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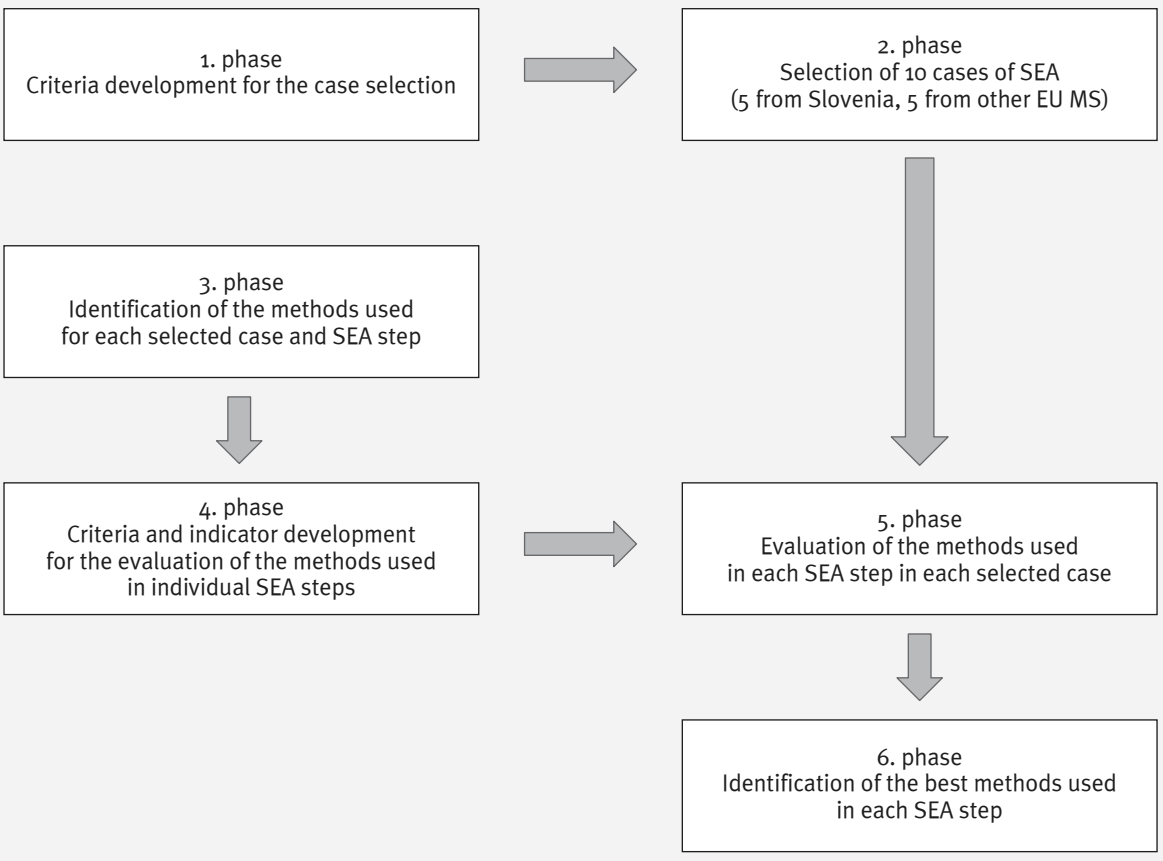
Fig. 1 Phases of the methodological approach



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Efficiency of Strategic Environmental Assessment Methods in Municipality Land Use Plans

efficiency
land use plans (LUPs)
planning
SEA directive
Strategic Environmental Assessment (SEA)

The integration of environmental aspects in land use plans (LUPs) through SEA varies across Europe and their efficiency is still not well known, motivating the research of SEA implementation for LUPs. The main aim of the research is to evaluate the methods of integrating environmental aspects into LUPs, based on ten best practices, five from Slovenia and five from other EU Member States. The research methodology proceeds from the review of various literature and studies, on the basis of which we have developed fifty efficiency criteria and evaluated the methods used in the LUP for each step of the SEA: (I) scoping, (II) environmental report preparation, (III) consultations with ministries and public organizations responsible for specific environmental issues, (IV) public participation, (V) decision-making and (VI) monitoring. The research has shown that the methods used differ in scoping, consultations, public participation, and monitoring. We have identified the methods that are most effective in each SEA step. The research findings emphasise the importance of scoping and monitoring methods. The conclusion suggests further research of efficiency by questionnaire.

Introduction

Before 2003, land use plans (LUPs) in municipal projects rarely underwent a Strategic Environmental Assessment (SEA), resulting in significant environmental and health impacts as well as costly problems such as flooding, erosion and ecosystem damage. Due to the disregard of environmental aspects, the implementation of such plans with significant environmental and health hazards (EC, 2019: 1) as well as increased costs due to flooding, erosion, environmental disasters and ecosystem restoration (Judd, 2018: 1-10; EC, 2019: 1).

To mitigate these consequences and develop environmentally balanced LUPs, various methods and approaches have been scientifically investigated. In the search for optimal methods to integrate environmental goals into plans, programs and spatial strategies, numerous authors from Europe (Joao, 2004; Schmidt et al., 2005; Fischer, 2007, 2012; Ashemann, 2005; OECD, 2012; Sadler, Dusik, 2016; Therivel, 2019: 266-278) have advocated an ecological, strategic, gradual and transparent SEA approach. The main achievements of SEA include improved strategic decision-making in relation to plans and the formulation and evaluation of alternatives (Jones et al., 2005; Joao, 2005: 331-344; Koblar, 2004: 175-187; Cepuš et al., 2019).

