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## **Technology and ecology: A comparative analysis of computer-aided tools supporting environmental impact assessments of construction projects in Poland and the Czech Republic**

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**Abstract:** The aim of the article is to compare selected tools supporting environmental impact assessments of construction projects in Poland and in the Czech Republic. Key functionalities of these tools were analyzed to help understand both similarities and differences in the two countries' approaches to developing solutions that comply with the legal requirements while also supporting investors in preparing environmental documentation. Recommendations for improvement were also included in the article.

**Keywords:** environmental impact assessment (EIA), computer-aided tool, construction project, Poland, Czech Republic, comparative analysis

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### **Introduction**

Computer-aided tools are software or IT systems designed to support users in performing various tasks, processes, or analyses. Their primary aim is to increase the efficiency, precision, and speed of these activities, which would otherwise require more manual effort or time. This article presents a comparative analysis of computer-aided tools for environmental impact assessments (EIAs) in Poland and the Czech Republic. The choice of the Czech system for comparison was justified because the Czech Republic, like Poland, is a member of the European Union,

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so the foundations of the adopted solutions should be the same. Despite similarities, differences can also occur, and the comparative analysis allows for the identification of better solutions and the formulation of potential improvements. Numerous studies have addressed the effectiveness of traditional tools to support the conduct of environmental impact assessments (EIA) (Forsberg & Malmberg, 2004; Gałaś & Bohatkiewicz, 2014; Haapio & Viitaniemi, 2008; Harasymiuk et al., 2019; Harasymiuk & Szafranko, 2022; Nowak, 2012; Tokarczyk-Dorociak et al., 2018). This is not surprising because for many years, EIA has been a mandatory element of investment procedures for construction projects that may significantly impact the environment. However, in the era of the digitalization of administrative procedures, digital tools supporting the preparation of the EIA processes are gaining importance. However, this issue is poorly described in the research (Harasymiuk et al., 2025; Poch et al., 2004). According to (Michalik & Zwirowicz-Rutkowska, 2023; Młodkowski & Jankowski, 2024; Ogryzek et al., 2020; Zwirowicz-Rutkowska & Michalik, 2016) portals available in Poland, such as Ekoportal, provide a central access point available that provides information about the environment and its protection and can support the preparation of local spatial development plans. However, (Dudzińska & Kocur-Bera, 2014) explains that the large number of environmental registers and databases and the poor interconnection between them result in duplicate data and are not used by more than one entity. The usefulness of each tool should be assessed in the context of the key features expected not only by administrative bodies but also by other key stakeholders involved in EIA processes.

The aim of the article is to assess the functionality of computer-aided EIA tools from the investor's perspective in the context of preparing construction projects.

## 1. Materials and methods

The article analyses the functionality of selected computer-aided EIA tools for construction projects in Poland and the Czech Republic. The research began with a review of the relevant literature and an analysis of source materials and information. The comparative analysis of the tools was conducted in four stages:

1. Tool selection – based on the criterion of compliance with legal requirements for ensuring public access to environmental information, three tools were selected for further analysis (Ekoportal, the Polish Environmental Impact Assessment Database and the Czech Environmental Information Database).
2. Identification of assessment criteria – a set of uniform, both general and specific criteria was established.
3. Tool evaluation – each computer-aided tool was evaluated against the established criteria.
4. Results analysis and conclusions – the results were summarized in tabular form and then interpreted for their usefulness in the context of practical applications.

## 2. Results

Modern computer-aided EIA tools for construction projects should be a key element in implementing sustainable development policies, as they facilitate informed decision-making, ensure regulatory compliance, and promote transparency and stakeholder engagement throughout the project lifecycle. Their role is particularly important in European Union member states, where a uniform legal framework stemming from the EIA Directive applies, but implementation may vary depending on national circumstances. This article presents an assessment of the functionality of such tools used in Poland and the Czech Republic – countries with well-developed environmental protection legal systems but diverse administrative structures.

Ekoportals is a nationwide online platform administered by the General Director for Environmental Protection. It was intended to integrate all levels of public administration and ministerial institutions, who were obligated to publish their administrative decisions and documents concerning the environment and its protection on this platform. By implementing it, the public was expected to gain easy access to necessary information, investors would learn about their obligations and how to fulfill them, and officials would be able to find the best legal solutions. Experience has shown that the platform's operation only partially achieves these ambitious goals (Ekoportals has limited integration functionality and does not cover all levels of administration or all types of projects). Ekoportals can be considered as an information tool for investors during the investment planning and documentation preparation phases. It enables obtaining information on procedural requirements, reviewing basic data on documents related to other projects (e.g., KIP), and monitoring the status of their own proceedings. It has a non-standard yet simple interface. However, it does not provide investors with direct access to data editing, as it does not serve as a platform for submitting applications or documents (this task is the responsibility of local systems operating within administrative bodies conducting specific administrative proceedings, such as those related to issuing decisions on environmental conditions). Under Polish law, the body conducting an EIA (e.g., the Regional Directorate for Environmental Protection, commune head, mayor, city president) must publish documents related to the procedure in its public information bulletin (PIB). As scattered PIBs are difficult for investors and citizens to search, and because there is a need to report to the European Commission on the number and type of EIAs conducted, another national tool operates in parallel with Ekoportals.

