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Abstract: The European Union is at the threshold of a new development period. Hungary as a Member State of the EU was given an opportunity to frame its comprehensive development programs for the next seven years (2007-2013). One of these programs is the Transport Operative Program, which focuses on large-scale, large-volume national transport infrastructure developments including road, air, inland water, rail, and combined transport. The Program cover a defined period, however, it will assign the direction of developments for a longer time and foreshadow the vision of the whole transport system in future.

Under the related EU legislation a Strategic Environmental Assessment (SEA) must be accomplished for these kinds of programs. SEA is a specific procedure to identify and control environmentally harmful processes at the earliest and highest level of planning. SEA covers all fields of environmental issues including wildlife conservation and biodiversity maintenance.

In the course of the present research we examined the opportunities the SEA's institutionalized framework (regulations as well as measures) offers or might offer to mitigate the direct and indirect impacts of transportation via the nascent Hungarian Transport Operative Program.

The half-year-long study conducted between June and December, 2006 primarily aims at exploring opportunities lying in strategic-level assessment to conserve biodiversity at national and regional level and to treat habitat fragmentation.. Our study focused on determining what are the main issues that can be handled by the SEA and which ecological conflicts can be – at least partly - resolved at this level.

During the course of the research we used experience gathered by older EU Member States like the UK, Italy and Spain that have been formulated in the form of guidelines. The significance of our research is strengthened by fact that the overwhelming majority of one out of the nine European eco-regions (called Pannonian Biogeographical Region) can be found in Hungary. It is a great challenge for the country to meet Europe's controversial expectations: how to conserve this valuable area but at the same time carry out a large transport infrastructural development.

The results gained suggest that SEA is a satisfactory tool to indicate large-scale harmful processes, however, it does not guarantee certain and sizable mitigation of effects unless the its methodology will be developed further and it will be integrated more efficiently in the implementation process of the transportation strategies in future.

Introduction

The European Union is at the threshold of a new development period. Hungary as a Member State of the European Union was also given an opportunity to frame its comprehensive development programs for the next seven years (2007-2013). One of these programs is the Transport Operative Program (TOP), which includes large-scale, large-volume nationwide transport infrastructure developments including road, air, inland water, rail, and combined transportation systems for the period marked above.

A primary concern during the elaboration of TOP was to ensure its conformity with the current Hungarian transportation policy as well as with the EU's official White Book on Transportation Policy, which was issued in 2001 and has once been revised since then. In practice, each Member State has the right to form their own strategy on the basis of their needs, however, the strategy has to fit to the current transportation and environmental policy trends. Environmental issues caused by transportation increasingly gain importance in European Union related policies and the White Book apparently also reflects this trend.

Strategic Environmental Assessment (SEA) is a relatively new procedure applied for certain development programs that should comply with the environmental requirements. The European Commission agreed Directive 2001/42/EC "on the assessment of the effects of certain plans and programs on the environment" – the 'SEA Directive' - on 27 June 2001. Since that date, the Directive has been adopted in the national legislation of the Member States, among them in that of Hungary. The objective of the Directive is: '*to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment*' (EC, 2001; Article 1).

Biodiversity has been decreasing steeply over a decade in several European countries. As a consequence, the conservation of biodiversity became an issue of high priority in the EU's environmental policy. EU Strategy for Sustainable Development (2001) set out a target by 2010: to halt the loss of biodiversity. Successful implementation of many of the priority objectives defined in the EU Biodiversity Strategy need sectoral considerations and the integration of biodiversity issues in other policies (EU Progress Report 2006). Beside the agriculture, transportation does not yet have a key role in the Strategy, although its fixed infrastructure might have a long-time effect on the affected habitats and wildlife.