A major milestone was the adoption of Directive 2001/42/EC of the European Parliament and of the Council on the Assessment of the Effects of Certain Plans and Programs on the Environment (hereinafter SEA Directive, 2001) and its transposition into national legal systems. The SEA Directive came into force simultaneously for all European countries that started to develop SEA methods, practices and research (Walsh, 2005; Sadler, Dalal-Clayton, 2010; Partidario, 2012; Pistotnik, 2017; Kolar Planinšič, 2021). It has been noted that appropriate methods are a prerequisite for effectiveness (Partidário et al., 2023) and that the long preparation and implementation time of the SEA increases substantive effectiveness. In 2003, the Protocol on strategic environmental assessment came into force in the UNECE[1] region (hereafter SEA Protocol, 2003)[2] too, supporting broader application.

To successfully conduct the SEA, various methods were applied within methodological steps, such as scoping, the preparation of environmental reports and engaging the ministries, organizations responsible for specific environmental protection issues and the public. The methods for carrying out the individual SEA implementation steps and their relationships have evolved according to the characteristics of individual regions (Partidario, 2012; Kolar Planinšič et al., 2013: 22; Sadler, 2016; Stenek et al., 2017: 95-100; Kolar Planinšič, 2017; Therivel, 2019: 266-278).

The question of which SEA methods are most appropriate for specific programs, plans and spatial strategies has already been raised by Noble, Gunn and Martin (2012) and the relationship with sustainability has been addressed by researchers and EU Member State (hereafter EU MS) authorities (Marsen, 1998; Environmental Protection Agency, 2012; Jacob et al., 2008; Mader, 2013; Schwab, 2021; Monteiro et al., 2017). Strategic thinking was emphasised by Partidario (2012) as an important prerequisite for efficient SEA. In addition, reliable data quality is one of the fundamental factors for effective SEA (Lazar, Podesser, 1999).

1 United Nations Economic Comission for Europe

2 On the 10th anniversary of the SEA Directive, European presentations stated that SEA is a key instrument for efficient environmental governance, which has a broad scope and content and is process oriented. Fundamental criteria for assessing effectiveness (the achievement of environmental goals, financial and resource efficiency, coherence, relevance and added value) were first set out in the SEA Directive evaluation study (European Commission, 2016). The second European study, SEA REFIT (European Commission, 2019), was the first to examine a broader sample of SEAs and identify a wider range of efficiency criteria, using the preservation and development of environmental standards and the relationship with other European directives, e. g. the Water Framework Directive (2000), the Habitat Directive (1992) and the Bird Directive (2010).

In this context, a particular challenge was seen in the lack of common evaluation criteria for the efficiency of SEA for LUPs. Therefore, authorities and practitioners could not analyse and compare the results or even improve them during the next planning period. Against this background, the research problem is to determine the criteria for evaluating the methods in each step of SEA and to identify the differences between the methods used in SEA for LUPs.

Therefore, the research question is: Which methods in the SEA steps (in scoping, SEA report preparation, public participation, consultations, mitigation measures and monitoring) are most appropriate?

Therefore, the aim of the study is to identify the effectiveness of best practise in SEA for LUPs. As SEA consists of methodological steps that incorporate environmental objectives into LUPs, the aim of our research is also to evaluate all methodological steps of SEA and identify the most effective and efficient methods within each step. Although various environmental evaluation systems in EU Member States are considered to have a common set of procedural requirements that contribute to an important level of environmental protection, these systems differ in their effectiveness and efficiency.

This research also considers the criteria of the second SEA REFIT study (EC, 2019), but focuses only on LUPs, which play a crucial role in sustainable development and climate change adaptation and considers the results of key studies to advance the SEA methodologies for these important spatial plans.

In the paper, we present the results on the effectiveness, efficiency, coherence, relevance and added value of the methods used in each SEA step, as well as the most effective methods. In the conclusion, we suggest further research on the topic of the paper.

For this research, the strategic environmental assessment means:

– the preparation of an environmental report, conducting consultations, taking the environmental report and the results of the consultations into account in decision-making and providing information about the decision;

– an important tool for integrating environmental considerations into the preparation and adoption of certain plans and programmes that are likely to have significant effects on the environment in the Member States, as it ensures that such effects of the implementation of plans and programmes are considered during their preparation and before their adoption.

Environmental impacts are defined as impacts on biodiversity, population, human health, fauna, flora, soil, water, air, climate, material assets, cultural heritage, landscape, and their interactions.

Methodology

In the study, we evaluate how the key methodological steps of SEA contribute to the integration of environmental objectives into LUPs in the period 2019-2023. These steps include (I) scoping, (II) preparing the environmental report, (III) consultations with ministries and organizations on environmental issues, (IV) public consultations, (V) decision-making on environmental impacts and (VI) monitoring.

To achieve this, we developed a two-part methodology (Fig. 1) with six phases based on existing research and studies. First, we established criteria for selecting examples of good practise and selected five from Slovenia based on their accessible data and five from other EU countries. Secondly, we developed criteria and indicators to evaluate the methods used in the different steps of SEA and applied them to all ten examples.