The Polish Environmental Impact Assessment Database (PEIAD) is a nationwide online platform managed by the General Director for Environmental Protection. Its primary function is to aggregate metadata from across Poland and enable centralized searches for information on EIA processes. The PEIAD supports monitoring and reporting in this area at both the national and EU levels. It features a uniform and simple interface and allows construction projects to be searched by authority, date, and document type. The analyzed solution lacks integration with other tools, such as GIS. The database also does not provide access to full documents submitted by investors as part of the EIAs procedures for construction projects (Environmental

Information Cards (EICs), environmental reports, referring users to the PIB maintained by the relevant office).

The Czech Information System Environmental Impact Assessment (CISEIA) is the most comprehensive computer-aided tool among those analyzed. It functions as a central environmental information system administered by the Czech Ministry of the Environment, with the Czech Environmental Information Agency (CENIA) responsible for its maintenance and technical development. Its main advantages include: enabling public participation in environmental procedures, ensuring the transparency of investment processes, and supporting administrative bodies and investors in searching for historical and current data (Soukopová et al., 2015). From the investor's perspective, the CISEIA enables monitoring of procedural obligations and allows for the analysis of previously issued EIA decisions for similar projects (data can be filtered by region, project type, procedural stage, and many others). The scope of information in the CISEIA is broader than in Polish solutions. It collects, archives and publicly makes available data on: projects implemented in the territory of the Czech Republic (including large projects requiring mandatory EIA and smaller projects subject to screening), projects implemented outside the Czech Republic and at the same time demonstrating a possible cross-border impact (e.g. wind farms in Poland and Germany), sub-threshold projects (below the thresholds from the annex to the Act, but potentially having a significant impact on the environment) and projects that may affect Natura 2000 areas. Other key data include, among others: current legal acts, methodological guidelines, lists of experts authorized to prepare environmental reports or reports on the impact of the projects on Natura 2000 sites. However, the requirement that only certified environmental experts may prepare or review such documentation has been criticized for limiting competition and transparency in the EIA process (Braniš, 1994).

### 3. Discussion

The absence of references in current research concerning the functionality of computer-aided tools supporting EIAs has created a significant knowledge gap that this publication seeks to address. The functionality of such tools determines the real support for investment processes. Without verifying this feature, it is difficult to discuss the viability of their implementation and improvement. The usefulness of the analyzed digital tools from the investor's perspective was assessed in two dimensions: formal and substantive. The formal assessment included two criteria: I.FA-A – Compliance with regulations and I.FA-B – Primary implementation aim. The substantive assessment encompassed seven criteria (from II.SA-A to II.SA-H), namely: ease of searching, user interface, document accessibility, information currency, language and comprehensibility, filtering capabilities and integration with other tools. The results of the assessment are presented in Table 1. Among the criteria analyzed, the following are particularly noteworthy: II.SA-D – Document Validity, II.SA-F – Data Filtering Capability, and II.SA-G – Integration with Tools Supporting Building Procedures.

**Table 1.** An investor-oriented evaluation of digital tools supporting EIA of construction projects in Poland and in the Czech Republic (*own research*)

Type of tool and criteria for its functionality	Ekoportál	PEIAD	CISEIA
I. Formal assessment (FA)			
I.FA-A Compliance with formal regulation	It is partially compliant with EU Directive 2011/92/EU because the obligation of transparency and making documents available is only partially implemented. It does not support public participation.	It is partially compliant with EU Directive 2011/92/EU, as it facilitates access to information about the existence of ongoing EIA proceedings. However, it does not publish the full text of key documents providing only metadata. Moreover, it lacks functionalities for public participation, including the absence of a consultation mechanism and the ability to submit comments.	It is compliant with EU Directive 2011/92/EU.
I.FA-B Primary implementation aim	Ensuring public access to EIA documents to fulfill transparency obligations.	Maintaining a central register of EIA proceedings nationwide. Providing metadata access for both authorities and the public.	Comprehensive support for the entire EIA processes, including document access, public consultations, and case management for all stakeholders. Ensuring transparency.
II. Substantive assessment (SA)			
II.SA-A Ease of searching	Access to the platform is possible via the website, which is administered by the General Director for Environmental Protection. It does not require registration.	Access to the database is possible via the website, which is administered by the General Director for Environmental Protection. Direct access is available via the "Handle the Matter" section, which is of limited intuitiveness. It does not require registration. The login function visible on the website is for administrative purposes only, which may be misleading to the investor.	Access to the database is possible via the website of CENIA in the "EIA" section. Registration is not required either to view metadata or to download documents (e.g. EIA reports, opinions, decisions).
II.SA-B User interface	Acceptable. It's largely form-based. A form is provided, where the investor enters his Project Information Card (PIC) search criteria, as well as a form with a list of found cards. If the search criteria are empty, the list presents all of them, starting with the newest ones.	Acceptable. The formal and tabular appearance is preserved.	Satisfactory. Searching many types of projects is possible: such as national, cross-border, with a potential impact on Natura 2000 sites and sub-threshold ones. Easy searching by location of a project, investor, and document type. A clear results structure is maintained.

