

# Peat Resource Management and Climate Change Mitigation issues. Case of Latvia.

**Anita TITOVA**

Faculty of Engineering Economics and Management, Riga Technical University  
Riga, LV-1048, Latvia

**Natalja LACE**

Faculty of Engineering Economics and Management, Riga Technical University  
Riga, LV-1048, Latvia

## ABSTRACT

Untouched peatlands serve two important functions: they are significant carbon reservoirs and biodiversity hotspots. Despite their ecological importance, the commercial use of peat is essential for many countries, including Latvia. This study aims to 1) identify the factors that influence the effective and environmentally friendly utilization of peat resources and 2) assess how these factors are integrated into national policy frameworks in Latvia.

Using a mixed-methods approach, the research begins with a qualitative content analysis of scientific literature, identifying nine key factors that impact peatland utilization: climate impact, legislation, incentives, dependency on peatland use, infrastructure, land ownership, local traditions, education, and research. Following this, an analysis of Latvian policy documents reveals a commitment to sustainable peatland management, including a phased ban on peat as an energy source by 2030. However, the findings indicate that while the factors are recognized, the mechanisms for optimizing their influence are partly unclear. This study highlights the need for further research to improve the effectiveness of peatland and peat utilization, especially at the firm (involved in excavating and processing peat) level.

**Keywords:** Peat, Effectiveness, Sustainability, Business Dynamics, Policy

## 1. INTRODUCTION

Peatlands are very essential world ecosystems that have two main functions [1]. One is serving as a global carbon tank. Another is – preserving biodiversity.

Peatlands exist in 90 percent of all countries [2]. North America and Asia have the largest share of them (32 and 33% respectively), Latin America and Caribbean – 13%, Europe – 12%, Afrika 8% and Oceania – 2%. Fauna and condition of peatlands (exist in the mountains, in lowlands, along rivers and at the coast) vary from one climate zone

to another, but their unique ecosystem principles are the same.

Besides the natural benefits for nature, they have economic benefits for regions where they are located. Peat is a mineral, which traditionally has been used as a fuel, fertilizer and medium in agriculture and horticulture. Also, peatland has been used for growing plants suitable for growing in peat areas [3].

Unfortunately, peat extraction and also rewetted peatlands after their harvesting contribute to significant carbon emissions. Also, as extraction involves clearing the vegetation on peatlands and draining the land, it leads to distraction of the fauna and flora, natural hydrological cycles and possible poisoning of the surrounding areas due to leaching of nutrients to the water [4].

Therefore, due to climate and biodiversity goals [5] countries and global and regional organizations around the world are trying to reshape the use of the peat in a more sustainable way. Different legislative acts, strategies and other political commitments have been released for that reason. The work in this direction is continued.

Different ideas exist on how to respond to the challenges posed by the peatland commercial use (impact on climate) and nonuse (impact on the economy of the regions). In countries, where peatland covers large area, and businesses in them finding sustainable ways to utilize peatland is paramount.

Peat is an important natural resource for Latvia. 1.5 billion tons of peat are available in Latvian peat deposits, which is 0.4% of the world's peat resources [6]. Latvia is the 7th largest country in terms of the proportion of peat bogs in the national territory. Latvian peat and peat products are in demand all over the world, they play an important role in European horticulture, providing 31% of professional horticulture requests. Latvian peat and peat products are used for growing vegetables, herbs, decorative plants, and trees. Peat industry companies are significant employers in rural areas of Latvia and also contribute to the development of related industries by utilizing their services.

There are a huge number of studies on the peatlands from an ecological and agricultural perspective. Still, the important stakeholders in the peatland management

system – companies working in the industry are very little studied. On opposite many studies from other industries show alternative, more effective and at the same time nature-friendly use of resources [7]. The effectiveness, optimisation the peat resources management [8], and ability to adapt to changing external conditions need more understanding, thus providing a better way for design of policy measures.