- **1. phase:** Criteria for selecting examples of good practise – In the first part of this phase, we used several criteria to select the cases from the EU Member States: (a) scientific papers on the topic are available in English, (b) the SEA systems are comparable, (c) the data are publicly accessible, (d) the environmental goals and indicators align, (e) the country demonstrates strong environmental performance, (f) the cases are from different climate regions, (g) the LUPs are for EU municipalities with fewer than 1.5 million inhabitants, (h) environmental aspects are fully integrated into the LUPs, and (i) the SEA authority recommends the case as an example of good practice example.

In the second part, we define criteria for the selection of SEA cases: (1) SEA is completed, (2) LUP has been adopted, (3) SEA is conducted in parallel with the development of LUP during the planning phase, (4) SEA is conducted within the LUP planning timeframe, (5) the SEA has defined a set of objectives and indicators during the scoping phase, (6) the environmental report was prepared according to the regulations and was of high quality, (7) the consultations with ministries and organizations were conducted professionally and within the deadlines, (8) public participation was effective, (9) objectives and indicators were set for all relevant environmental areas, (10) alternatives were assessed, (11) environmental aspects were

TABLE I EVALUATION CRITERIA, THEIR GROUPS AND RELATED NUMBER OF INDICATORS

Evaluation criteria in groups and sub-groups	Number of developed indicators in each group of criteria
I. Effectiveness	
I.1 Completeness and depth of the environmental report	11
I.2 Objectivity	4
I.3 Verifiability and transparency	4
I.4 Public participation	4
I.5 Compliance with legislation and standards	5
I.6 Mitigation measures	4
I.7 Regular monitoring	5
II. Efficiency	
II.1 Efficiency in financial and human resources inputs	5
III. Coherence	
III.1 SEA coherence	4
IV. Relevance	
IV.1 SEA relevance	2
V. Added Value	
V.1 Added value	2
Total number of criteria	**50**

integrated into LUP and recorded in regulatory units or spatial implementation conditions, (12) there were no appeals or lawsuits regarding the decision on environmental impacts and the SEA process was in line with the findings of the EU Court, (13) monitoring was proposed and (14) the area is located in different biogeographical regions.

- **2. phase:** Selection of good practices of SEA – Based on the criteria from the first step (Fig. 1), we selected five effective SEAs from Slovenia – Ljubljana, Novo Mesto, Ankaran, Bohinj and Rogaška Slatina — and five from other European countries: Graz (Austria), Varaždin (Croatia), Dublin (Ireland), Sintra (Portugal) and Copenhagen (Denmark).

- **3. phase:** Identification of the methods used for each selected good practise and SEA step – The methods for each SEA step were identified based on a literature review of known methods already used in the SEA steps, a review of environmental reports and other reports related to SEA and a review of 10 selected cases. Their relationship to the groups of evaluation criteria and related indicators is shown in Table II (Results chapter).

- **4. phase:** Development of criteria and indicators for the evaluation of the methods used in the individual SEA steps – The evaluation criteria were developed based on literature research and more than 20 years of experience[3] in SEA implementation. Five groups of criteria were defined: Effectiveness, Efficiency, Coherence, Relevance and Added Value. Indicators were developed for each criterion. Their number depends on the importance of the criterion (Table I).

- **5. phase:** Evaluation of the methods used in each SEA step in each selected case – Detailed evaluation indicators were developed for the appropriate evaluation of the cases: 37 detailed indicators for effectiveness, 5 for efficiency, 4 for coherence, 2 for relevance and 2 for added value. All 50 SEA indicators were used to evaluate all methods used in the selected cases and to identify the most successful methods for each SEA step. The SEA steps are as defined in SEA Directive and its implementation practise. They are as follows and presented in Table III: scoping (I.), preparation of environmental report (II), consultation with ministries and organisations (III), consultation with public (IV), environmental acceptability decision (V) and monitoring (VI). The results, the connectivity and relation to the SEA steps are shown together with the developed indicators in Table II.

For each method used in the 10 selected LUP cases, a rating was created for each indicator on a scale of 1 to 5, where 1 is inadequate, 2 is poor, 3 is good, 4 is very good and 5 is excellent. A detailed rating scale was developed for each indicator according to its content to make the ratings as objective as possible. After scoring all 10 cases, we calculated the average score for each individual method used. Table II shows the scores from 1 to 3 to indicate the areas where further development of SEA methods is needed.

In this section, we also clarify which individual methods are evaluated as verbatim quotations from the SEA Directive (2001), as otherwise various criteria such as effectiveness and efficiency could be misunderstood.

– Effectiveness evaluates the extent of the predetermined objectives in terms of a particular intervention, legal provision, act or series of acts (in this case the SEA Directive). The objectives that are the subject of the effectiveness evaluation are listed in Article 1 of the SEA Directive.[4]

It analyses the extent to which SEA has contributed to ensuring a high level of environmental protection in LUPs. As the effectiveness indicator is most complex, it has been divided and organised into the following seven sub-groups of indicators:

a) Completeness and depth of the environmental report
b) Objectivity
c) Verifiability and transparency
d) Public participation
e) Compliance with legislation and standards
f) Mitigation measures
g) Regular monitoring

– "Efficiency considers the relationship between the resources used by an intervention and the changes generated by that intervention (which may be positive or negative)." (EC, 2019: 76)[5]

– Coherence: In the research, we examine the extent to which the SEA Directive is coherent with other relevant EU environmental

3 Co-author Kolar Planinšić has 20 years of experience in SEA performance in Slovenia, Europe and UNECE as Chair of buro of the SEA Protocol, Member of European Commission Working Group on EIA/SEA and as Slovenian Competent Authority, responsible for tranposition and implementation, including quality assurance and capacity building.

