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Online job portals as a tool for reducing information asymmetry in the labour market

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Abstract

Motivation: Information asymmetry remains a key cause of labour market inefficiency, raising search costs and degrading match quality. Online job portals have emerged as dominant intermediaries; yet platform proliferation and uneven data quality may simultaneously reduce asymmetry and generate new forms of it. In Belarus, this is compounded by 2025 regulatory changes requiring employers to prioritize the State Employment Service portal (gsz.gov.by), reshaping information flows.

Aim: This study assesses the role of online job portals in creating informational conditions conducive to reducing information asymmetry in Belarus by examining the trade-off between market coverage and data quality. It also evaluates the impact of 2025 legislative changes on vacancy content across portals and aggregators.

Results: Analysis of 2018–2025 data reveals a trend toward centralisation: vacancies on gsz.gov.by grew 2.5-fold, while the CV database expanded 6.5-fold. Content analysis of 300 vacancies shows substantial differences in skills data quality: rabota.by leads with 61% structured skills fields; gsz.gov.by records 8% with 100% classifier compliance; belmeta.com shows 0% structured fields. The 2025 reforms have driven retransmission of vacancies from the state portal to commercial platforms – 65% of rabota.by vacancies now link to gsz.gov.by – broadening coverage but risking the propagation of low-information descriptions. The study concludes that an integrated model is needed, combining the state portal's breadth with the higher data structuring standards of commercial platforms.

Keywords: information asymmetry, labour market, online job portals, Belarus

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1. Introduction

Information asymmetry is one of the central obstacles to efficient labour market functioning. Employers lack complete information about candidates' qualifications, skills, and motivations, while job seekers have limited visibility into working conditions, organisational culture, and career prospects. This bilateral asymmetry drives inefficient labour allocation, higher search and recruitment costs, elevated structural unemployment, wage distortions, and related adverse outcomes (Cardoso et al., 2015; Dato et al., 2016; Bar-Isaac et al., 2021; Golan, 2005).

Traditional labour market intermediaries – public employment services, staffing agencies, and print media – have historically mitigated asymmetry, but face serious constraints in the digital era: high transaction costs, limited geographic reach, slow information updating, and insufficient granularity of vacancy and candidate data.

Over the past two decades, online job portals have radically transformed labour market mechanisms. Digital platforms provide instant access to thousands of vacancies and CVs, reduce search costs on both sides of the market, enable sophisticated matching algorithms, and support real-time labour market monitoring. In Belarus, as in many other countries, online portals have become the dominant channel connecting employers and job seekers, largely displacing traditional institutions.

According to Cedefop (2019a), online job portals perform a critical transparency and signalling function: they reduce transaction costs, accelerate market clearing, and lower frictional unemployment through rapid information flows. In European practice, they are increasingly treated as sources of real-time labour market intelligence that complement traditional statistical methods.

Yet digitalisation also creates new challenges. The proliferation of portals with varying business models and data quality standards risks fragmenting the information space and generating new asymmetries. Existing research has several notable limitations. Most studies focus on developed countries with mature digital ecosystems (Carnevale et al., 2014; Cedefop, 2019a; Kureková et al., 2015; Napierala, 2023), leaving transition economies understudied. Research also tends to examine isolated aspects of portal functioning (Cedefop, 2019b) rather than offering a comprehensive framework for assessing their role in reducing asymmetry. Methodological approaches to comparing data quality across different portal types remain underdeveloped.

These gaps are particularly consequential for Belarus. Prior studies of the Belarusian online portal market (Vankevich & Zaitseva, 2020; Zaitseva, 2025) assessed leading portals by volume and information quality and developed a methodology for extracting and structuring vacancy data according to national classifiers (Vankevich & Kalinouskaya, 2021). However, none examined online portals through the lens of information asymmetry theory. The issue has gained urgency with the 2025 legislative changes: amendments to Belarus's employment law now require employers to publish vacancies on gsz.gov.by as a first priority before using other recruitment channels, fundamentally altering the architecture of labour market information exchange.

No study has yet systematically compared the effectiveness of different portal types – commercial, state-run, and aggregator – in creating informational conditions conducive to reducing information asymmetry, or offered evidence-based recommendations for designing an optimal digital labour market infrastructure.

The primary objective of this study is to assess the role of online job portals in creating informational conditions conducive to reducing information asymmetry in the Belarusian labour market, by examining the balance between market coverage (vacancy volume) and data quality (skills structuring), and to evaluate the impact of the 2025 regulatory changes on the digital ecosystem's effectiveness.

To this end, the study addresses four research tasks:

1. Identify key trends in the development dynamics of Belarusian online job portals over 2018–2025, including concentration of information flows;
2. Compare skills data structuring across a state portal, a commercial portal, and an aggregator to assess information quality for labour market participants;
3. Evaluate the impact of the 2025 legislative changes on the content structure and data quality of commercial portals;
4. Develop recommendations for an integrated digital labour market ecosystem that balances coverage and data quality.

Research hypothesis: The capacity of online portals to create informational conditions conducive to reducing information asymmetry depends on the balance between market coverage and data quality. The state portal dominates in coverage but lags in information quality, necessitating integration of both models to optimise the digital labour market ecosystem.

The article proceeds as follows. Section 2 reviews the theoretical foundations of information asymmetry, the role of online portals as information intermediaries, methodological approaches to data quality assessment, and regulatory experience in EU and Central and Eastern European countries. Section 3 describes the research design and methods. Section 4 presents empirical results: online portal market dynamics (4.1), skills data structuring across three portal types (4.2), and the impact of the 2025 legislative changes (4.3). Section 5 offers conclusions, practical recommendations, and directions for future research.

2. Literature review

2.1. Theoretical foundations of information asymmetry in the labour market

The theoretical framework for information asymmetry was established by George Akerlof, Michael Spence, and Joseph Stiglitz. Akerlof (1970), in his seminal “market for lemons” article, showed how quality uncertainty can drive high-quality goods from the market. Applied to labour markets, this implies that without reliable signals of candidate quality, employers offer average wages – demotivating highly skilled workers. Spence (1973) extended this insight with signalling theory: job seekers use education and credentials as observable proxies for productivity. Stiglitz (1975) complemented this with screening theory, showing how employers design mechanisms to elicit true candidate quality. Together, these contributions established a conceptual framework for understanding how agents attempt to overcome information asymmetry – while demonstrating that such mechanisms carry significant social costs.

Search theory developed in parallel, originating with Stigler’s (1961) foundational work on the economics of information. Diamond, Mortensen, and Pissarides subsequently developed search and matching theory, which has become the standard framework for analysing labour market frictions. Petrongolo and Pissarides (2001) systematised empirical evidence showing that lower search costs improve labour allocation efficiency and reduce frictional unemployment. The role of labour market institutions in shaping labour market efficiency has also been studied in the literature (Sordyl, 2024).

These theories, however, were developed in the pre-digital era, assuming fixed search costs, limited information processing capacity, and sequential

search. Contemporary digital platforms have transformed these parameters: algorithms process millions of vacancies in real time, and search has become parallel. Internet-based data sources expand analytical opportunities for monitoring labour market dynamics and tracking economic uncertainty in real time (Pietrucha & Gulewicz, 2025), but the quality and reliability of such data require systematic assessment.

In the context of online job portals, signalling and screening mechanisms take on new dimensions. Employers acting as screeners seek to filter candidates based on observable attributes such as educational credentials, work experience, and certified competencies – the informational inputs that portals help to standardise and present. Online portals facilitate this process by enabling the structured and comparable presentation of such signals across large numbers of applicants. At the same time, portals enable job seekers to signal their quality more effectively through structured profiles, skills endorsements, and portfolio materials. However, it is important to note that portals provide the infrastructure for signalling and screening; they do not eliminate information asymmetry *per se*. Whether asymmetry is actually reduced depends on the quality, completeness, and standardisation of the information presented – which is the central question addressed by the present study.

2.2. Empirical research on the impact of the internet on the labour market

From the early 2000s, the internet as a job search channel attracted active empirical attention. Autor (2001) was the first to systematically analyse its potential, arguing that online technologies should reduce search costs, expand geographic reach, and improve match quality through three channels: lower transaction costs, better information quality, and broader market access.

Early empirical results were, however, counterintuitive. Kuhn and Skuterud (2004), using U.S. Current Population Survey data for 1998–2000, found no significant effect of internet use on unemployment duration – and in some cases, a positive association with longer spells. They attributed this to self-selection: the internet was used disproportionately by those struggling to find work through traditional channels.