The Conflict

Transportation development has always been a major driving force as well as an important target for SEA. Not surprisingly, as transportation has serious impacts on the environment that have been widely known for a long time. At a regional and global scale these effects on ecosystems, on the nature reserves as well as on other protected nature values is being increasingly recognized among the other environmental concerns (TERM report 2002). This can only

partly be put down to the generally growing endangerment of biodiversity, as underlying, there is fundamental dilemma: A primary objective of the European integration is the creation of a common market, which is in turn based on four guaranteed franchises: the free movement of goods, services, capital and workforce is greatly dependent on the existence of a highly developed and sophisticated transportation network that encompasses and interconnects the whole continent. At the same time, by creating the Natura 2000 network, the European Union has declared that the conservation of the common European natural heritage is also of key importance. Natura 2000 is Europe's ecological network, which connects all valuable nature areas all over the continent. As the pan-European transportation and ecological network necessarily cross each other, one of them has to be favored at their junctures. Unfortunately, the EU Biodiversity Strategy does not give feasible and executable propositions to resolve of the foreseeable conflicts. The related chapter of the document is not very specific, all it contains is that protected areas (with Natura 2000 areas), valuable but not protected nature areas as well as animals' migration routes have to be avoided by the transportation corridors. If the latter is not possible, at the crossing points of migration routes, conditions of safe passing of animals should be ensured. While the former suggestion for avoidance of vulnerable areas is often simply unfeasible, the latter cannot be translated into design terms at the level of strategies and thus it cannot be taken into consideration at the beginning of designing.

In the preparing phase of TOP, we examined what tools are at disposal to implement these propositions and to conserve biodiversity, and we also attempted to identify situations when the territorial overlaps are regarded as acceptable solution to the conflict between transportation corridors and nature.

Methodology

This paper summarizes the findings of a half-year-long survey that was conducted between June and December, 2006. We primarily aimed at exploring theoretical and practical opportunities lying in strategic-level assessments to avoid further loss of biodiversity at national and regional level and also focused on managing habitat fragmentation. In this study several SEAs featuring transportation development and ecological assessments have been reviewed. As it turned out from the statements, the thematics of SEAs are similar to that of our research target, but the assessments have not a uniform and clear-cut methodology yet. The European countries adopted numerous different methods, among them qualitative analysis, ranking models, comparison of external expenses, risk assessment, multi-criteria assessment, matrices of impacts, cost-benefit analysis and the DPSIR model. Uniform methodology, however, exists neither at the same level of the assessment hierarchy, nor in the group of similar fields. Policies, programs and plans for different fields also prepared in different ways. Standalone strategic ecological assessments are relatively rare and information is hard to find on how the few exceptions are taken into account and how they are integrated (if ever) into the design process. If it functions, it functions on a non-systematic, case-by-case basis.

DPSIR model is listed among the SEA-related propositions issued by the EU as the most appropriate approach towards structuring and managing information on the environment. Consequently, the Hungarian SEA carried out for TOP also used a method based on the DPSIR model; a method called Strategic Assessment Methodological Principle. The environmental specialists examined to what extent the sustainability principles function at the different levels of interaction. The interactions include driving forces, pressures, state, impacts and lastly, responses. A complete environmental assessment has been implemented for the TOP, whose chapter on biodiversity and conservation of nature resources chapters are structured similarly in the SEA statement, according to the interactions. Apart from the ecology-specific findings and suggestions, this way we had an opportunity to review the specificities of the DPSIR model. Our primary concern was to find what is the scale and the depth of ecological processes that can be identified by this model. It was also important to find out what special tools are available for preventing and/or mitigating undesired changes, and how effective these are in practice. The study also aimed at learning how the most significant problems and conflict situations that are well-known and are listed in the SEA statement can be managed in the course of the professional consultation between designers and environmental specialists. We used the relatively unsophisticated cost-benefit analysis and a qualitative-type analysis as the main method of the research. The choice has proven adequate for drawing attention to the opportunities lying in the examined phenomena while at the same time it was sensitive enough to identify any specialties and difficulties in practice.

Discussions

Approaches

In practice, there are two conceptions of the role SEA plays in the design process. These are not in conflict but they are essentially different from each other. The first approach emphasizes SEA' similarities to environmental impact assessments (EIA) and considers SEA as the first step of a series of assessments, which is thus suitable for the geographic localization and prompt identification of problems right from the outset. This view is in line with the definition of SEA formulated by Sadler and Verheem in 1996, according to which "*SEA is a systematic process for evaluating the environmental consequences of proposed policy, plan or programme initiatives in order to ensure they are fully included and appropriately addressed at the earliest appropriate stage of decision making on par with economic and social considerations*".

The greatest advantage of this conception lies in its insistence that SEA precedes the environment impact assessment phase and thus it draws attention to conflict points even before the design of the given infrastructure elements pertaining to the policy, program or plan. This provides an opportunity for solving the problem in time.