4 "To provide for a high level of protection of the environment and to contribute to the integration of environment consideration into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with the directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment." (EC, 2019: 56; SEA Directive, 2001: 1)

5 "It aims to provide an understanding of the extent to which the benefits of having and implementing the SEA Directive justify the costs. Both cost and benefits

legislation and sectoral policies as well as with the EU's international obligations.[6]

– "Relevance assesses whether the original objectives of the SEA Directive continue to meet the needs of current and future EU planning, assessment, and environmental policy."[7] (EC, 2019: 101)

– Added Value: "The assessment of EU added value considers the benefits and changes resulting from implementation of the SEA Directive that are additional to those that would have resulted from action taken solely at regional/or national level." (EC, 2019: 159)

• **6. phase:** Identification of the best practises (cases) used in each SEA step – The most effective methods were those that had been rated as most effective in the previous methodological phase and received an average score between 4.0 and 5.0 (Table II). We therefore identified the most effective methods for each step of the SEA separately. In this phase, individual SEA steps were linked to the stages of the LUP preparation process, where relevant, and summarised selected cases that proved to be the best practise for each method were applied (Table III in the Results chapter).

Results of the Evaluation of the Methods Used in Relation to the Selected Indicators and Criteria

The results of the evaluation (Table II) show that all the methods used are of a fairly high standard, with the average rating of each method for all the selected cases nowhere below 2.6 (the SEA report suggests monitoring) and a very large number of indicators achieving the highest rating of 5 (22 out of 50). Overall, the selected cases are balanced for most indicators, with only a few showing significant deviation. This is generally the case for the good practise examples, where individual indicators are rated with the lowest scores (2 and 3) and the range of scores for all case indicators is from 2 or 3 to 5.

A more detailed presentation of the results for each group of criteria and indicators follows later in this chapter, focusing on the evaluation of the results for each group of criteria and indicators with the link to the SEA steps (Table II).

– Effectiveness – The results on effectiveness in achieving environmental goals show that the integration of environmental aspects in LUPs in Slovenia and other EU countries is of high quality, with only minor deviations. Differences exist in terms of climate change and water.

Biodiversity is one of the most methodologically advanced areas. Other environmental aspects are well integrated, although methods vary in terms of precision and detail. Environmental reports from larger cities such as Ljubljana (Janković et al., 2021), Varaždin, Sintra, and Copenhagen are rather general, with a medium level of detail. In contrast, places such as Rogaška Slatina, Bohinj, Ankaran, Dublin, and Graz use more precise methods, focusing more on cultural heritage and urban content. This suggests that methods for evaluating environmental reports are tailored to the level and content of the plans. There are no significant differences in structure or goals, nor in the way they relate to other plans. The environmental characteristics are clearly described in nine out of ten cases, with only minor deviations in one. All cases address key environmental aspects, particularly those related to ecological sites under the Habitat (1992) and Birds Directives (2010), showing strong compliance with European and national environmental goals.

There are notable differences in the assessment of likely significant environmental impacts, such as effects on biodiversity, population, human health, fauna, flora, soil, water, air, climate, material assets, cultural heritage, landscape, and their interactions. While 5 out of 10 cases cover these areas thoroughly, in some cases one or two aspects are either vaguely or inadequately assessed.

Regarding the indicator of mitigation measures, these are listed and partially described in all cases, but their feasibility is either not mentioned or is insufficiently evaluated.

Inadequacies can be found in some cases in the reasons for choosing the considered alternatives and the description of the evaluation process and any difficulties encountered. There are clear differences in monitoring, where 80% of the measures are listed and partially described, but only 20% are fully described and monitored.

can be monetary and non-monetary. The evaluation of efficiency also needs to provide an understanding of the factors that influence efficiency and look the administrative burden the Directive imposes on key stakeholders, such as public authorities." (EC, 2019: 76)

6 "Evaluating the coherence of legislation, policies and strategies means assessing if they are logical and consistent with each other and with other legislation, as well as with relevant policies. This included determining whether there are significant contradictions or conflicts that stand in the way of their effective implementation, or which prevent the achievement of their objectives." (EC, 2019: 113)

7 „It looks at whether the objectives of the legislation remain necessary and appropriate, and if the objectives and requirements set out in the Directive are still valid in contributing to sustainable development." (EC, 2019: 101)