Stevenson (2009), analysing a longer period (1998–2006), found more nuanced results. Internet use significantly reduced job search duration in small towns and rural areas, where traditional channels are less effective, but had negligible effects in large cities – highlighting the importance of local labour market context.

By the late 2000s, the picture had shifted. Kuhn and Mansour (2014), using 2008–2009 data, found that internet job search was associated with significantly

shorter unemployment spells. They attributed this to rising internet penetration (which reduced self-selection), improved platform quality, and greater employer participation in online posting.

Faberman and Kudlyak (2019) added an important nuance: the impact of online job search depends not merely on internet use but on search intensity. Online platforms reduce the marginal cost of additional search, enabling job seekers to consider more vacancies within the same time investment.

2.3. Mechanisms for reducing information asymmetry: data quality and algorithms

Contemporary research focuses on the specific mechanisms through which online portals reduce asymmetry. Marinescu and Wolthoff (2020), using data from CareerBuilder.com, showed that the level of detail in vacancy descriptions, use of specific terminology, and transparency about working conditions significantly increase the volume of relevant applications – supporting the hypothesis that richer information improves match quality.

Horton (2017) conducted a field experiment on oDesk (now Upwork), randomly providing employers with algorithmic candidate recommendations. Employers who received recommendations hired more quickly, and match quality – measured by subsequent ratings and rehiring probability – was significantly higher. This provides causal evidence that algorithms can improve matching efficiency.

Critical scholarship, however, points to potential downsides. Rani and Furrer (2021), studying gig economy platforms in developing countries, found that algorithmic opacity creates new forms of asymmetry: workers do not understand how ratings are formed or orders distributed, generating uncertainty and eroding bargaining power.

For the present study, these findings imply that assessing portal effectiveness cannot be reduced to vacancy counts. The structuring of skills information is critical, as it determines the feasibility of applying matching algorithms and the quality of initial candidate screening.

2.4. Online vacancies as a data source for labour market analysis

A parallel strand of literature uses online vacancy data for macroeconomic analysis. Askatas and Zimmermann (2015) demonstrated that internet data – including online vacancies, search queries, and social media – enable real-time labour market analysis, overcoming the publication lags and limited granularity of traditional statistics.

Kureková et al. (2015) compared online vacancy data with traditional labour market surveys across several European countries, identifying both

advantages (timeliness, skills granularity, text analysis potential) and limitations (incomplete market coverage, occupational and regional bias, vacancy duplication). They emphasised the need to validate online data against official statistics.

Hershbein and Kahn (2018) used online vacancy data to show that during and after the 2008–2009 recession, employers significantly raised educational and experience requirements even for positions where such requirements had not previously existed – interpreted as skill upgrading under conditions of labour supply surplus.

Turrell et al. (2019) developed a methodology for transforming unstructured vacancy texts into structured economic indicators using machine learning and NLP, enabling real-time tracking of skill demand and high-granularity regional analysis.

Cedefop (2019a), in a large-scale study of the EU online vacancy market, confirmed that online portals perform a critical transparency and signalling function, reducing transaction costs and contributing to faster market clearing. A critical reading of this literature, however, reveals persistent limitations: most studies rely on single-platform data, precluding assessment of cross-portal differences; and methodological challenges around representativeness, employer posting practices, and deduplication remain unresolved.

2.5. The role of the state: public employment services and regulation

A separate strand of literature examines public employment services in the digital era. International Labour Organization (ILO, 2023) analytical materials note that while many countries are developing digital vacancy matching channels, the maturity and integration of these solutions vary considerably. Key conditions for effective digital employment services include comprehensive market coverage (through regulatory requirements and employer incentives), integration with administrative data and digital registries, and the development of algorithmic and personalised matching tools, subject to data protection and non-discrimination requirements.

Card et al. (2018), in a meta-analysis of 207 active labour market programme evaluations, found that job search assistance – including online tools – ranks among the most cost-effective interventions, particularly in the short term, though effects vary substantially by programme design and context.

Belot et al. (2019) conducted an experiment providing unemployed individuals in the Netherlands with personalised online job search recommendations, finding a significant positive effect on employment probability – particularly for the long-term unemployed.

Mandatory vacancy posting on state portals, however, creates both opportunities and risks. It ensures maximum market coverage and equal in-

formation access, but risks formalisation: employers may post minimally informative descriptions to satisfy legal requirements while retaining detailed vacancies on commercial platforms. State portals also frequently lag behind commercial ones in interface quality and functionality, potentially limiting their practical effectiveness.

2.6. The context of Central and Eastern European Countries and Belarus

Most research on online labour market platforms is conducted in developed countries with high internet penetration and mature digital ecosystems. The specificities of Central and Eastern European (CEE) countries, where digital transformation unfolds against a backdrop of institutional weaknesses and structural labour market challenges, remain understudied.

For Belarus, prior studies (Vankevich & Zaitseva, 2020; Zaitseva, 2025) laid an important foundation by assessing the structure and dynamics of the online portal market, adapting the European Training Foundation methodology developed by Mercorio and Mezzanzanica (2019) for ranking online labour market data sources. However, these studies did not examine online portals through the lens of information asymmetry theory.

2.7. Gaps in the literature and the contribution of the present study

The literature review identifies four significant gaps. First, research on online labour market platforms is insufficiently connected to classical information asymmetry theory; no integrated conceptual model explains the specific mechanisms through which platform characteristics affect asymmetry reduction. Second, most studies focus either on quantitative indicators (vacancy volume, market coverage) or behavioural outcomes (unemployment duration), without systematically analysing skills data quality as a key parameter of platform effectiveness. Third, no systematic methodology exists for comparing different portal types – state-run, commercial, and aggregator – that accounts for the balance between coverage and data quality. Fourth, there is a near-total absence of research evaluating the effects of regulatory changes aimed at strengthening state portals in contexts of commercial platform dominance.

This study addresses these gaps through a comprehensive analysis of online job portals' role in creating conditions conducive to reducing information asymmetry in the Belarusian labour market, assessing portal effectiveness along two measurable dimensions – market coverage and skills data structuring – and examining how the 2025 regulatory changes affect this balance.

3. Methods

The study combines quantitative analysis of online platform market dynamics with qualitative content analysis of skills data structuring in vacancies, enabling assessment of both the market coverage provided by different portal types and the quality of information available to labour market participants.

3.1. Comparative analysis of online job portal dynamics

To trace the evolution of the Belarusian online employment platform market, the study draws on data collected by the authors between 2019 and 2025 (Vankevich & Zaitseva, 2020; Zaitseva, 2025). The methodological basis is the European Training Foundation methodology for assessing and ranking online labour market information sources (Mercorio & Mezzanzanica, 2019), which involves systematic collection of data on website and vacancy characteristics and the construction of a source ranking model based on informativeness and reliability.

Adapting the ETF approach to Belarusian conditions enabled the capture of both long-term trends and the effects of recent regulatory changes. Data sources included publicly available portal statistics and materials from the authors' prior studies.

Portal selection followed the ETF methodology, based on rankings in Google and Yandex search results for the queries “work” (“работа”) and “vacancies” (“вакансии”), ensuring sample representativeness and reflecting actual user search behaviour. This approach provides a comprehensive picture of the market's competitive structure and enables identification of trends toward centralisation or diversification.

3.2. Content analysis of skills data structuring

To assess information quality, a comparative content analysis of vacancies was conducted across three platforms representing distinct models of online labour market functioning: the National Vacancy Bank (gsz.gov.by), the official state portal representing the institutionally regulated segment; the commercial portal rabota.by, representing the market-oriented matching segment; and the aggregator belmeta.com, representing the intermediary level that consolidates data from multiple sources. This selection ensures coverage of different models and enables identification of systemic differences in skills information presentation.

The sample comprised 300 vacancies, evenly distributed across three portals and five occupational groups: “accountant”, “sales manager”, “program-

mer”, “loader”, and “sales assistant”. These occupations were chosen to span a broad range of qualification levels – from low-skilled labour to highly qualified specialists – enabling analysis of how occupational specificity affects data structuring. While the sample does not claim full statistical representativeness, it provides a sufficient basis for qualitative comparative analysis and identification of key patterns.

Vacancies were assessed according to four criteria (Table 1):

- Skills field type (structuring). This criterion determined whether the vacancy contained a dedicated, explicitly labelled section for skills – such as a “Key Skills” or “Requirements” block listing specific competencies. Vacancies with such a section were classified as Type 2 (structured); those mentioning skills only within the body text, without explicit demarcation, as Type 1 (unstructured); and those with no skills information at all as Type 0;
- Presence of hard skills. This criterion recorded whether the vacancy specified concrete professional and technical competencies – for example, proficiency in software (1C, Excel, programming languages), knowledge of regulatory acts, or possession of relevant certificates;
- Presence of soft skills. This criterion captured the mention of personal, communicative, or behavioural qualities, such as responsibility, communication skills, stress tolerance, or initiative;
- Use of the classifier. This criterion determined whether the vacancy used an official job title or code from the state occupational classifier, or a free-form, non-standard – including marketing-oriented – title.