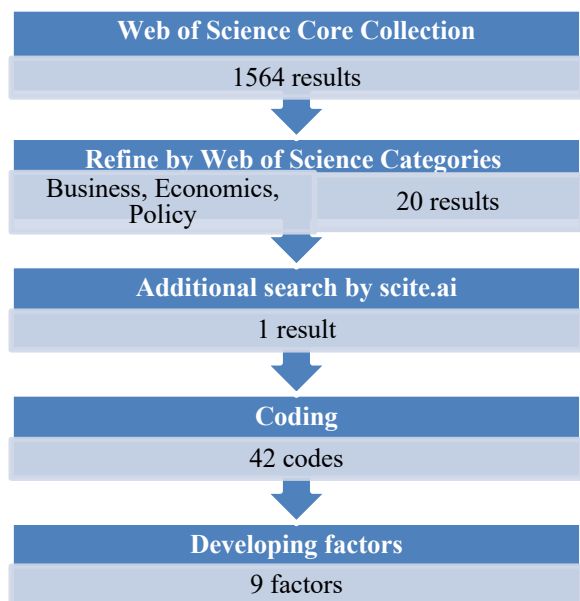
Therefore, it is very important to understand the factors impacting the effectiveness of peat use.

The aim of this article is to find factors impacting effectiveness of peatland use and check how these factors are taken into account in Latvia's policy documents.

The article is organized as follows: the next section describes the research design. The results of the study are presented in the third section. Section 4 outlines the main conclusions.

## 2. RESEARCH DESIGN

The mixed methods approach was used for this study. The first step was to determine the factors influencing how effectively peatland and peat itself are used. For that reason, a qualitative content analysis of the scientific articles was conducted. The process of qualitative content analysis visually is described in Figure 1.



**Figure 1** The process of qualitative content analysis (developed by the authors)

Web of Science was used to find appropriate studies. The search terms were: Peat AND sustainable utilization OR sustainable use OR sustainable management. The search tool identified 1564 articles. After refining the results by Science Categories (excluding studies related to environment, food and similar other nonbusiness, economics sciences) only 20 articles were left. These 20 articles are from Economics, Business, Agricultural

Economics policy, Management, Public Administration and Political Science studies.

Even though no publication year limit was used, no article was published before 2001. These articles were cited 263 times (without self-citations).

Additionally, one article was added after trying to find relevant articles with the help of scite.ai tool. The tool was used for additional search because it allows to search by science categories.

During qualitative content analysis of these 21 articles, 42 codes were identified. From the codes, 9 categories were developed.

The second step involved analysing Latvian state policy documents related to peat. This analysis focused on whether these policies considered the factors impacting the results of peat use, as identified through the preceding content analysis. The READ method, previously used to evaluate peat strategies in other European countries [9] was employed for the documents' analysis. As in the Nordbeck and Hogl study, the number of documents reviewed was small due to the specific focus on peat-related policy.

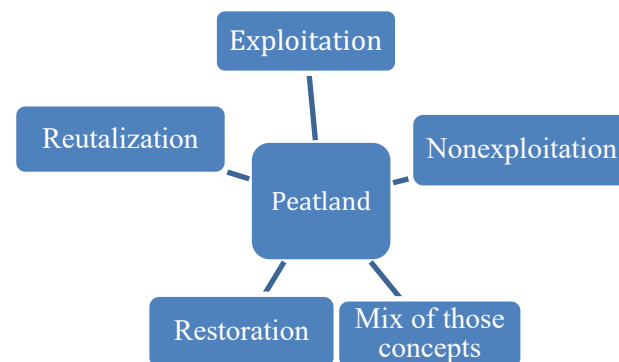
The study was conducted in December 2024 and January 2025.

## 3. RESEARCH RESULTS

### 3.1. The results of the qualitative content analysis of the literature

The research question for the qualitative content analysis was - What are the key challenges and opportunities for the effective utilization of peat resources?

During the process of the analysis besides the codes directly related to the research question the key concepts of how peatland can be used were found and summarized [10]. The concepts are listed in Figure 2 and explained below.



**Figure 2** The possibilities for the use of peatland (developed by the authors)

**1. Peatland exploitation.** This term refers to the utilization of previously non-harvested peatland for various purposes with activities changing its natural state.

These activities mostly include peat mining for use in energy production [11, 12, 13], as fertilizer in agriculture [14] and horticulture [15]. This also includes readjusting the previously unused peatland for agricultural needs (industrial plantation) [16]. The literature provides also other examples of how peat in previously unused peat territories is used. These activities, even if done carefully and with limits, to some degree have a negative effect on the environment.