TABLE II EVALUATION MATRIX OF 50 SEA CRITERIA

SEA STEP	I	CRITERIA	Case 1	2	3	4	5	6	7	8	9	10	A
EFFECTIVENESS													
Completeness and depth of the environmental report													
I., II.	1	Content	5	5	5	5	5	5	5	5	5	5	**5**
I., II.	2	Environmental state	4	4	4	5	5	5	5	5	5	4	**3.6**
I., II.	3	Possible impacts	5	5	5	5	5	5	5	5	5	4	**4.9**
I., II.	4	Environmental problems	5	5	5	5	5	5	5	5	5	5	**5**
I., II.	5	Environmental aims	5	5	5	5	5	5	5	5	5	5	**5**
II.	6	Environmental effects (nature/biodiversity, water, floods, air, cultural heritage, health, climate)	4	4	5	5	5	4	4	5	5	4	**4.5**
II.	7	Mitigation measures	4	5	5	5	4	3	3	4	4	4	**4.1**
II.	8	Alternatives	4	4	4	4	4	3	3	5	3	3	**3.7**
VI.	9	Monitoring measures	4	4	4	4	4	5	4	4	5	4	**4.2**
II.	10	Non-technical summary	3	3	3	3	3	4	4	5	4	4	**3.6**
II.	11	Cumulative effects	3	3	4	4	4	4	4	4	4	3	**3.7**
Objectivity													
II.	12	Scientific approach	3	3	4	4	4	5	4	4	5	4	**4**
II.	13	Objectivity of data base	5	5	5	5	5	5	5	5	5	5	**5**
II.	14	References	4	4	4	5	5	5	5	5	5	5	**4.7**
II.	15	Cooperation of science	2	2	2	3	5	3	3	5	3	2	**3**
Verifiability and transparency													
	16	Process description and verifiability	5	5	5	5	5	5	5	5	5	5	**5**
V.	17	Publication of SEA report and LUP	5	5	5	5	5	5	5	5	5	5	**5**
IV.	18	Anyone can have an insight into the procedure	5	5	5	5	5	5	5	5	5	5	**5**
III.	19	The opinions of ministries and organizations are summarized and the whole process is described in the decision on Environmental acceptability/final decision	5	5	5	5	5	5	5	5	5	5	**5**
Public participation													
IV.	20	SEA report is publicly available with invitation for comments	5	5	5	5	5	5	5	5	5	5	**5**
IV.	21	Reasonable time	5	5	5	5	5	5	5	5	5	5	**5**
IV.	22	Public answers to public comments	5	5	5	5	5	5	5	5	5	4	**4.9**
IV.	23	Comments considered	4	5	4	5	4	5	5	5	4	4	**4.5**
Compliance with legislation and standards													
II., III., IV., V., VI.	24	All national legislation considered	5	5	5	5	5	5	5	5	5	5	**5**
II., VI.	25	EU legislation considered	5	5	5	5	5	5	5	5	5	5	**5**
II., VI.	26	International legislation considered	5	5	5	5	5	5	5	5	5	5	**5**
II., VI.	27	Standards considered	4	5	5	5	5	5	4	4	4	4	**4.5**
VI.	28	No complaints or court procedures	4	5	4	5	4	5	5	5	5	5	**4.7**
Mitigation measures													
II.	29	SEA report proposes mitigation measures	4	4	4	4	4	4	4	4	4	4	**4**
II.	30	Mitigation measures are feasible and technically justified	3	5	4	5	5	5	5	5	5	5	**4.7**
II., VI.	31	Mitigation measures are applicable to the LUP	5	5	5	5	5	5	5	5	5	5	**5**
II., VI.	32	Mitigation measures are included in the LUP	4	5	5	5	5	5	5	4	5	4	**4.7**
Monitoring													
II.	33	SEA report proposes monitoring	3	3	3	3	3	3	3	1	2	2	**2.6**
VI.	34	Monitoring is set out in the decision on environmental acceptability/final decision	5	5	5	5	5	5	5	5	5	5	**5**
VI.	35	Municipality/city conducts monitoring	4	4	4	4	4	4	5	4	5	4	**4.2**
VI.	36	Monitoring report is sent to SEA authority or is public	3	3	3	3	3	5	4	5	5	3	**4.0**
VI.	37	Monitoring is used for future LUP changes	5	5	5	5	5	5	5	5	5	5	**5**
EFFICIENCY													
Efficiency in financial and human resources inputs													
II.	38	The environmental report does not exceed the costs of the LUP	5	5	5	5	5	5	5	5	5	5	**5**
I.-VI.	39	SEA is conducted within a reasonable time	5	5	4	4	2	5	5	5	5	5	**4.5**
I.-VI.	40	Highly professional staff in the municipality	5	5	5	4	4	5	5	5	5	5	**4.8**
I.-VI.	41	Highly professional staff at the ministry, responsible for SEA	5	4	4	4	4	5	5	5	5	5	**4.6**
I.-VI.	42	Highly professional staff at the ministries and organizations involved in SEA	4	4	4	4	4	4	4	4	4	4	**4**
COHERENCE													
I., II.	43	The Environmental Report complies with the Habitats Directive	5	5	5	5	5	5	5	5	5	5	**5**
I., II.	44	The Environmental Report complies with the Bird Directive	5	5	5	5	5	5	5	5	5	5	**5**
I., II.	45	The Environmental Report complies with the Water Framework	5	5	5	5	5	5	5	5	5	5	**5**
I., II.	46	The Environmental Report complies with the Flood Directive (2007)	4	5	5	4	4	5	5	5	5	4	**4.6**
RELEVANCE													
II.	47	SEA responds to current environmental issues	4	4	4	4	4	4	4	4	4	4	**4**
II.	48	SEA assesses all essential environmental content	4	5	5	5	5	5	5	5	5	4	**4.8**
ADDED VALUE													
II., VI.	49	SEA proposes alternatives or modifies the plan to ensure that it is environmentally acceptable / no adverse effects on the environment	5	5	5	5	5	5	5	5	5	5	**5**
II., III., IV., V., VI	50	**SEA greens the plan and contributes to sustainable development**	5	5	5	5	5	5	5	5	5	5	**5**

Legend: I – index; A – average

No.	Case	No.	SEA step
1	SEA for Land Use Plan Ljubljana	I	scoping
2	SEA for Land Use Plan Novo Mesto	II	preparation of environmental report
3	SEA for Land Use Plan Ankaran	III	consultations with ministries and public organizations responsible for specific environmental issues
4	SEA for Land Use Plan Bohinj		
5	SEA for Land Use Plan Rogaška Slatina		
6	SEA for Land Use Plan Graz	IV	public consultations
7	SEA for Land Use Plan Varaždin	V	decision-making and the final decision on environmental impacts
8	SEA for Land Use Plan Dublin		
9	SEA for Land Use Plan Sintra	VI	monitoring
10	SEA for Land use Plan Copenhagen	II.	preparation of environmental report

A non-technical summary is present in all cases and contains all the necessary content. However, the readability and the degree of justification vary.