An illustrative example of the vacancy assessment is presented in Table 1. Assessment was conducted through manual analysis of vacancy text, enabling evaluation not only of the formal presence of information but also of its quality in terms of comprehensibility and utility for recruitment. Manual coding ensured that the linguistic and contextual nuances of different vacancy formats – difficult to capture through automated text processing – were appropriately accounted for.

3.3. Analysis of the impact of the 2025 regulatory changes

The dataset also enables assessment of the initial effects of the new employment legislation requiring employers to publish vacancies on gsz.gov.by as a first priority. Each vacancy was manually coded for markers indicating its legal status: the presence of a direct link to the State Employment Service portal (confirming compliance with the general statutory requirement); explicit designation as a “prospective” vacancy (which, under the 2025 legislation, exempts the employer from posting in the National Vacancy Bank); or the absence of both markers (classified as indeterminate compliance status).

4. Results

4.1. Dynamics of the online portal market in the Republic of Belarus

The development of Belarus's digital labour market ecosystem over the past 25 years has been characterised by a transition from quantitative growth to institutional transformation, driven by two primary forces: the national digitalisation strategy and amendments to employment legislation – specifically, Law No. 36-Z “On amendments to laws on employment of the population”.

Comparative analysis of online labour market structures suggests that Belarus gravitates toward a model with a strong state actor under conditions of high market concentration – a pattern shared by EU countries such as Cyprus, Denmark, France, Croatia, Sweden, and Finland, where state portals (Public Employment Services) function as aggregators consolidating vacancies from multiple private sources (Cedefop, 2019a). Unlike more fragmented markets dominated by private paid-posting platforms (e.g., Germany or the Netherlands), the Belarusian model exhibits more rigid centralisation around the state resource. EU experience suggests that the most conducive conditions for reducing information asymmetry are created where state portals partner with private ones – through automatic data exchange, as in Estonia or Belgium – rather than competing with them, thereby expanding audience reach without duplicating information.

Data for 2018–2025 (Table 2) reveal a clear shift from relatively balanced vacancy distribution between state and private portals to clear dominance by *gsz.gov.by*. This reflects a process of information flow concentration and the consolidation of the state portal's role as the primary vacancy aggregator. The CV database on the state portal grew more than sixfold (648.4%), reflecting both expanded functionality and growing job seeker trust in official digital employment channels. Private portals – primarily *rabota.by* – nonetheless retain leadership in accumulated human capital, with over 3.27 million CVs in 2025, underscoring their continued importance as specialised channels, particularly for highly qualified and IT professionals.

The total number of active online job portals in Belarus declined by approximately one third over the review period (from roughly 15 to 10 active portals). This consolidation may improve data quality and standardisation, but warrants attention to risks of monopolisation and reduced diversity of job search channels.

To assess portal effectiveness as Big Data sources, the 2020 and 2025 studies applied ranking methodologies based on website characteristics and vacancy parameters (skills description completeness, salary data availability,

geographic coverage, etc.) using the ETF methodology (Mercorio & Mezzanzanica, 2019). Table 3 presents the ranking dynamics.

The data indicate a shift in the portal hierarchy, reflecting a transition from the quantitative dominance of private platforms to the qualitative superiority of the state resource in terms of information structuring.

The following key trends in the Belarusian online job portal market can be identified:

1. Despite more than 10 active platforms, the majority of traffic and vacancies are concentrated on 3–4 leading resources (gsz.gov.by, rabota.by, praca.by, belmeta.com). The commercial segment leader remains rabota.by (part of the hh.ru ecosystem), which accumulates the highest-quality vacancies and CVs;
2. The State Employment Service portal (gsz.gov.by) has substantially increased its vacancy volume. Whereas in 2019 it was regarded primarily as a database for low-skilled labour, by 2025 its role as the central information hub has become critical;
3. Leading portals have introduced mobile applications, automatic matching algorithms, and analytics tools, substantially reducing the time costs of initial candidate screening;
4. The mandatory primary publication requirement has conferred on gsz.gov.by the status of the most representative source for monitoring labour demand;
5. Private portals are evolving into service platforms offering employer branding and career counselling, while the state portal focuses on ensuring comprehensive statistical vacancy records.

4.2. Skills data structuring on online portals

The content analysis results (Table 4) reveal substantial differences in approaches to presenting skills information across portal types.

The commercial portal rabota.by demonstrates a high level of formalisation and standardisation: 61% of vacancies contain a structured skills field, 100% include explicit hard skills, and 60% include soft skills. This enhances data quality and facilitates precise, efficient personnel matching using contemporary algorithmic methods.

The state portal, fulfilling its institutional function, is characterised by more formal and less informative vacancy descriptions. Despite full compliance with the occupational classifier (100%), only 8% of vacancies contain a structured skills field, 32% include explicit hard skills, and 25% include soft skills. This reflects the administrative nature of publications, which are oriented toward regulatory compliance rather than optimising the employment process.

Belmeta, as an aggregator, demonstrates limited informativeness due to the retransmission of simplified data from primary sources. The absence of

structured skills fields (0%) and low granularity of hard and soft skills (0%) reduce the value of aggregated vacancies for competency analysis and effective matching. Approximately 15% of vacancies use the state occupational classifier.

These findings point to the need to integrate the advantages of different models. The state portal should develop structured skills description functionality while preserving normative accuracy and comprehensive coverage. Commercial platforms, in turn, can serve as sources of granular data and innovative matching tools, but require alignment with state classifiers to ensure systemic compatibility.

4.3. Impact of the 2025 legislative changes on commercial portal content

Analysis of the data in Table 5 yields several important conclusions. The high share of vacancies containing a direct link to the National Vacancy Bank (65% on *rabota.by*) confirms the effectiveness of creating a unified information space in which commercial platforms function as retransmitters of the state database. The share of vacancies marked as “prospective” (15–20%) reflects the scale of employers’ use of the legal exemption to preserve recruitment flexibility. The considerably higher share of vacancies without a link or “prospective” designation on *belmeta.com* (37%) may indicate a “grey zone” or slower business adaptation to the new legislative requirements.

Overall, the dominance of vacancies originating from the National Vacancy Bank leads to the automatic propagation of the state interface’s limitations across the broader market: employers seeking to comply with the law copy formal descriptions, which explains the deficit of soft skills data and rigid classifier adherence identified in the previous section.

The 2025 regulatory changes have thus produced significant centralisation of information flows, but at the cost of declining data quality on commercial portals through the mechanical replication of formalised state portal descriptions.

5. Conclusion

5.1. Main findings

This study provides a comprehensive assessment of the informational capacity of online job portals in Belarus, confirming the hypothesis that the ability of a digital ecosystem to create conditions conducive to reducing information asymmetry depends on the balance between quantitative market coverage and qualitative data content.

First, analysis of 2018–2025 market dynamics reveals a radical shift from a competitive model to state centralisation. The 2025 legislative changes consolidated the State Employment Service portal as the central hub of information flows, mitigating the data fragmentation characteristic of early digitalisation – but creating new challenges associated with the monopolisation of search channels.

Second, comparative content analysis reveals a systemic quality gap between the state and commercial segments. While commercial portals (exemplified by *rabota.by*) achieve near-100% structuring of professional requirements (hard skills), the corresponding figure on the state portal is only 32%. The State Employment Service portal currently performs primarily a formal administrative record-keeping function, while commercial platforms remain the primary tools for effective candidate-vacancy matching.

Third, assessment of the 2025 regulatory changes reveals an “information convergence” effect: commercial portals and aggregators have become active retransmitters of the state database (up to 65% of *rabota.by* vacancies link directly to *gsz.gov.by*). However, this has led to the mechanical copying of simplified vacancy descriptions, reducing overall market informativeness and impeding the use of AI-based matching algorithms.

5.2. Practical recommendations

On the basis of empirical findings and international experience, three directions for developing the digital labour market ecosystem are proposed:

1. Transition to competence-based matching. The primary development vector for the National Vacancy Bank should be the introduction of systems capable of analysing specific skills – not merely job titles – requiring technological modernisation of the state interface;
2. Development of public-private partnerships. Rather than administratively displacing private platforms, a unified information space should be created through API integration, combining the state resource’s comprehensive coverage with the data depth and innovative algorithms of commercial portals;
3. Standardisation of transparency. Introducing recommendations for mandatory disclosure of salary ranges and structured skills lists would reduce search transaction costs and improve labour resource allocation efficiency.

