, Modena.
- Provincia di Modena (1997) *2a Relazione sullo Stato dell'Ambiente nella Provincia di Modena*, C.P.F. – Modena.
- Provincia di Modena (1999) Date 21/03/1999, <http://www.provincia.modena.it/>, reference to the published reports.
- Provincia di Modena (Settore Difesa del Suolo e Tutela dell'Ambiente) (1994) *Noi e i Rifiuti – Verso il 2000*, Settore Difesa del Suolo e Tutela dell'Ambiente, Modena.
- Regenerative bzw. Erneuerbare Energien von Internationalen Wirtschaftsforum (1999) Date: 06/07/1999, <http://www.uni-muenster.de/Energie/>.
- Silingardi, P. (1997) *Globalità Sostenibilità e Amministrazione Locale*, Agenda XXI, Comune di Modena – Provincia di Modena, suppl. of NOI & L'AMBIENTE No. 50, 1st quarter of 1997.
- Stadt Bochum: Bochum Planung (1996) *Bochum-Planung 2010, Rahmenplan Umweltschutz*, Stadt Bochum.
- Stadt Bochum: Statistisches Jahrbuch (1999) *Statistisches Jahrbuch der Stadt Bochum*, Herausgegeben vom Amt für Statistik Stadtforschung und Wahlen, Stadt Bochum Hauptamt, Bochum.

Tivioli, S. (1998) *L'Agenda 21 Locale e il Forum Ambiente Sviluppo Sostenibile*, NOI & L'AMBIENTE – Provincia di Modena, No. 54, 1st quarter of 1998, pp.4–6.

Umweltbundesamt (1997) *Daten zum Umwelt- der Zustand der Umwelt in Deutschland – Ausgabe 1995*, Umweltbundesamt, Bonn.

Umweltbundesamt (1999) *Daten zum Umwelt- der Zustand der Umwelt in Deutschland – Ausgabe 1997*, Umweltbundesamt, Bonn.

Notes

¹Group of the 7 (+ Russia) most industrialised countries of the world.

²Where $x = 1, 2$.

Annex 1**Table 1** Study-cases' comparison matrix

| <i>Issues</i> | | <i>Measurements</i> | <i>Cities</i> | |
|---------------------|-------------------|---|------------------------------------|----------------------------------|
| Natural environment | Ground-water | State | Bochum | Modena |
| | | Trend* | Less than optimal | Less than opt. |
| | | Pressure attributed to (activities**) | n.e. | 0 |
| | Surface water | State | Mining | Agr |
| | | Trend | Moderately polluted | Moderately polluted |
| | | Pressure attributed to | ++ | ++ |
| | Ambient air | State | Res, Agr, Ind | Agr, Res |
| | | Trend | Less than opt. | Less than opt. |
| | | Pressure attributed to | ++ | + |
| | Land use | State | Tr., Ind | Tr, Ind |
| | | Trend | 26% | 19.6% |
| | | Mostly expanding occupancy | Tr (+++), Res (+) | n.e. |
| | Soil | State | – | n.e. |
| | | Trend | Deteriorated | Less than opt. |
| | | Pressure attributed to | n.e. | n.e. |
| | Waste management | Production | M. related activities | Ag, Res |
| | | Treatment (%) | 2,054 | 692 (Ag not incl.) |
| | | Trend: production/recycling | Inc.: 20, B.: 22, L.: 13, Rec.: 45 | L.: 55, IE. and I.: 30, Rec.: 15 |
| | Energy management | Consumption: total (PJ)/electricity (GWh) | – – –/+++ | +/+ |
| | | Trend: total/electricity | 287/5,398 | 267.6 (estimation)/2,646 |
| | | Use of renewable (proportion) | ++/– – | ++/+++ |
| | Noise nuisance | Level | 4.4% (over electricity) | 3.2% (over electr.) |
| | | Complaints | n.a. | 68.8 |
| | | Trends: level/complaints | 900 | n.a. |
| | Traffic | Pressure attributed to (%) | n.a./+++ | – –/n.a. |
| | | Car occupancy (per 1,000 inh.) | Tr | Tr |
| | | Trend: occupancy | 509 | 625 per 1000 inh. |
| | | | ++ | +++ |

Table 1 Study-cases' comparison matrix (continued)

| <i>Issues</i> | | <i>Measurements</i> | <i>Cities</i> | |
|---------------------------|-----------------------|--|--------------------------------|-------------------|
| Socioeconomic environment | Public transportation | Trend | +++ | + |
| | Production economy | GDP/Added value/Investments (in €) | 14,040/5,605/1,885 | 9,231/9,421/1,751 |
| | | Employment/unemployment | 52.1%/13.2% | 62.1%/4.0% |
| | | Trend: (EDP)/employment/unemployment | (++/0/+)/-/++ | (+/++/++)/++/- |
| | Social charter | Innovative milieu | Sub-optimal, externally driven | Fully developed |
| | | Population: C-R****/C (x1000 inh.) | 724/414 | 467/181 |
| | | Trend: C-R/C | +/0 | +/- |
| | | Income per capita (in €)/trend | 13,716/++ | 9,979/++ |
| | | Education: students/retraining (per annum) | 46,100/5,000 | 23,500/5,700 |
| | | Health care (beds/Dr. per 1,000 inh.) | 9.4/3.64 (C) | 5.9/8.3 (C-R) |

+: Slight improvement or increase.

++: Improvement or increase.

+++ : Significant improvement or increase.

- : Slight deterioration or decrease.

-- : Deterioration or decrease.

--- : Significant deterioration or decrease.

*Trends are considered over the period ten years; they rate as follows: n.e. = not evident; n.a. = not available; 0 = no change.

**Agr = agricultural; Ind = industrial; Mining = mining; Res = residential; Tr = traffic; Nat = natural causes.

***L = landfilling; IE = incineration for generation of electricity; Inc = incineration; Pr = prevention; B = biological; Rec = recycling.

****C-R = figures over the city-region; C = figures over the Community (municipality).