In evaluating the applied methods, particular care has been taken to ensure that the impacts have been considered in scoping, the environmental report, consultations and integration into the LUPs. In all cases these impacts are listed and include all types of impacts, however, they are incomplete in 2 cases and slightly incomplete in 7 cases. The survey confirms that the authors consider these impacts to be irrelevant and prefer not to "burden" the environmental report. However, this lack of transparency requires adequate clarification during scoping to avoid overlooking potential mitigation or monitoring measures. In most cases, the positive impacts are also not adequately highlighted.

The objectivity criteria show that the environmental reports are professionally justified but differ in their scientific justification. In 2 cases the scientific justification is present but partially incomplete; in 6 cases it is largely justified but some content still raises scientific doubts; in 2 of the remaining cases the reports are fully justified. Objective data sources were available in all cases and were fully considered, demonstrating the objectivity of the presentation of environmental conditions. The references achieve a rating of 4-5 in all cases.

The process is clear, transparent, and fully verifiable in all cases. The LUPs were published online for public access and review, and the opinions of the ministries and organizations were summarized in the final environmental acceptability or alternative decision. The procedures followed in the cases observed were transparent and met the criteria.

The results of public consultation show varying levels of public involvement, from fulfilment of the minimum requirements to broad public cooperation. In all cases, the LUPs were published on a designated website, where the public could submit comments online, attend workshops and participate in public hearings. Specific deadlines and contact information were provided for submitting comments, which were then compiled and publicly responded to. In all cases, comments were considered in full or to the extent possible. In 5 out of 10 cases, some comments could not be fully addressed but considered where possible.

The methods for submitting and considering comments vary widely. The methods for public hearings at the drafting phase differ considerably from those for early public participation before the plan is drawn up. Initiative-taking public participation took place systematically in the LUPs for the municipalities of Dublin (SEA Guidance, 2020), Graz (Raumplanung Steiermark, 2009; Pistotnik, 2017; Schwab, 2021), Sintra (Partidario, 2018; Partidário, Monteiro, 2019), Rogaška Slatina and Ankaran. Partial own-initiative participation took place in Ljubljana (scoping) MOL (2018) and Copenhagen, while official public hearings were held elsewhere during the drafting phase.

In all cases, all national and EU legislation was fully implemented. Mitigation measures were proposed in the environmental reports and included in the LUPs. In 8 out of 10 cases, the proposed mitigation measures were fully taken into account. In 3 cases, the measures were largely taken into account and in 7 cases they were fully taken into account.

The result of the regular monitoring shows differences. In one case, the environmental reports did not provide for any monitoring at all and in 3 cases the monitoring was only minimal. In 6 cases, partial monitoring was carried out. In 8 cases, the monitoring was mainly carried out by the municipalities, but only in 2 of them (Graz and Dublin) the results are published transparently.

– Efficiency – The evaluation of the financial and personnel costs was difficult due to the different data from publicly accessible information and surveys. However, it is evident that the preparation of the LUPs required significant financial investment, while the SEA report was cost-effective in all cases.

The SEA was conducted within a reasonable period of up to four years in 7 cases, four to five years in 2 cases and six to seven years in 1 case. In 1 case, the duration was influenced by external factors and staff shortages. The municipalities provided at least one full-time employee in 2 cases and at least two full-time employees in 8 cases. Higher efficiency was observed when two employees were involved.

Among ministry staff, higher efficiency was observed when more than one person was employed for a period of four-month, which was the case in 6 out of 10 cases. In 4 cases, only one person was engaged for a four-month and efficiency was lower.

Official representatives of ministries and organizations (up to 40), experts, authors, reviewers and municipalities participated in the SEA processes. Other authors participated in the preparation of the LUPs. Active participation and co-operation led to the most efficient results. Efficiency was achieved in 9 cases through active communication and co-operation in spatial planning and environmental assessment, which had a positive impact on decision-makers.

– Coherence – In all cases, the environmental reports follow the Habitats Directive (1992), the Birds Directive (2010) and the Water Framework Directive (2000). Appropriate evaluations are detailed and transparent. There are some differences in the evaluation of compliance with the Floods Directive (2007), particularly in the detailed explanations and the graphical presentation. The explanation and transparency of the assessment methods are more precise if the database on the state of water bodies and the hydrological model were previously created in the initial planning phase and therefore used in the scoping and the SEA report.

In the case of Ljubljana, Copenhagen and Rogaška Slatina in particular, climate change was considered using a combination of meteorological data and holistic climate change models. In Ljubljana climate change mitigation measures were proposed in the plan and the so-called "new graveyard area" in the plan was accepted with the remark that it can only be used once the climate change mitigation measures will have been implemented on site, which is about 10 years later.