5.3. Limitations and directions for future research

The study is limited by the short time elapsed since the 2025 reforms took effect. More broadly, the methodological design has several inherent limitations that should be acknowledged.

First, the content analysis is based on a purposive sample of 300 vacancies distributed across five occupational groups and three portals; while sufficient for qualitative comparative analysis, it does not claim full statistical representativeness. Second, the study evaluates informational inputs — the completeness and structure of vacancy descriptions — rather than outcomes such as hiring speed, match quality, or employer satisfaction. Accordingly, the study assesses the informational conditions that may facilitate signalling and screening processes but does not and cannot directly measure a reduction in information asymmetry in the classical sense of Akerlof (1970), Spence (1973), and Stiglitz (1975). Third, manual coding, while enabling nuanced assessment of vacancy content, introduces potential subjectivity; inter-coder reliability was not formally assessed. These limitations define the boundaries of interpretability of the findings.

A promising direction for future research is examining how enhanced data transparency and the introduction of competence-based matching algorithms affect job search duration and skills deficit reduction in the Belarusian economy.

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Appendix

Table 1. Excerpt from the assessment of vacancies for the query “Programmer” on the portal rabota.by

No.	Vacancy (Organisation)	Skills Field Type (0–2)	Hard Skills (0–1)	Soft Skills (0–1)	Use of Classifier (0–1)
1	Middle Automation QA Engineer (Itransition)	2	1	1	0
2	1C Programmer (Zhofre Labortekhnika)	2	1	1	0
3	Senior Unity Developer (IkonGames LLC)	2	1	1	0
4	Intern Developer (Sintegriko LLC)	2	1	1	0
5	Middle PHP Developer (Sportdata LLC)	2	1	1	0
6	C++ Developer (Valun Soft LLC)	2	1	1	0
7	Sales Development Representative (HYPERVSN)	2	0	1	0

Source: Own preparation based on data of portal rabota.by.

Table 2. Dynamics of key indicators of the main online job portals in the Republic of Belarus, 2018–2025

Portal	Indicator	September 2018	September 2019	April 2020	July 2025	Growth rate 2025/2018, %
gsz.gov.by	Vacancies	87 613	97 678	85 402	216 263	246.8
	CVs	2 981	2 968	3 218	19 329	648.4
	Organisations	120 882	122 133	135 479	n/a	112.1 (2020 vs. 2018)
rabota.by (formerly jobs.tut.by)	Vacancies	31 165	27 766	18 848	33 129	106.3
	CVs	1.76 million	2.05 million	2.18 million	3.27 million	185.8
	Organisations	31 165	27 766	18 848	8 556	27.5



praca.by	Vacancies	10 461	15 604	14 064	15 367	146.9
	CVs	246 815	308 976	349 977	546 816	221.5
	Organisations	71 196	84 261	89 077	125 433	176.2
belmeta.com	Vacancies	n/a	122 409	70 161	130 249	106.4 (2025 vs. 2019)
	CVs	n/a	n/a	n/a	n/a	–
	Organisations	n/a	1 113	n/a	3 972	356.9 (2025 vs. 2019)

Source: Own preparation based on online portal data and Vankevich & Zaitseva (2020); Zaitseva (2025).

Table 3. Comparative dynamics of online job portal rankings calculated using the ETF methodology

Portal	Ranking 2020 (position/coefficient)	Ranking 2025 (position/coefficient)
gsz.gov.by	3 (0.871)	1 (0.184)
belmeta.com	3 (0.871)	2 (0.120)
rabota.by (formerly jobs.tut.by)	1 (0.941)	3 (0.112)
praca.by	1 (0.941)	4 (0.112)
joblab.by	1 (0.941)	5 (0.104)
riv.by	9 (0.665)	6 (0.098)
kufar.by	2 (0.918)	7 (0.097)

Source: Own preparation based on online portal data and Vankevich & Zaitseva (2020); Zaitseva (2025).

Table 4. Results of the analysis of skills data structuring on online portals in the Republic of Belarus

Analysis criterion	National Vacancy Bank (gsz.gov.by)	Rabota.by	Belmeta.com (aggregator)
Share of vacancies with dedicated structured skills fields (Type 2), %	8.0	61.0	0.0
Share of vacancies with explicit Hard Skills, %	32.0	100.0	0.0
Share of vacancies with explicit Soft Skills, %	25.0	60.0	0.0
Use of the state occupational classifier (OKRB), %	100.0	0.0	~15.0

Source: Own preparation.

Table 5. Distribution of vacancies by source of origin and legal status

Category	rabota.by, %	belmeta.com, %
Vacancies with a direct link to the State Employment Service (general procedure)	65	48
Vacancies with a “prospective” designation (lawful exemption)	20	15
Vacancies without a link and without a designation (indeterminate status)	15	37

Source: Own preparation based on online portal data and Vankevich & Zaitseva (2020); Zaitseva (2025).



Artificial Intelligence in Judicial Management: Applications, Ethics, Risks and a Polish Perspective

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Abstract

Motivation: The integration of AI into judicial systems is rapidly transforming court administration, case management, and decision support. While these innovations promise efficiency gains and improved access to justice, they also introduce complex ethical, governance, and institutional risk challenges that appear to remain underexplored, particularly in Poland's transitional judiciary.

Aim: This systematic literature review examines global and Polish-focused scholarship to identify gaps in current research and synthesise major themes in AI applications for judicial management. It aims to provide a high-level overview of international developments and regulatory frameworks at the global and EU levels. It explores associated ethical and legal considerations as well as implementation risks. Finally, the review looks into best practices and potential pitfalls of AI deployment in courts.

Results: Three overarching themes emerge. First, AI applications in judicial management encompass automated case triage, predictive analytics for sentencing, and document and workflow automation. Second, ethical and governance considerations focus on such areas as transparency and explainability, algorithmic bias mitigation, and accountability frameworks that preserve human oversight. Third, institutional risks include data privacy vulnerabilities, unclear liability and regulatory gaps, and capacity constraints within court infrastructures.

Across these themes, the Polish context highlights barriers such as limited digital infrastructure, evolving legal frameworks, and the need for specialised training of judicial personnel.

Keywords: AI; judicial management; ethics; risk; Poland

JEL: K40; K41; L86; M15

1. Introduction

Courts worldwide are undergoing a digital overhaul. They use artificial intelligence (AI) to speed up routine tasks, improve case tracking and assist judges in making decisions. At the same time, bodies like the EU and UNESCO have set rules, such as the EU AI Act (Regulation 2024/1689) and UNESCO's guidelines, to ensure AI in the public sector stays ethical. Leading systems in the United States and China already run AI tools in courtrooms, boosting efficiency but also sparking debates about transparency, accountability and fair trials.

Yet we know little about how courts actually manage and govern these AI tools, especially in young or transitional democracies. Regrettably, most scholars only dive into technical advances or large-scale social effects, rather than the managerial, legal and ethical issues of AI in court administration.

How can we bridge that gap? This review concentrates on mapping global AI uses in judicial management and highlights Poland as an example of a transitioning judiciary. It examines ethical principles, governance structures and institutional risks, e.g. data privacy, liability and limited technical capacity, in order to pinpoint research gaps for future study.

The approach combines a critical analysis of scholarly work with an inductive review of legislation and policy documents at national, regional and EU levels. The paper unfolds in four parts: the literature review, the methodology, the results and the conclusions.

2. Literature review

The literature on AI in court management has dynamically expanded over the past decade (striving to keep in step with the development of AI itself), highlighting efficiency gains, greater transparency and complex ethical challenges. Studies show that machine learning and natural language processing (NLP) streamline tasks such as document classification, case scheduling and legal research, thereby reducing backlogs and optimising resources. At the same time, "open justice" initiatives convert court data into easy-to-use formats, supporting evidence-based policies and enhancing public engagement. More recent research explores multimodal AI systems that integrate audio, video and physiological data to assist in hearings, but it remains to be seen

whether these systems respect cultural contexts and guarantee algorithmic accuracy.

The second theme this review focuses on concerns regulatory and governance frameworks. International and national bodies, especially within the EU, have proposed legislation and guidelines (e.g. the AI Act (Regulation 2024/1689) and UNESCO's recommendations (UNESCO, 2021)) that set standards for transparency, accountability and data protection. Yet, it appears that courts still face technical and organisational obstacles to implementing these rules.

The third subsection addresses ethical considerations and risks. Experts warn that using “black-box” AI, which cannot explain its decisions, may undermine judicial independence, fairness in procedures, and the right to a fair trial (de la Osa & Remolina, 2024; Teremetskyi et al., 2025).