**2. Peatland nonexploitation.** This term refers to allowing the peatland to stay in its natural state and avoiding purposeful activities which change the peatland's ecosystem [16]. Still, this concept includes such activities as using peatland for activities not changing the ecosystem. Such as different kinds of tourism [17], non-industrial fishing, grazing and hunting [18]. Such approach supports the conservation of peatland ecosystems and doesn't lead to carbon sequestration and biodiversity loss as a result of the activities on the peatland.

**3. Peatland Reutilization.** This term refers to repurposing previously harvested peatlands for other economic activities. It could be the cultivation of biomass [17] or farming on rewetted peatlands [19], growing trees [20]. It also could be the extraction of peat from degraded (previously harvested) areas, where only black peat (with lower quality than white peat) is available [15].

**4. Restoration of Peatland.** Restoration refers to the process of restoring previously harvested peatlands to prevent further damage to the ecosystem due to water table changes, lost biodiversity, potential pollution and carbon emission. This primarily involves trying to restore the water table to its natural level, blocking drainage ditches and rewetting it [17]. Also, it could involve activities to restore the native biodiversity of peatlands [15].

**5. Mix of the concepts.** This term refers to the simultaneous use of different strategies regarding the peatland. Conserving some parts of the peatland and using others [21]. For example, limiting peat extraction to areas that have already been harvested [20] and actively promoting reuse and rehabilitation of the harvested areas.

To answer the research question "What are the key challenges and opportunities for the effective utilization of peat resources?" nine categories were developed from the qualitative content analysis. Table 1 shows the factors.

**Table 1**

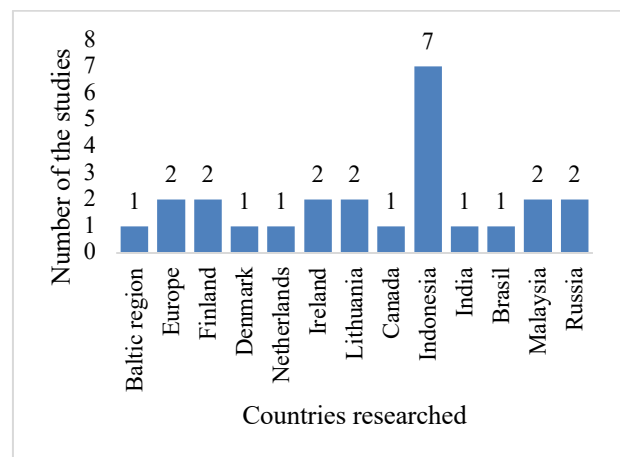
The factors impacting the ways how the peat resources are used.

| No | Categories                            |
|----|---------------------------------------|
| 1  | Impact on the climate                 |
| 2  | Legislation                           |
| 3  | Incentives                            |
| 4  | Dependency on Peatland Utilization    |
| 5  | Infrastructure                        |
| 6  | Land Ownership and Rights on the peat |

|   |                  |
|---|------------------|
| 7 | Local traditions |
| 8 | Education        |
| 9 | Research         |

The analysis did not reveal differences between the significance of the factors in countries covered by the articles selected for the analysis. Still, it is important to highlight that the articles researched cover only countries with significant peat resources or those whose economies are heavily reliant on peat availability (as in the case of the Netherlands). This finding is in line with Nordbeck and Hogi [22] who found that even peatland ecosystem is very important for the whole world, peatland strategies usually exist only in regions where peatlands are significant for local ecological and economic reasons.

Figure 3 shows the number of articles per researched countries in them.



**Figure 3** The number of articles per researched countries/regions in them.

The articles that examine a broader region rather than a specific country were counted separately in the column for that region. Additionally, if the article included a specific analysis of a country, it was also added to the total number of articles for that country. For example, an article focused on the Baltic region would be listed separately in the Baltic region column, but it would also contribute to the count of articles related to Lithuania as it had specific analysis about Lithuania.

Below are the explanations of the factors:

**1. Impact on the Climate.** This factor relates to any unwanted effects of peatland exploitation. It starts from releasing CO<sub>2</sub> [16], methane, the problems with water system disbalance and its effect on surrounding areas [23], minerals leaking out in the freshwater [24] and effects as loss of natural biodiversity [18].

**2. Legislation.** This factor relates to legislation which can significantly influence peatland management decisions [17]. It can restrict peat extraction or allow it only in certain areas or with certain conditions [13]. Not only local legislation can influence the use of peat, but also legislation in the countries where the peat is exported [16].