According to the other approach, SEA is wholly new and independent form of supervision, and only its origin links it to EIA. Its tools are primarily suitable for seizing problems that can be interpreted predominantly at that strategic level. Consequently, environmental assessments following this conception are clearly biased towards processes present at landscape level, regional and global scale. These studies ascribe a relatively high relevance to impacts that are either indirect, synergistic or trans-boundary. Additional habitat loss along the transportation corridors caused by other infrastructure (industrial estates, warehouses, shopping centers etc.) is ranked as a critical issue, a major object of an SEA in this approach.

On the basis of the related literature it can be claimed that the first conception is much more widespread in practice. Presently, the transformation of a landscape in a smaller region is primarily determined by the development of the transportation network, most importantly roads and major ship-canals or other waterways. In a fragmented landscape connectivity will become a limiting factor for conserving biodiversity. We have increasingly more extensive knowledge on both habitat changes at landscape level and their significance in nature protection, thus the first approach is expected to gain more weight in future.

The scaling is apparently two central question of SEA: what processes can be managed by the SEA and which ecological conflicts can be – at least partly - resolved at this level. Two fields deserve our special attention which can hardly (or not at all) be treated at a lower level of design: the large-scale and longer ecological processes on the one hand, and the responsible planning process (implementation of transport policy that is more sensitive to wildlife conservation issues), on the other.

Accordingly, two features of SEA have to be highlighted from the perspective of this examination:

- It identifies the indirect and cumulative impacts of a planned strategy, program, plan prepared for a sizeable region – for a region or a whole country;
- Its findings can influence not only the program's implementation but – optimally – its content and logical structure, i. e. the direction of the development.

Evaluation of Tools

Every examined SEA used common tools or a combination of these for assessing the expected impacts on nature and on biodiversity. Methods can be classified on the basis of their similarity with each other and on the basis of their distinctive features. Theoretical toolkit that might be employed could be much larger than that is used in practice. In the research we collected the most frequently used tools, as well as we summarized their advantages and disadvantages. In the evaluation process we took into consideration the general methodological guidelines for SEA proposed by the EU, together with the methods featuring in sustainability assessments that are somewhat similar in nature to SEA.

1. Habitat Analysis

In the literature review preceding the research we found that it is the most popular and, in case of conservation issues, often exclusively used measure in SEA assessments. All methods classified as habitat analysis center around the comparison of the spatial distribution of vulnerable natural values with that of the designed infrastructure developments, and draft propositions for overlapping areas, be these plans for avoidance or – incidentally - for crossing. There are several methods for preparing a biodiversity map and also for confronting it against development plans. In a previous Hungarian strategic environmental assessment carried out for the development of national motorway system four alternatives were compared by measuring the length of road segments that cross national reserves and Natura 2000 areas for each alternative plan.

Identifying biodiversity hotspots requires a more refined method, but in most cases the results reflect the distribution of only a few, but veritably keystone species or habitats. For a complex evaluation of affected ecosystems enormous amount of data is needed. In the lack of available data everyday experience of field ecologists is usually ranked above the available methods.

As this tool has been used for a long time and in many forms in assessments at different levels, its advantages and disadvantages have become clear by now.

Table 1: Habitat Analysis Tool

Disadvantages	Advantages
Extraordinary amount of data is needed for a regional or a national transport plan	Clear, widely understandable interpretation of expectable conflicts
Controversial results: habitat requirements of species can differ	Applicable also at lower levels of planning (this is rather an EIA-type of tool)
Avoiding all nature areas is unrealizable in a country that is rich in nature values	Indispensable for nature reserves of exceptionally high value (sanctuary-like areas)
Transportation lines are usually not fixed at this early level of planning, development elements are under continuous change during the planning phase: new analysis is needed again and again	
Efficiency of the tool is sometimes low mainly because several professional fields' requirements, maps have to be reconciled and often those maps are preferred that are less conflicting with the originally desired development goals	

2. Modifying the Strategy by Changing the Share of Various Transportation Sectors

It has been well-known long ago that different transportation sectors have different ecological impacts and endanger wildlife to a different extent. Roads not only occupy huge strips of land from the landscape, but they are known to have several impacts that seriously damage the integrity and connectivity of habitats, moreover, even the life of certain animals (Trombulak and Frissell 2000). Generally, the least damage is assumed to be caused by railway and other means of fixed-line transportation. The various existing technical solutions are judged differently in any given transportation sector: a good example for this is the construction of high-speed railways especially in areas rich in natural resources.