– Relevance – SEAs respond to current environmental issues in all key areas such as environment, cultural heritage, landscape, water, population and health. Due to climate change the average rate is 4 but is considered holistically. The more exact measure on climate change could include different long-term alternatives near coastal areas (Copenhagen). The climate change mitigation measures related to landscape, population and health are very well integrated into the plan of the same city, such as large green areas, green structures and renaturation areas, as the essential environmental context has been assessed. As can be seen from the documentation, the relevance of the SEA methods is high in all SEAs, as all current environmental issues are considered (rate 5), apart from climate change mitigation measures. As land use planning is the only planning that defines land use at the municipal level, this is the only planning area where the creation of measures is possible.[8] Climate change in general is mentioned in the SEA reports, but in individual SEAs climate change is not considered as much as other issues, and therefore the common rate is 4.

In terms of cultural heritage, the relevance of the methods is the highest in Dublin, Copenhagen, Graz, Varaždin, Sintra and Rogaška Slatina. The relevance of the methods that take climate change into account achieves medium rates and is not completely transparent. Further investigation is therefore required.

– Added value – The results show that all SEAs propose alternatives or modify the LUPs, formulate the LUPs greener and contribute to sustainable development. They represent national and European added value. In all 10 SEA cases, alternatives or mitigation measures are proposed and the LUPs are modified. The SEAs amend the plan to ensure that it is environmentally sound and does not have a negative impact on the environment. The results of the evaluation show that the added value from the documentation is seen with up to the highest rate of 5.

THE BEST METHODS IN THE SEA STEPS

Based on the analysis of all methods in relation to the previously developed criteria and indicators, this chapter highlights the best methods used in the SEA steps (Table III). The success of the individual steps (I to VI) and the overall SEA process depends on the combination of methods and the co-operation of all parties involved. The methods used differ in the degree of stakeholder involvement, which can be open (inclusive) or closed (non-inclusive), with inclusive methods having a higher degree of effectiveness.

I – Scoping methods – Seven (Table III) methods were identified as the most effective for scoping (I. SEA step), which can also be used in combination with each other:

– Two of them, internal and external interdisciplinary scoping methods are fundamental and should always be used as they form the basis for the further proper assessment of SEAs. An interdisciplinary team must work on both the scoping and SEA.

– The consultation method, where proper goals and indicators are named, is an enhancement and should be supported by the thematic scoping workshops, which are also one of the best scoping methods.

– The scoping workshop method helps to find key issues and cut irrelevant issues to ensure that the SEA focuses on the most important challenges.

– Internal and external consultation methods are also needed to properly develop the assessment method and present it to the stakeholders.

– The survey method shows critical decision factors, helping to avoid unforeseen issues

8 The Strategy for Climate Change gives directions generally and specifically for sectors and aims to transform the EU into a climate-neutral area by 2050. National energy and climate change plans give more directions generally and specifically for sectors considering all countries to become climate-neutral by 2030 with a view to 2050. Land use plans are created with the purpose to implement the land use and measures in reality in next one to five years, so the climate change measures must be written in the plan and appropriate mitigation measures must be formulated.

Table III The most effective and efficient methods for the transparent integration of environmental considerations into the SEAs for the LUPs

SEA steps	SEA methods	LUP phase	Case
I. Scoping	The method of internal interdisciplinary scoping.	Aims of a LUP. Indicators of a LUP. Definition of an alternative.	Ljubljana, Ankaran, Sintra, Dublin, Graz, Copenhagen, Ljubljana, Varaždin
	The method of external interdisciplinary scoping.		Ljubljana, Graz, Dublin, Copenhagen
	The consultation scoping method for settling the relevant aims and indicators for environment, nature, landscape, cultural heritage, water.		Ljubljana, Bohinj, Ankaran, Sintra, Dublin
	Thematic scoping workshops.		Ljubljana, Graz, Copenhagen
	The internal/external consultation method for settling the SEA evaluation method.		Sintra, Dublin, Graz
	The survey method for identification of critical decision factors.		Sintra
	The strategic thinking method for identification of alternatives with planning and environmental experts.		Sintra
II. Preparation of the environmental report	The method of literature survey to show environmental problems.	Preparation of a LUP draft. Integration of environmental issues/alternatives into a LUP.	Bohinj, Rogaška Slatina, Ljubljana, Ankaran, Graz, Varaždin, Copenhagen, Dublin
	The method of internal interdisciplinary teamwork.		All cases
	The survey method.		Sintra
	The method of external consultation workshop.		Rogaška Slatina, Ljubljana, Dublin
	The method of external independent scientific checking/quality assurance.		Sintra
III. Consultations with ministries and public organizations	The method of written consultation with ministries/organisations.	Consultation with ministries and organisations.	All cases
	The method of on-site consultation with ministries/organisations.		Ljubljana, Graz, Copenhagen
	The method of workshop consultations with ministries/ organisations.		Ljubljana
IV. Public consultations	The method of written public consultation (on-line, time).	Public consultation. Preparation of answers on how the comments were considered.	All cases
	The method of site-by-site presentations and public consultation.		Ljubljana, Novo Mesto, Bohinj, Ankaran, Rogaška Slatina, Graz,
	The method of thematic focus meetings.		Ljubljana, Ankaran, Graz, Dublin, Copenhagen
	The method of location workshops, walking tours.		All cases
	The method of interdisciplinary consideration of comments.		All cases
	Personal written information on considering comments.		Graz
V. Decision-making and the final decision on environmental impacts	The method of actively taking comments from III and IV. SEA steps into account.	Integration of all SEA topics into a LUP. Integration of mitigation measures into a LUP. Integration of monitoring into a LUP. Acceptance of a LUP. Final decision making.	Ljubljana, Bohinj, Ankaran, Graz, Dublin, Copenhagen
	The method of thematic meetings.		Ljubljana
	The inclusive method of preparation of environmental acceptability approval.		Ljubljana, Novo Mesto, Bohinj, Ankaran, Graz, Dublin, Copenhagen
VI Monitoring	The regular municipal monitoring methods.	After a LUP adoption.	Ljubljana, Novo Mesto, Copenhagen, Graz
	Case by case monitoring methods.		All cases
	Public monitoring methods used for next LUPs.		Graz