Finally, the review turns to Poland as a case study of a transitioning judiciary. How will Poland navigate the challenges of change management and influence its rulings through AI?

2.1. Applications in court management

In the growing body of literature on court administration, three broad yet interconnected areas of AI application consistently stand out: comprehensive smart court platforms, predictive analytics and performance tools, and the expanding field of AI-driven document analysis and multimodal courtroom technologies. The following subsections examine each of these domains more closely, as each offers distinct advantages and poses unique challenges.

2.1.1. Comprehensive smart court systems

A “smart court system” refers to a technology-based court that uses digital tools to digitise, automate and optimise all court operations. Unlike traditional courts reliant on manual processes, smart courts consolidate electronic filing, online hearings, case management, decision support, and enforcement – all powered by AI, big data analytics, blockchain, and advanced automation.

China's Smart Court is the largest digital transformation to date, assembling big data, blockchain, and both advisory and determinative forms of AI under one system (Shi et al., 2021, pp. 8–12). This framework has delivered easier access to justice, faster dispute resolution, and substantial cost savings by enabling processes and judgment enforcement online. However, automating judicial functions raises concerns about judicial independence, algorithmic bias, privacy, and the digital divide (Shi et al., 2021, pp. 12–18).

Some other countries adopt more tailored approaches, e.g. Singapore's Small Claims Tribunal uses in-house generative AI (Harvey AI) to advise citizens, guide them through procedures, and estimate claims. A system that

appears to embody a real-time user-supportive smart court (de la Osa & Remolina, 2024, pp. 9–10). Estonia pilots decision-support tools and data analytics in its e-Justice system, showing it wants to scale up transparent and efficient solutions (de la Osa & Remolina, 2024, pp. 9–10). These examples show that using digital-first court management improves efficiency and public service but must still learn to balance innovation with legitimacy and human supervision.

2.1.2. Predictive analytics and performance management

“Predictive analytics” in the judicial context means using statistical and machine learning techniques to predict case results, help manage courts, and plan how to use resources. Unlike simple data reports, predictive analytics allows courts to forecast patterns and manage workloads ahead of time by analysing large amounts of data.

For example, using a statistical method, Tehran’s General Court of Law was able to correctly predict case outcomes with 95% accuracy, showing that resolving more cases not only reduces backlog, but also improves court efficiency (Farzammehr et al., 2024, pp. 389–390). Similarly, New Zealand created a mixed model, which combines machine learning with legal rules for sentencing assault cases, ensuring that judges can understand the results (Rodger et al., 2023).

Spain’s Judicial Administration 4.0 uses both predictive tools for triaging cases and generative AI for drafting orders, while putting in place regulatory controls to prevent technology from outpacing law (Torres, 2025, pp. 108–110, 125). The Netherlands encodes procedural rules directly to digital systems, which does improve efficiency, but raises concerns about fairness when decisions are automated (Reiling & Contini, 2022, pp. 13–14).

Comparative research (Guitton et al., 2025) shows that national factors such as political attitudes and administrative capacity have a strong impact on how and why courts use predictive analytics. These tools are valuable for planning, however still require constant supervision and careful integration to preserve justice values.

2.1.3. Advanced document processing and information extraction

Document processing systems refer to AI-powered tools that manage, analyse, and interpret judicial documents, therefore enabling faster review, classification, anonymisation, and even translation. This application is especially relevant as courts become overwhelmed with electronically filed cases and digital archives.

The highest performing systems use deep learning and transformer models. For example, in Indonesia, a “Bidirectional Encoder Representations

from Transformers” model (BERT) is deployed. BERT is a machine learning model for NLP, which reads text both ways (left-to-right and right-to-left; unlike earlier models that read text in one direction only). It reached 0.96 accuracy in classifying court decisions (Solihin et al., 2025, p. 1627).

Slovakia uses NLP to automatically anonymise published judgments, achieving strong privacy standards (Kvasnica, 2025, pp. 275–276). Whereas Brazil piloted a text simplification tool, which makes difficult legal texts easier to read for the public (Alves et al., 2023, pp. 281–282).

In order to reduce backlog in the judiciary, India employs two AI platforms, SUPACE and SUVAS, to allocate cases and triage filings (Sharma, 2023, p. 109). SUPACE, which stands for Supreme Court Portal for Assistance in Courts Efficiency, is an AI-driven portal launched by the Supreme Court of India to help judges manage case data, assist with research, data analysis, and drafting support without replacing judicial decision-making. The other tool, SUVAS, is an AI-powered translator developed by the Supreme Court of India to translate English judicial documents, orders or judgments into multiple Indian regional languages, promoting the use of vernacular languages in legal proceedings.

According to “the Guidance for Judicial Office Holders”, published in April 2025, the UK allows generative AI for administrative drafting but forbids it in substantive reasoning. It requires all outputs to remain under human supervision (Judiciary of England and Wales, 2025). Similarly, the fresh from the press, “Interim Principles and Guidelines on the [Canadian] Courts’ Use of AI”, “human in the loop” and deep transparency for AI application is a requirement (Federal Court of Canada, 2025).

One gets the impression that while the abovementioned systems offer speed, scalability, and accessibility benefits, their implementation must be grounded in robust regulatory and ethical frameworks.

2.1.4. Multimodal courtroom technologies

Finally, multimodal courtroom technologies extend AI application beyond text into other types of sensory data like audio, video, body language (such as eye movements), and physiological signals. These systems assist judges and litigants by providing objective means to assess witness behaviour, truthfulness, and even understand the courtroom dynamics.

Joshi et al. (2025, p. 11) developed the “CogniModal-D dataset”, which combines EEG, ECG, EOG, eye-gaze, audio, video, and skin responses to train models that detect deception, reaching up to 79% accuracy. They found that behavioural signs like tone, movement and eye contact proved to be easier to interpret than neurophysiological signals. The move to multimodal data allows for richer and more nuanced evidence assessment, but it also raises serious ethical concerns about privacy, consent and reliability of the data.

These technologies seem to represent a new stage in judicial AI, where e-courts may not only analyse text and data but also observe, hear and sense. Therefore, careful empirical research and legal scrutiny appear vital before these systems are widely adopted – if at all?

Overall, based on the above, a clear trend emerges, namely that courts worldwide are not just digitising processes but carefully balancing and negotiating new technology with oversight. Smart courts, predictive analytics, sophisticated document management, and multimodal evidence, each promise efficiency gains, yet they also introduce ethical, procedural and institutional dilemmas. How can justice embrace speed without sacrificing fairness?

To assist in answering this, Table 1 provides a snapshot of AI use in judiciary worldwide, listing employed technologies, their maturity and the policy frameworks that accompany them. These data highlight both the broad experimentation in courts and the uneven rate of change.

2.2. Regulatory, governance and technical frameworks

As the justice sector embraces AI, a complex web of regulatory initiatives has emerged to steer this transition responsibly. The judiciary now faces the challenge of integrating autonomous systems without undermining fundamental justice principles, leading to a surge in international and national rules designed to ensure transparency and human control. A primary milestone is the EU AI Act (Regulation 2024/1689), which classifies judicial AI as “high-risk,” demanding the highest level of regulatory scrutiny. It requires systems to have detailed documentation, high data quality to minimise bias, and immutable logging for later analysis. Crucially, it mandates that judges must be able to understand and challenge AI outputs. These obligations were originally to apply from 2 August 2026. Regulation (EU) 2026/1744 (the Digital Omnibus on AI), in force since 27 July 2026, postponed the application of the Annex III high-risk requirements to 2 December 2027, and those for Annex I embedded systems to 2 August 2028, without altering the classification of judicial AI as high-risk.

Long before binding laws, the Ethical Charter (CEPEJ, 2018) established core principles, prioritising fundamental rights over mere technological efficiency. The Charter calls for explainability, technical reliability, and, most decisively, “human-in-the-loop” oversight, reminding institutions that algorithms must assist rather than replace judicial reasoning. Beyond the AI Act, other European instruments like the EU Data Act (2023), the EU Data Governance Act (2022), and the AI Liability Directive proposed in 2022 and formally withdrawn by the European Commission in October 2025 collectively shape a framework intended to reinforce trust in digital transformation.

At the global level, the OECD AI Principles (2019) and UNESCO AI Recommendation (2021) form the normative backbone for worldwide governance, balancing innovation with accountability. UNESCO’s Global Toolkit

(2023) emphasises fairness and participatory dialogue, framing AI in justice as a social project requiring public trust and continuous ethical reflection.