**3. Incentives.** This factor relates to any public incentives for impacting the decisions of peatland and peat owners on how to use peatland. It could be for example favorable taxation on the sustainable use of peatland and its products and increasing taxes for commercial energy production [25]. It could be compensations to land owners for the conservation of peatland [21] or using sustainable farming practices on the land [17]. Also, lack of incentives or inappropriately designed incentives [26] to use peatland sustainability belong to this factor. It could be also public support for developing civil society engagement and cooperation in the peatland management process [26] thus spreading the awareness of peat ecosystem issues and involving local society in developing the solutions. There could also be penalties for using unsustainable practices [27].

**4. Dependency on Peatland Utilization.** There is a broad discrepancy between countries regarding the availability of peat on their territories and the traditions of using it. For the countries and territories relying on peatland utilization for economic activities, it is complicated to limit the use of peat and/or convert it to more sustainable ones. Even countries using a substantial amount of exported peat products (such as the Netherlands) are sensible to any restrictions regarding the use of peat [28]. So, for such countries, the necessity of a balance between climate actions and other goals is very high [17]. Countries non-dependent on peat resources may be more willing to support peatland nonexploitation practices, especially in cases where they don't have an obligation to participate in funding the compensation process for peatland conservation or reverting to sustainable management.

**5. Infrastructure** The availability and quality of infrastructure, such as drainage systems, irrigation, transportation networks, existing production units, technique and access to markets impact peatland management decisions [26]. Adequate infrastructure is necessary for any of the peat-use strategies. It is important to admit that existing infrastructure's capabilities impact decisions in favor of some particular use of the peat. For example, the sustainable use of peat-burning products – ashes, is possible only if there are ash granulation units [13].

**6. Land Ownership and Rights on the Peat.** The peatland areas function as a cohesive mechanism, making it necessary to have the support of all landowners for successful restoration or reutilization measures [29]. Therefore small, fragmented ownership of peatland areas could be a problem [24] if owners' rights under certain conditions are not limited.

**7. Local Traditions.** This factor refers to all traditional activities on peatland and peat use in a particular area. For example, peat as alternative energy source in Finland is very common [25]. In the Netherlands, peat and its substrates are used as growing media for horticulture [28]. In Indonesia and Malaysia pineapple, citronella plants and shallots [26, 30] are planted on peat soil. In Malaysia, farmers of pineapple are practicing the residue burning method, burning the pineapple residue at the end of the

planting cycles before they begin another cycle [27]. The traditional knowledge of a community could conflict with sustainable practices for peat use.

**8. Education.** This factor refers to the knowledge of local people and owners of the land about peatland significance, different practices to use it, alternatives and innovations in this sphere, management tools, appropriate machinery and sustainable approaches. This factor also refers to the capability to use this knowledge. This factor also includes all activities to raise local awareness, knowledge and capability to implement above mentioned [26].

**9. Research.** This factor refers to all research regarding peat. This includes studies from ecological, economic, management and social perspectives. The aim is to understand peat ecosystem better, develop new more sustainable peat management practices [28] and new alternative ways for sustainable peat use [30], analyse public policy impacting the peatland strategies and develop best practice guidelines.

### 3.2. The current state of the peat industry in Latvia

Peat deposits in Latvia occupy about 10% - 15% of the country's area or about 6782 km<sup>2</sup> to 9700 km<sup>2</sup>. These figures are approximate due to discrepancies in data from various sources. The lack of a comprehensive inventory and monitoring of these resources over the past few decades contributes to this uncertainty. The last extensive inventory of peat areas was conducted between 1978 and 1997 [6].

Most peat mining sites in Latvia are owned by the government (55%) or municipalities (16%) [31]. Therefore, most of the peat extraction companies work on the territories which they rent from the public entities.

It is acknowledged that the resource is important for the development of the country, and the economic potential of it is not fully utilized [6].

#### 3.2.1. The Peat industry in Latvia

A total of eighty-three companies in Latvia are engaged in the peat industry. These companies vary significantly in size, legal structure, revenue, and profitability levels. The characteristics of companies in the peat industry (NACE 08.92) are summarized in Table 2.