Despite the hypothetically enormous advantages in exploiting the opportunities lying in strengthening the presence of more environment-friendly transportation sectors and technical solutions, this is a quite rarely used measure for economic reasons. It is obvious that in case of huge complex designs, the chances of shifting the emphasis on the basis of solely ecological considerations are very low. The success of the measure is also challenged by the fact that the most popular way of transport is usually the least nature-friendly, e.g. traveling by automobile. Well-founded proposals, however, play an enormous part in environmental consciousness-raising and in enlightening the interrelatedness of seemingly independent issues. In the process of TOP, nature conservation and environmental concerns emerging in connection with the plan of the Hungary's largest river, the Danube's transformation into a ship-canal can serve as a very good example for the role of consciousness-raising. The easement of shipping that has already been carried out in other countries in the planned way and that is otherwise rightly regarded as environment-friendly would presumably seriously imperil nature here due to the specific geomorphological characteristics of the Danube's Hungarian section. Although the decision not to canalize the river is presently questionable, the risk was mentioned in the final version of documents, and further measures have been taken to explore risk-related issues.

Table 2: Transportation Sector Tool

Disadvantages	Advantages
Difficult to take into consideration in the course of the design: generally high-speed rails and ship-canals do, traditional railways and in-land shipping do not cause conflicts	Decreasing the share of the most harmful transportation sectors : it can indirectly exert its benign effect through improving the state of other environmental elements like water and air
Limited applicability: this tool can be applied only in certain cases	Highly effective and efficient tool alone: no roads no serious ecological problems
At best only partial management of ecological conflict situations possible: other measures are always needed	Decreasing the need of costly mitigation and acting longer

3. Evolving and Applying Sustainability Criteria

Sustainability criteria include among others the conditions for the conservation of the natural environment and the preservation of biodiversity. Sustainability helps to decide among different values and the criteria draw attention to issues that might stir conflicts and mark areas that are especially sensitive.

Another opportunity lying in employing sustainability criteria is that with their aid, environmental and conservation principles can be integrated directly into the design process. The criteria most frequently feature in distinct planning and so-called Good Practice guidelines. These guidelines are able to exercise strict control from the first planning phase to the implementation and maintenance phase (i. e. monitoring and indicators?)?. In the Hungarian SEA, minimum sustainability criteria have been determined concerning development priorities, but unfortunately, these have not been included in TOP.

Table 3: Sustainability

Disadvantages	Advantages
It can hardly be integrated into a given design system	Fits tightly to strategic level assessments
High resistance against it from the engineering and transportation planning side	Fits better to the modern conservation paradigm
No immediate impacts	It can help communication between different partners
Long learning curve	Facilitate joint thinking

4. Indicators

In theory, indicators are indispensable elements of any strategy. They can play an important role in the comparison of various alternatives, or of similar indicators reported by other countries, and also in the evaluation of programs by comparing status indicators measured before and after a given program. In the field of nature conservation, effect indicators are supposed to be the most expedient, but at present these are not yet available. The European Environmental Agency have developed some result-type indicators that reflect nature-related effects of transportation and transportation infrastructure development'. These can be used comparatively on larger (European or regional) scales. However, indicators for areas destroyed by roads, for the fragmentation of nature areas and for the proximity of protected nature reserves are not yet veritably expedient in comparing a whole country's alternative development programs and thus they do not facilitate the decision among them. The key problem lies in the enormous data input required for the calculation of the indicators, as well as in the simplifying nature of calculation that masks qualitative differences. Consequently, indicators do not feature in the Hungarian SEA for TOP.

Special issues in the Hungarian Case Study

Hungary is struggling to make up a considerable leeway in economy and infrastructure development. This effort is subsidized by the EU, among other supporting the transportation development. At the same time Hungary (partly due to the leeway) has still significantly more natural values than the older Member States. With the accession the country enriched EU' natural heritage with the majority of an additional biogeographical region, the Pannonian region. Maintaining and conserving the values of this region are also subsidized by European funds.