Complementing these legal boundaries are technical standards, such as the NIST Risk Management Framework (2023) and the ISO AI Risk Management (2023) standard. Together, they offer a technical scaffolding of auditing and regular checks to ensure broad ethical principles translate into measurable operational standards.

This multi-layered ecosystem reflects a cautiously hopeful approach, ensuring that efficiency gains never come at the expense of fairness or the fundamental human authority of the courts.

2.3. Poland: digitalisation and AI in judicial administration

Over the past decade, Poland's judiciary has been, quite frankly, on quite an ambitious journey of digital transformation. This effort is not just about making things faster – though that is certainly part of it – but also about making justice more accessible and transparent. At the heart of this effort lie two key pieces of legislation: the Act on Computerisation of Public Administration and the Civil Procedure Code. Together, they provide the legal right for electronic communication with courts, laying a solid foundation for a fully digitised judicial process (Computerisation Act, 2005; Civil Procedure Code, 1964).

Now, it is important to remember that Poland is not doing this in isolation. These reforms are deeply intertwined with the aforementioned evolution of Europe's digital and ethical framework. For example, in response to the developments on the EU AI front, Poland's Ministry of Digital Affairs initiated an extensive consultative process on the Draft Act on AI Systems in late 2024. In December 2024, a draft AI Systems Act was opened up to scrutiny by over 2000 stakeholders – judges, technologists, academics and civil groups – encouraging broad feedback on oversight mechanisms (Ministerstwo Cyfryzacji, 2024). By February 2025, proposals included forming a Commission on the Development and Safety of AI to coordinate responsible AI use across public bodies. The Act of 3 July 2026 on AI Systems was signed by the President on 24 July 2026 and promulgated on 27 July 2026 (Journal of Laws 2026, item 1003). It entered into force, as a rule, on 11 August 2026, while the provisions on inspections, proceedings, individual opinions and administrative fines apply from 28 October 2026. The Act establishes the institutional framework for implementing the EU AI Act in Poland, designating the Commission for the Development and Security of Artificial Intelligence (KRiBSI) as the market surveillance authority.

Hopefully, guided by the AI Development Policy to 2030 and the justice digitalisation agreement signed in April 2025, Polish courts are on the verge of significant transformation. The Ministries of Justice and Digitisation

committed to comprehensive court digitalisation, which is framed within a broader programme known as Digital Court (Ministerstwo Sprawiedliwości & Ministerstwo Cyfryzacji, 2025). This programme includes several ambitious projects, such as:

- The Judge’s Digital Assistant, which automates various judicial tasks in complex case types, like those involving Swiss Frank. This assistant incorporates an extensive database of European Court of Justice rulings, calculation tools, and automated document drafting capabilities. Pilots began in late 2024 and are progressively advancing.
- The Electronic Summons Proceedings System 3.0, which integrates automated communication, data extraction, and system interoperability with national registers such as KRS, CEIDG, and others.
- The Central Repertory and Clerical System, aimed at standardising digital case files across regional courts and automating document categorisation and workflows.
- Revamping the court’s Information Portal for seamless electronic submissions, interactive communication channels, and unified user interfaces supporting electronic signatures.

Together, these efforts are designed to address core administrative burdens, enhance the security and auditability of judicial data, and improve access and convenience for citizens and legal professionals alike. A crucial feature is ensuring interoperability across systems and avoiding “digital islands” thus building a coherent and scalable digital court system.

To support this systemic shift, the government has earmarked PLN 50 million to train more than 60 000 judges and court staff (Ministerstwo Sprawiedliwości, 2025b). The aim is to build not only technical expertise but also institutional trust in AI-assisted administration.

To grasp why these reforms are so urgent, one only needs to consider the sheer workload of Polish courts. In 2024 alone, over 14.6 million cases were processed, producing between seven and eight kilometres of paper files per appellate region every year (Ministerstwo Sprawiedliwości, 2025a). This staggering volume reveals the enormous administrative burden traditional procedures impose and the tremendous potential gains from comprehensive digitalisation. As Kowalski (2025, p. 437) observes, automating repetitive, labour-intensive tasks – from registering cases to assigning file numbers or sending correspondence – can relieve enormous pressure on court staff, allowing human resources to focus on work requiring discretion and judgement.

In this context, judicial administration has already begun integrating AI tools directly within the e-court infrastructure, transforming what used to be routine clerical tasks into intelligent process management. For instance, the following have already been piloted:

- Machine-learning classifiers that automatically sort incoming documents by case type, drastically speeding up docket processing.

- Natural-language tools designed to recognise urgent filings instantly, ensuring swift prioritisation of time-sensitive matters.
- Conversational chatbots to guide litigants through procedures, deadlines, and forms, making navigating the justice system less intimidating and fairer (Ministerstwo Sprawiedliwości, 2025a).

Importantly, it appears that each prototype system undergoes thorough, modular testing before any nationwide deployment. For example, the Wrocław Appellate Court's Information Portal pilot programme zeroes in on optimising user experience and streamlining electronic workflows, influencing future regional rollouts (Ministerstwo Sprawiedliwości, 2025b). This effort is overseen by an Interdisciplinary Team for Modern Technology Implementation, which pulls together experts from the National Prosecution Service, Attorney General's Office, judiciary, and academia. Acting as what seems to be a collaborative think tank, they have been tasked with diagnosing institutional needs, consulting professional groups such as bar associations, notaries, and bailiffs, and drafting long-term strategies (Ministerstwo Sprawiedliwości, 2025b).

When it comes to technical infrastructure, one standout is the LEX-AIS system developed by Gdańsk University of Technology. It provides near-real-time, AI-powered courtroom transcription with over 98% accuracy, trained on a massive corpus of half a million rulings. This promises to speed hearings by up to 50%. After successful phase two pilots in four courts during 2024, expansion to 100 courts is planned before national roll-out (Gdańsk University of Technology, 2024). Similarly, AI-augmented arbitration pilots early in 2024 revealed time savings exceeding 60% – all without compromising human arbitrators' ultimate authority (Ministerstwo Sprawiedliwości, 2024).

It is worth noting that Polish scholarship does attempt to address the development of AI in the Polish judiciary. The book by Dolniak et al. (2024) on AI in the judiciary provides a foundational overview of the regulatory and institutional environment as of mid-2024. It maps the early policy frameworks, including Polish 2020 AI strategy, the AI Working Group (GRAI) recommendations, the Ministry of Justice's April 2023 "Ius ex silico. AI in the service of the judiciary" conference as well as documents stakeholder attitudes captured in the January 2024 survey by the Ministry of Justice. While the book undoubtedly offers a broad interdisciplinary treatment of civil, criminal and procedural law perspective, its primary focus remains legal doctrine rather than management. Moreover, given the accelerating pace of AI development and implementation, the institutional landscape the monograph describes has already shifted considerably in the intervening period.

Where Dolniak et al. (2024, p. 58) document an early consultative phase marked by low engagement (just 1.8% of judges and 4% of administrative staff) and mainly aspirational strategies, this review instead reflects the first tentative steps toward real-world implementation. By late 2024 and early 2025, Poland had already progressed from surveying potential AI uses to

piloting concrete systems, i.e. the LEX-AIS courtroom transcription, AI-assisted arbitration platforms and the broader Digital Court Programme. This rapid shift underlines both the dynamism of judicial AI adoption and the need for management-focused scholarship that goes beyond legal and ethical questions to examine the organisational, budgetary and change-management challenges essential for sustaining technological improvements in court administration.

It seems that combining legislative, technological, and educational initiatives with a strategic long-term vision, Poland might just be positioning itself at edge of judicial digitalisation. However, challenges remain. The urban-rural digital divide risks perpetuating inequities in accessing efficient justice. Concerns around algorithmic opacity, bias, and cybersecurity vulnerabilities to name a few.

Ultimately, success in Poland's judicial digitalisation likely rests not on technology alone but on sustained commitment to trust, transparency, and human oversight. Continued dialogue with stakeholders and strong ethical safeguards are essential to ensure innovation bolsters, rather than threatens, judicial independence and legitimacy.

2.4. Ethics and risks in the application of AI to court systems

The integration of AI into judicial processes introduces ethical risks that demand targeted management to uphold the rule of law and public trust. When an algorithm recommends a sentence or triages a case, it interferes with transparent, adversarial processes. Algorithmic decision support may obscure reasoning or introduce procedural shortcuts that infringe upon the right to a fair trial under Article 6 of the ECHR (Selcuk et al., 2025, p. 1). If reasoning is hidden inside a “black box”, procedural safeguards protecting the innocent are compromised. AI must support, not replace, human judgement.