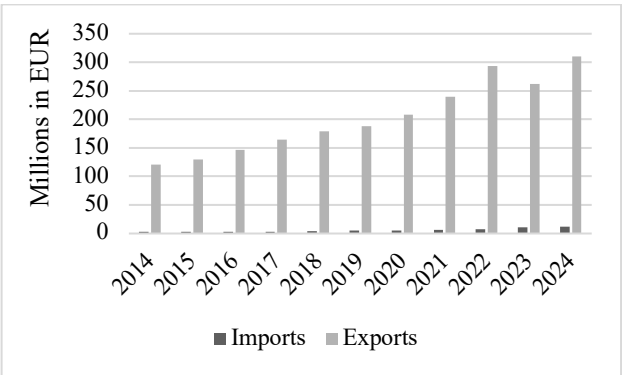
**Table 2**

The companies in Latvia in the Peat industry  
(developed by the authors from Lursoft.lv data)

| Characteristics   | Companies  |
|---|--|
| Size<br>(as per Article 2 of Annex I of Commission Regulation No. 651/2014) | One large company, others - medium, small and micro companies.   |
| Legal forms   | Joint Stock Companies - 4, Limited liability companies - 57, Individual Merchants - 20, farm enterprises - 2 |

|   |  |
|---|--|
| The dynamics of revenue and profitability (2021-2023) | Most of companies have profit. Revenue and profitability levels on average have not significantly changed over the period. Still, the revenue and profitability levels between the companies differ substantially. |
| Owners' characteristics                               | Most of the companies (large and middle) have foreigners between the owners.   |

The majority of peat and its products are exported. Over the last decade, the value of peat and its exported products has more than doubled in euros. Interestingly, there is also an import of peat products into Latvia. Over the past 10 years, imports have accounted for an average of 2.7% of the export value. However, in 2023 and 2024 (up until November), imports increased by 4.2% and 3.8%, respectively. Figure 4 provides data on the yearly export and import values.



**Figure 4 The export value of peat** (developed by the authors from CSB.lv data)

Peat is exported to numerous countries. According to CSB.lv data for January to November 2024, the main export partners were as follows: China (19,51 %), Germany (11,09%), Italy (9,15%), Saudi Arabia (5,01%), Netherlands (4,8%), Poland (4,42 %), Belgium (3,61%), USA (3,57%), South Korea (3,3 %), Spain (3,25 %).

### 3.2.2. Peat utilization concepts and factors in Latvia

To examine Latvia's policies regarding peatland use, we reviewed the main policy document "Guidelines for the sustainable use of peat" [6] and related documents. These documents outline the commitments of the Latvian government for the period from 2020 to 2030.

According to these documents, the government plans to adopt a mixed strategy for peatland utilization. This strategy includes allowing continued peatland exploitation, taking measures to restore degraded peatland areas, and promoting reutilization activities. However, there are a lot of unsolved questions how the restoration of specific sites will be carried out.

To encourage a more sustainable approach towards peatland use, starting in 2030, the use of peat as an energy source for commercial processes will be prohibited.

The analysis describes how various factors influencing the effectiveness of peat utilization have been considered in Latvian government policy.

**1. Impact on the Climate.** The exploitation of peat can have harmful effects on the climate, and this is clearly recognized, along with the need for reutilization strategies and the restoration of degraded areas. Several potential approaches to decrease greenhouse gas emissions and preserve biodiversity are outlined, along with necessary actions to be taken. To mitigate these harmful effects, research is encouraged on innovative solutions for peat extraction, processing, and alternative uses, as well as on accounting for greenhouse gas emissions. Additionally, the law stipulates that the use of peat as a commercial energy source will be prohibited starting in 2030.

**2. Legislation.** The impact of legislation on peatland use is acknowledged. A pressing issue is the need to address the monitoring and mapping of peat resources. To achieve this, the consent of all peatland owners, including private individuals, is necessary. Therefore, it is necessary to improve the regulatory framework to enable the state to conduct geological mapping on areas owned by private individuals.

**3. Incentives.** The need to promote more sustainable practices regarding peat is acknowledged in the documents. However, the authors found only a few programs that provide actual support for these activities. Particularly, there is support from EU Cohesion Policy funds for the following initiatives: i) obtaining and analyzing data on historical peat mining sites and the use of peat in energy within municipalities; ii) creating a research platform to develop research capacity and competencies focused on the sustainable use of natural resources, including peat; and iii) renaturalizing historical peat extraction sites in specially protected natural areas. Additionally, the Natural Resources Tax Law has been amended to increase the tax on peat extraction and to eliminate the exemption for CO<sub>2</sub> emissions related to the use of peat in stationary technological equipment.