There are two remarkable special issues worth mentioning from our case study. In Hungary, areas located closely around settlements are in many cases of high, sometimes European-level ecological value. In the past, these areas were inappropriate for house-building or cultivation and served as a boundary for the settlement's further expansion, while nowadays these are - in many cases – the last natural values within the settlement's authority. By-pass roads built primarily for environmental reasons (in order to decrease noise and air pollution, high risk of accident inside the settlements) effect just these areas the most fatally. Balancing environmental protection and conservation objectives does not yet seem to be manageable in the framework of the strategic analysis as the settlements' interests is also inevitably justified. Decisions made at lower levels of design – again drawing on the Hungarian experience – have given rise to many conflicts.

Compensation could be offered in cases where damaging nature areas is inevitable. Application of compensation in Hungary is regulated by a decree on Natura 2000. Practically, the decree adopts the „no net effect" principle of the EU's biodiversity strategy for the affected areas. Still, compensation is a highly disputed measure among ecologists and conservationists, as the criteria for inevitability of natural damage are not defined in an exact and transparent way. Western European examples show that compensation can easily become a simple economic consideration (i. e. it is „cheaper" to compensate for than to avoid damage), and this practice can in turn cause serious damage to nature. In the final analysis, compensation does not create new value, all it tries to do is to substitute - with more or less success - an existing value doomed to devastation. The main impediment of realizing the modern "dynamic" conservation paradigm is also closely connected to the institution of compensation: there are very limited space for the creation of sizeable and valuable new habitats, Hungarian land use suits no longer the natural dynamics of ecological processes.

Conclusions

We have to come to terms with the fact that major developments of transportation networks will necessarily affect negatively the natural environment to be protected. In most cases of a well-thought design, there are environmentally acceptable solutions, but even these are compromises at the best that result in only a moderate" degradation of the of habitats. Apart from gaining much more thorough scientific knowledge about the phenomena, the theoretical

guidelines will have to be clarified in order to elaborate solutions that would keep damages done to the wildlife at a still tolerable level in the long run. The first step would be the clear and unambiguous articulation of different policies, and as concerns the professional fields themselves, coordination and cooperation should be heightened. Developing compromises, cooperation and dialog is declared and intended to be SEA's key responsibility. As concerns the policies, conservationists necessarily have to establish a realistic, an optimistic and a pessimistic vision about the transportation networks. These visions will have to determine those target states of damaged or endangered habitats similarly positioned by the transportation lines whose evolution is acceptable for conservationists. In current practice, it too often occurs that two significantly different propositions are worked out for the same issue, where the conditions are completely alike in both cases. Without setting target states and delineating the appropriate method to reach these, different and in many cases, ad-hoc solutions will continue to be given to current and future conflicts, depending on the knowledge and jurisdiction of the commissioned expert of exert group. This, as we have experienced many times, has already undermined the trust of designers in conservation experts.

In the field of transportation development, the lack of standalone and unified environmental policy could also be felt in the reviewed documents, as well as in the argumentation supporting the TOP.

This is well reflected in the wording of TOP: there are contradictory environmental and sustainability targets and unrealistic, and hence not too detailed commitments. Presenting by-pass roads as a progressive step „successfully" masks the fact that probably conservation areas are being damaged, while the amount of emitted pollutants and noise will even grow due to the increasing traffic and speed on that road – the only thing that will change is the location of the emission.

Transport infrastructure generates regional development, moreover, this is one of its major objectives. Regional development requires additional areas, often in the zone of newly built roads and railways. Facilities directly linked to transportation infrastructure are intrinsically inseparable from them, and amplify their negative effects on the environment. As at the level of EIA the permitting procedure of roads and that of other facilities are separated in time and in administrative process, this relationship has to be taken into consideration and their synergistic impacts has to be handled in SEAs. For the time being, this important objective is not being attained by the predominantly adopted approach of regarding SEA as one form of impact assessment.

Concluding, we can claim that SEA in its present form is yet a weak tool for conservation biodiversity. The study has revealed that theoretically, SEA offers many opportunities, while in practice only some of them have proven really effective. Consequently, it is imperative to improve its methodology and to widen its usability, and it should be integrated more efficiently in the whole implementation process of the transportation strategies in future.

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