The principle that justice must be “seen to be done” underpins public confidence; however, “black-box” systems conflict with this tenet. When a judge cannot explain an AI recommendation, or a litigant is told to “trust the algorithm,” judicial authority crumbles (de la Osa & Remolina, 2024, pp. 4–5; Teremetskyi et al., 2025, p. 128). Mandatory explainability and accessible documentation are essential to maintaining the social contract between courts and citizens. Furthermore, AI systems can encode societal prejudices from training data, leading to discriminatory outcomes. The US COMPAS tool illustrates this, as studies found it disproportionately labelled African American defendants as high-risk regardless of offence severity (Selcuk et al., 2025, p. 6; Teremetskyi et al., 2025, p. 129). Regular audits and inclusive data curation are necessary to ensure AI serves all individuals fairly.

Judicial independence is also at risk if overreliance on algorithms shifts authority to opaque systems designed by private vendors - a phenomenon termed

“algocracy” (de la Osa & Remolina, 2024, p. 9; Florez Rojas, 2025, pp. 110–111). Clear protocols must reserve final authority to human judges so that algorithms advise rather than command. Surveys show that people trust human judges more than AI, especially in high-stakes contexts (de la Osa & Remolina, 2024, p. 5; Teremetskyi et al., 2025, p. 128). Vulnerable litigants may perceive AI-driven processes as arbitrary, eroding institutional legitimacy. Rebuilding trust requires transparent governance and inclusive dialogue.

Liability presents another challenge: when AI misinterprets evidence or recommends unjust outcomes, accountability gaps complicate redress (de la Osa & Remolina, 2024, pp. 20–21). Contractual frameworks and audit trails are vital to ensure technology does not shield institutional irresponsibility. Additionally, processing sensitive judicial data heightens privacy risks, especially with third-party vendors (de la Osa & Remolina, 2024, p. 8; Teremetskyi et al., 2025, p. 129). Data breaches could have severe consequences, making encryption and informed-consent moral imperatives.

Generative AI “hallucinations” – fabricating citations or precedents – further undermine reliability (de la Osa & Remolina, 2024, pp. 7–8). The *Mata v. Avianca, Inc.* case serves as a warning after a lawyer submitted a brief with non-existent cases generated by ChatGPT. Finally, the digital divide risks creating a two-tiered justice system where those without digital literacy face a slower process (Teremetskyi et al., 2025, p. 128; de la Osa & Remolina, 2024, pp. 9–11). Mitigating these risks requires multi-layered frameworks embedding transparency and human oversight throughout the AI lifecycle.

3. Methods

This study employed a systematic literature review guided by PRISMA principles to ensure transparency and reproducibility in mapping, evaluating and interpreting scholarship on AI applications in judicial management systems from 2015 to 2026. In October 2025, two multidisciplinary databases were searched to capture both technological and legal perspectives.

On Scopus, the following Boolean query was used in TITLE-ABS-KEY fields: (“AI” OR AI OR “machine learning”) AND (judiciary OR “court management” OR “court administration” OR “justice management” OR “judiciary management” OR “judicial administration” OR “judicial management” OR “court case management” OR “e-justice” OR “smart court”) AND PUBYEAR > 2014 AND PUBYEAR < 2027.

This retrieved 336 records (121 open access). An equivalent strategy in the Web of Science Social Sciences Citation Index returned 143 records (62 open access). To accommodate institutional access limits, only open access publications (n = 183) were retained. After removing duplicates, 119 unique articles progressed to screening.

Rigorous inclusion and exclusion criteria were then applied. Eligible studies were peer-reviewed articles from 2015–2026, written in English or Polish, and directly addressed AI or machine learning in judicial systems, court management or administration. They encompassed empirical research, case studies, theoretical frameworks or policy analyses with clear practical implications and touched on at least three thematic categories of the review framework. Excluded works included conference papers, book chapters, general AI-ethics discourse lacking judicial focus, and highly abstract or redundant studies.

The selection process unfolded in two phases. First, titles and abstracts of all 119 articles were reviewed for thematic relevance, prioritising those that covered multiple aspects of AI in courts, such as case triage, decision support and ethical governance, which resulted in 75 papers for full-text assessment. Detailed evaluation against the inclusion/exclusion criteria followed, leading to the exclusion of seventeen articles for insufficient managerial focus ($n = 6$), overly theoretical orientation ($n = 6$) or limited novelty ($n = 5$). Ultimately, 58 studies met all criteria and formed the qualitative synthesis underpinning this review.

Consequently, this review offers a robust cross-section of empirical and conceptual work, enabling the identification of distinct global adoption patterns, risk-governance strategies and institutional adaptation models, and situating Poland's trajectory within the broader international landscape.

4. Results

The review highlights three overlapping trends shaping AI-driven court management, namely operational automation, ethical safeguards, and institutional risk. It also examines how they play out in both global experiments and Poland's pilot schemes. Together, these themes reveal how technical advances, governance measures, and systemic barriers intertwine to influence the adoption of AI in the judiciary management.

On the automation front, China's Smart Court offers a prime example, since it employs big-data analytics, blockchain, and AI to streamline case triage and even forecast outcomes. Yet critics warn that such deep centralisation could threaten judicial independence (Shi et al., 2021, pp. 12–18). In Estonia, the e-File pilot expedites submissions without marginalising judges, striking a balance between efficiency and discretion (de la Osa & Remolina, 2024, pp. 9–10).

Equally vital are the ethical and governance measures that underpin legitimate AI use in courts. Opaque “black-box” algorithms in sentencing models have prompted urgent calls for transparency and explainability, ensuring all stakeholders can comprehend decisions (de la Osa & Remolina, 2024, pp. 4–5; Teremetskyi et al., 2025, p. 128). Following the uncovering of discriminatory

risk pathways in systems like COMPAS, bias-mitigation strategies now emphasise continuous monitoring and third-party audits (Selcuk et al., 2025, p. 6; Teremetskyi et al. 2025, p. 129). The concept of algocracy offers six dimensions of legitimacy-transparency, accountability, fairness, efficiency, participation, and reversibility in order to guide democratic oversight of AI in courts (Flores Rojas, 2025, pp. 110–111). Notably, New Zealand's assault-sentence model demonstrates that predictive accuracy and interpretability can coexist when outputs are co-designed with judges (Rodger et al., 2023).

However, institutional risks pose significant hurdles, particularly in emerging democracies. It might be because, as comparative studies suggest, adoption trajectories depend more on political leanings, administrative complexity, and regional technology diffusion than on technical abilities alone (Guitton et al., 2025). Advanced technology alone cannot drive transformative change. Without concerted efforts to modernise legacy systems, improve data accessibility, and bolster judicial resources, AI risks remaining an unfulfilled promise. Effective adoption demands a holistic strategy that aligns technical innovation with ethical oversight and capacity building.

Furthermore, courts across jurisdictions confront three primary challenges, in the form of entrenched reluctance, fragmented non-machine-readable records, and severe resource shortages, which impede tool deployment and erode public trust (Yoon, 2023, pp. 355–362).

Fortunately, overlaying these themes, there is a regulatory framework, i.e. the EU AI Act, which imposes strict requirements for documentation, data quality control, immutable audit logs, and explainability to protect due process. Complementary requirements, from the CEPEJ Ethical Charter to the OECD AI Principles and UNESCO's AI Recommendation, reinforce inclusive governance, transparency, and ongoing skill development.

Poland's own forays into AI-augmented court management reflect both ambition and caution. Pilots such as the AI-supported case-triage system and the LEX-AIS courtroom transcription project at Gdańsk University of Technology have delivered measurable efficiency gains while preserving essential human oversight (Gdańsk University of Technology, 2024). From a governance perspective, the Digital Court Programme, aligned with the EU AI Act's high-risk safeguards, provides a robust regulatory foundation for further innovation. Yet uneven digital infrastructure across regional courts hampers seamless e-filing and real-time analytics, and limited training opportunities leave judges and staff hesitant to embrace new tools. Moreover, persistent non-machine-readable case files and constrained budgets continue to reinforce the three systemic barriers that is reluctance, fragmentation as well as resource scarcity that courts worldwide must overcome before AI can fulfil its transformative potential (Yoon, 2023, pp. 355–362).

Furthermore, survey data collected in 2023 and published by the Ministry of Justice in early 2024 (Ministerstwo Sprawiedliwości, 2024, pp. 4–6) pro-

vide critical insight into judicial attitudes towards digitalisation and AI adoption at a formative moment. The survey found very low overall engagement in digitalisation, showing these tools were still at an early stage of adoption. Judges were keen on automatic hearing transcripts, text recognition and AI help with drafting decisions, while administrative staff mainly appreciated easier access to court files. Employees with mid-level experience were the most open to digital tools, whereas those with very long service were the least enthusiastic. Although most judges and assessors supported fully digital case files, a substantial minority of referendaries and administrative personnel opposed the change.