**4. Dependency on Peatland Utilization.** The peat resource is recognized as vital for the economy of Latvia. Since it is found in all regions of the country, it offers opportunities for balanced regional development. Companies in the peat industry are significant employers in rural areas. Additionally, peat extraction and processing support the growth of related industries by utilizing their services, such as logistics, fuel trade, packaging production, electricity generation, insurance, banking and accounting services, construction services, machinery repair, and geological exploration. Therefore, the policy aims to continue utilizing peat resources while striving to balance economic benefits with climate challenges.

**5. Infrastructure.** Infrastructure is recognized as crucial for the sustainable use of peat. Modernizing peat extraction technologies and processes is identified as an activity that should receive support. Interestingly, Latvian policy papers indicate that general infrastructure—such as roads—is maintained and developed not solely for the

peat industry, but as a result of the peat industry's positive impact on regional development, benefiting other related industries.

**6. Land Ownership and Rights on the Peat.** It is acknowledged that land ownership and rights associated with peat significantly impact the sustainable use of peat resources. In Latvia, the rights to the depths of the earth, including peat, belong to the landowners. This situation presents challenges for conducting nationwide geological mapping and research within the peat industry. Such mapping and research are essential for gathering comprehensive data about peat resources, which is necessary for making informed decisions. Additionally, the fragmentation of property within individual peat areas creates further obstacles for developing common strategies and deciding on the ways to utilize the peatland.

**7. Local Traditions.** The use of peat as a fuel has a long history in Latvia, dating back to the 17th century when it was first used for heating. However, by the end of the last century, major heating suppliers in Latvia ceased using peat. As a result, in the current century, peat for heating is utilized only in minimal amounts. Most of the peat extracted today is exported in the form of peat substrates, fractionated prepackaged peat for horticulture, and peat crumb.

**8. Education.** The guidelines acknowledge that education and management practices significantly influence peat usage. It has been noted that since the latter half of the last century, there has been a lack of training for specialists in the peat industry in Latvia, which is regarded as a pressing issue. It is also essential to train specialists in various relevant fields, including research, development, peat processing, and the recultivation of bogs and peat deposits. As key areas of expertise are listed hydrology and ecology, hydrogeology, land reclamation, and environmental management. To enhance local employment opportunities and improve socio-economic conditions in regions dependent on the peat industry, training in sustainable peat extraction technologies and innovative production methods for high-value-added products is essential also for locals.

**9. Research.** The guidelines acknowledge the potential of the research. They emphasize the need for studies focused on new, modern methods of peat processing, the development of innovative peat products with higher added value, and the efficient use and management of peatlands. Additionally, geological research concerning peatland mapping and its current status is deemed essential. However, there is no mention of studies that assess effectiveness at the firm level in the peatland industry.

In summary, all factors identified in the content analysis are acknowledged in Latvia's policy documents as significant, and the country has expressed its commitment to address them.

## 4. CONCLUSIONS

This study explored the factors that influence the effective utilization of peat resources and their integration into Latvia's policy framework. Through qualitative content analysis of scientific literature, nine key factors impacting the effective use of peat resources were identified: climate impact, legislation, incentives, dependency on peatland utilization, infrastructure, land ownership and rights related to peat, local traditions, education, and research.

The study confirms that many countries, particularly those with significant peat resources, strive to balance economic interests with environmental responsibilities. Latvia is following this trend by integrating various peatland use strategies, including controlled exploitation, reutilization, and restoration. The decision to phase out peat as an energy source by 2030 demonstrates Latvia's commitment to environmental sustainability; however, the economic dependency on peatland utilization necessitates careful transitional strategies.

The analysis of Latvia's policy documents concerning peatland use confirmed that all factors identified in the content analysis are recognized as significant. However, how to maximize the beneficial influence of the factors remains largely unclear. Additionally, no strong incentives were identified in the document analysis for companies in the industry to enhance their efficiency. No firm-level research was recommended to achieve better peat utilization. These findings lay the groundwork for further studies on the development of the peatland industry in pursuit of climate goals.

The authors acknowledge limitations in their results due to the chosen research approach, as document analysis is based on existing materials that may not fully capture the dynamic nature of the issues being studied [32].

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