II.SA-C Document accessibility	Unsatisfactory. The full text of PIC/report may require contacting the appropriate administrative body. As of July 1, 2025, the Ecoportal is no longer a place where metadata about environmental documents is published. The relevant administrative bodies will have to publish such information independently in their own Public Information Bulletins (BIP) or other IT systems.	Insufficient. Direct searches for the PIC are not supported; however, the land property can be identified, along with its spatial and environmental characteristics, which constitute the basis for preparation of the PIC.	Satisfactory. Public access to documents is provided, including reports, graphic attachments, opinions, decisions, and even historical data on EIA proceedings.
II.SA-D Information currency	Data is updated, but the pace and regularity of updates depends on the authorities conducting the proceedings.	Data is updated.	Information about ongoing and completed EIA processes and accompanying documents is current.
II.SA-E Language and comprehensibility	The official language is used. Environmental documentation is in Polish (if provided). No multilingual support.	The official language is used. Multilingual support is not provided.	Operation is available in English and Czech. The structure and accessibility are good. The documentation is in Czech.
II.SA-F Filtering capabilities	Insufficient. Basic filtering options are retained (e.g., by document type, voivodeship name, publication date). Filtering by procedure status (initiated, completed), investor, or document author is not possible. Advanced multi-field filtering and data export to a document are missing.	Also insufficient. Users have more advanced filters, but still limited to predefined search fields. Filtering by section "report" can be confusing for investor – instead of individual environmental reports, investors may receive general, aggregated summaries of varying nature.	Satisfactory. Searching is possible by: project type, procedure status (e.g., submitted, in consultation, completed), impact category, document type (KIP, report, decision), region/location (country, district), documentation author (expert), transboundary impact (YES/NO), and date of procedure initiation and completion. Data export (e.g., results list to a CSV file) is possible. Advanced, multi-field information search type.
II.SA-G Integration with tools supporting building procedures	Insufficient. Lack of integration with the e-Construction platform.	Lack of integration with the e-Construction platform.	Sufficient. It provides a public API enabling automatic download of environmental decision data (for local offices).

Document validity is crucial because investors must base their decisions on reliable data. The ability to filter data directly affects the efficiency of investment planning and the duration of administrative decision-making processes. Integration with building procedure tools enables seamless data transfer, reduces formal barriers, and shortens the time of administrative procedures. The Czech EIA database demonstrates an advantage in both of these criteria, ensuring more systematic documentation

updates and better connection with the online construction application submission tool. Unlike Polish solutions, this allows investors and officials to manage the entire investment cycle more efficiently and consistently, reducing the risk of data inconsistencies and contributing to increased transparency of the investment process.

## Conclusions

Both Poland and the Czech Republic are countries with well-developed legal systems for environmental protection, which have various digital tools supporting the EIA processes for construction projects. The adequacy of these tools should be assessed by all key participants of these processes, with particular emphasis on the investor, who, as a non-expert in this field of knowledge, has the right to expect support in preparing appropriate environmental documentation.

The conducted comparative analysis demonstrated the superiority of the Czech solution over the Polish ones in formal and substantive dimensions.

The parallel operation of the Ecoportal and the Polish Environmental Impact Assessment database may be a source of confusion for investors, especially those with less experience. It is important to understand that the Ecoportal is solely a publication register. It does not replace formal communication with the office and does not relieve the investor of the obligation to submit an application for a decision on environmental conditions for the construction project in the required form. Additionally, the discontinuation of publishing metadata on environmental documents in the Ecoportal is associated with the dispersion of such data and may hinder their comparability and accessibility at the national level. From a utility perspective, clear public communication regarding the functions and limitations of these tools would be advisable.

Both the Polish and the Czech systems demonstrate a need for greater integration with building procedures.

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