and shorten the timeline. Without systematic identification, stakeholders may have differing views, lengthening the process and reducing transparency and efficiency.

– The strategic thinking method of identifying alternatives with planning and environmental experts helps to develop alternatives and identify the real challenges of the SEA that require a qualified, independent expert.

II – The SEA report preparation methods – Five methods for the preparation of the environmental report were identified in the SEA report phase:

– The literature review method, which helps to identify environmental problems and the method of internal interdisciplinary teamwork are two basic approaches used in all cases.

– The interdisciplinary teamwork of different experts, including local experts, is a key factor for a methodological efficiency. The simultaneous application of both methods represents an efficient approach.

– The survey method proves to be particularly useful and effective for complex new land uses, such as the assessment of new location alternatives for large energy or transportation infrastructure.

– The external consultation workshop method is an advanced approach that facilitates the identification of environmental issues and the alignment and focussing of indicators. This method is inclusive and highly efficient, albeit time-consuming, and it increases the legitimacy of the results.

– The method of external independent scientific review / quality assurance and consultation of the process is innovative and leads to better, scientifically validated results. Although it has only been used in one case, it has the potential to be combined with the four methods above mentioned when dealing with complex LUPs.

III – Methods for consultations with ministries and public organizations responsible for specific environmental issues – The three most effective consultation methods with ministries and organizations are written consultations, on-site consultations, and workshops. Written consultations were used in all 10 SEA cases, as they are the basic method that ensures legitimacy. On-site consultations and thematic workshops were used in 8 cases and make the process more efficient, especially for complex SEAs. These methods help to focus on key issues and avoid critical decision factors by addressing problems directly on site and through group discussions.

IV – Public consultation methods – There are six very efficient methods:

– The first and most basic is written public consultation, where LUPs are published online, and a clear time is given for comments. It has been effective in all cases where the online publication is known to the public and the practise is encouraged and easy to evaluate as well as transparent and published on a SEA website describing the whole process.

– The method of site-by-site presentations and public consultations is another method that was used in all cases.

– The method of thematic focus meetings, which was used in 6 cases, helps to introduce new or challenging land use to the public, and is therefore an extension of the first two methods.

– The method of location workshops and the method of walking tours were used in half of the cases where there were numerous alternatives or ideas, mostly for settlement areas and their organisation.

– The combination of all five SEA methods is the most efficient and helps to make the LUPs more democratic and acceptable.

– The method of interdisciplinary review of comments was used in all cases. A written statement of how the comments were considered was prepared and published. The authorities have taken note of the comments as far as possible. The response to the comments was written and published in all cases. In 1 case, the responses were also sent to the persons concerned.

V – Decision-making and the final decision on environmental impacts – The inclusive method of preparing the environmental acceptability assessment, which considers all comments from steps III, IV, V, is recommended to maintain transparency and legitimacy. It is crucial to actively review all written comments, address them professionally, and carefully consider each one. If contradictory points arise, they should be confronted and clarified with a more detailed approach. In such cases, thematic meetings or round tables are effective methods to resolve differences and ensure a thorough discussion.

VI – Monitoring methods – In all cases, the SEA reports included monitoring methods, although some focussed only on the monitoring of mitigation measures. Overall, the monitoring methods were weak and not fully integrated, except in one case. There are no publicly available monitoring reports. The SEA monitoring of a LUP should be conducted over a five-year implementation period, an area requiring further research and development. Regular municipal monitoring methods were only used in 4 cases, published in 3 cases, and provide a good basis for ongoing planning and future SEAs.

Conclusion

The evaluation of the criteria related to the methods used in the SEA steps for the ten European LUPs proves the overall effectiveness of SEA in terms of management, organisation of interdisciplinary teams for the preparation of LUPs and SEAs, process solutions and sustainable orientation of city planning authorities. However, there are some weaknesses in dealing with climate change and flooding, which need to be further analysed.

The 50 evaluation indicators cover all aspects, from methodology to process and management, and are recommended for the evaluations of SEAs for LUPs. The methods used in the 10 SEAs are categorical and differ significantly from the observed examples of good practise but remain within the framework of the SEA Directive. There are four areas where the differentiation of methods is the greatest: a) Scoping, b) Public participation, c) Mitigation measures, d) Monitoring.

To improve SEA, it is recommended to strengthen existing laws and regulations, improve participatory methods, explore new digital tools, conduct more research on SEA effectiveness, particularly its impact on decision-making, and encourage innovative sustainability practises.

Recognising that no general conclusions can yet be drawn, we she proceed with an in-depth study based on a questionnaire survey and in-depth interviews with experts from different European countries to further explore the possibility of developing an optimal model for the SEA of LUPs.

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Source of illustration and tables

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