These findings underscore both the heterogeneity of expectations across occupational groups and the persistence of generational and institutional barriers. They highlight the necessity for tailored training programmes and differentiated implementation strategies rather than uniform roll-outs. When set against more recent developments, including the expansion of the LEX-AIS transcription system and the allocation of PLN 50 million for capacity building, the 2023 data show courts have come a long way but warn that progress may stay limited to a few pioneering courts. Understanding this starting point is essential for assessing whether current initiatives can achieve long-term system-wide integration.

In short, Poland stands at a crossroads: unless it synchronises cutting-edge technical solutions with sustained capacity building and ethical governance, its judicial AI initiatives risk remaining cautious experiments rather than enduring, equitable digital practices.

5. Conclusion

This review reveals a pressing gap in understanding how AI affects court management in specific national contexts. Although abundant research examines AI's technical capabilities and normative frameworks, little attention has been paid to the practical impact of AI tools on administrative workflows, judicial discretion, and institutional legitimacy. Poland's transitional judiciary provides a particularly rich case for exploring these dynamics.

Future studies should investigate how AI reshapes routine management tasks, such as case triage, scheduling, and document processing as well as how and if judges and court staff incorporate algorithmic support into their decision-making processes. Equally important is assessing how oversight and audit mechanisms translate regulatory intent into effective controls that preserve human judgement and maintain public confidence in court administration. The author intends to address these questions in future research to produce actionable evidence on how AI can be used in the judiciary to enhance efficiency while safeguarding judicial independence and upholding public trust.

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Appendix

Table 1. Comparative overview of AI applications in judicial systems worldwide

Jurisdiction	Type of AI technology	Implementation stage
Australia	NLP triage, remote hearings assistance	National rollout
Brazil	NLP for text simplification and summarisation	National implementation
Canada	Automated decision-making tools (AI-assisted judgements)	Interim policy (September 2025)
China	Big data analytics, blockchain, decision-making AI	Nationwide deployment
Estonia	Automated filing, experimental AI-judge modules	Advanced pilots
France	Statistical outcome prediction	Pilot initiatives
Germany	Machine learning for case triage	Early adoption
India	Speech recognition, NLP document processing	Pilot and regional rollout
Netherlands	Online portals, predictive case analytics	Established system
New Zealand	Automated filing, virtual hearings	Pilot and regional rollout
Poland	Electronic document exchange, e-case management	Pilot and regional rollout
South Africa	Automated filing and OCR	Nationwide deployment
Spain	Case management analytics, e-filing	Pilot initiatives
United Kingdom	Generative AI for non-substantive judgement drafting	Guidance issued (April 2025)
United States	IBM Watson-based triage and document analysis	Early rollout

Source: Own preparation based systematic literature review and policy documents including international reports and national judicial AI initiatives.



Public Rules or Market Enforcement? Institutional Gaps and the Cost of Compliance in Maritime Labour

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Abstract

The Maritime Labour Convention (MLC, 2006) was designed to harmonise minimum standards of working and living conditions at sea across jurisdictions. Despite its near-universal ratification, significant disparities in labour conditions persist, indicating limited effectiveness in the implementation of the regulatory framework.

This article aims to explain this paradox by analysing the MLC through the lens of institutional economics and multi-level governance. In particular, the study examines how the institutional structure of the system—encompassing both public and private actors—affects the effectiveness of enforcement. It advances the argument that the limitations of the MLC do not stem from insufficient regulatory harmonisation, but rather from the system's limited capacity to generate sufficiently high and consistent costs of non-compliance. The analysis demonstrates that the hybrid and multi-level governance structure gives rise to three types of institutional gaps: vertical, horizontal, and perceptual. Drawing on data from Port State Control (PSC) regimes, the study shows that deficiencies related to working conditions are relatively frequently identified, whereas detentions—representing the primary enforcement mechanism associated with significant economic costs—remain relatively limited and

uneven across regions. The findings reveal a systematic asymmetry between the detection of violations and their sanctioning. This asymmetry lowers the expected cost of non-compliance, weakens the deterrent function of regulation, and creates conditions conducive to regulatory arbitrage. At the same time, the analysis suggests that, in certain contexts, market-based mechanisms may generate stronger incentives for compliance than fragmented public enforcement systems.

The contribution of this article is threefold: (1) it develops a conceptual framework of three types of institutional gaps, (2) it links these gaps to regulatory arbitrage from a transaction cost perspective, and (3) it provides empirical evidence of enforcement asymmetry based on PSC data. The findings suggest that improving the effectiveness of the MLC requires strengthening enforcement mechanisms and increasing the credibility and consistency of sanctions, rather than further expanding regulatory standards alone.

Keywords: Maritime Labour Convention (MLC); institutional gaps; regulatory arbitrage; enforcement asymmetry; maritime governance

JEL: L51; D23; K23; F23; J81

1. Introduction

The Maritime Labour Convention (MLC, 2006) represents one of the most comprehensive attempts to establish global minimum standards for working and living conditions at sea (Fotteler et al., 2018). Since its entry into force in 2013, the Convention has been ratified by the vast majority of maritime states, covering most of the world's merchant fleet. In principle, such widespread adoption should ensure relatively uniform labour standards across jurisdictions.

However, empirical evidence suggests that these expectations have not been fully realised. Persistent deficiencies in working conditions, wage practices, and effective access to legally guaranteed rights, benefits, and onboard welfare provisions continue to be observed. This raises a fundamental question: why do widely adopted regulatory frameworks fail to ensure consistent labour standards in practice? This question is particularly relevant in transnational sectors characterised by multi-level governance and fragmented enforcement environments.

This article addresses this question by analysing the MLC through the lens of institutional economics and multi-level governance. The central argument is that the limitations of the Convention do not stem from the design of regulatory standards, but from the structure of their enforcement. In particular, the MLC does not fail in detecting non-compliance, but rather in generating sufficiently high and consistent costs of non-compliance.

From an institutional perspective, regulatory effectiveness depends not only on the existence of rules, but also on the conditions under which they

are enforced—namely the probability of detection and the credibility and magnitude of sanctions (Coase, 1937; North, 1990). When violations are identified but rarely lead to economically significant consequences, regulated entities are incentivised to engage in selective rather than full compliance.

This pattern is observable in the case of the MLC, where data from Port State Control (PSC) inspections indicate that employment-related deficiencies are frequently identified, yet only a small proportion result in ship detention—the primary enforcement mechanism capable of generating immediate and substantial economic costs, including operational delays, port-related expenses, and contractual penalties.

To explain this dynamic, the article conceptualises the MLC as a hybrid and multi-level regulatory system characterised by institutional gaps. Vertical gaps arise from fragmentation across governance levels, enabling jurisdictional mobility. Horizontal gaps reflect variation in enforcement practices among actors operating at the same level. Perceptual gaps capture discrepancies between formal indicators of compliance, such as ratification rates, and observed labour outcomes in practice.

To support this analysis, the paper develops a conceptual model of multi-level governance and institutional gaps (Figure 1), linking regulatory structure to observed enforcement outcomes.

Taken together, these gaps reduce the expected cost of non-compliance and create conditions conducive to regulatory arbitrage in global maritime labour markets. In such an environment, actors respond not only to formal rules, but also to differences in enforcement intensity and associated compliance costs.

The article contributes to the literature on institutional economics and regulatory governance in three ways. First, it develops a structured framework of institutional gaps applicable to multi-level regulatory systems. Second, it links these gaps to regulatory arbitrage through the lens of transaction cost economics. Third, it provides empirical support for this argument using PSC data complemented by industry evidence.

The remainder of the article is structured as follows. Section 2 outlines the theoretical framework, focusing on institutions, enforcement, and regulatory arbitrage in multi-level governance systems. Section 3 presents the research design, including the analytical framework, data sources, and analytical procedure. Section 4 examines maritime governance and enforcement structures. Section 5 analyses the Maritime Labour Convention (MLC) as a regulatory system. Section 6 identifies institutional gaps in the implementation of the MLC and examines their empirical manifestations. Section 7 discusses the findings, and Section 8 concludes with policy implications and directions for future research.

2. Institutional Foundations of Regulatory Enforcement

2.1. Institutions and Transaction Costs

Institutions shape economic behaviour by structuring incentives and reducing uncertainty (North, 1990). Following North's conceptualisation of institutions as formal and informal "rules of the game", they organise repeated interactions and stabilise expectations (North, 1990; Ostrom, 2005). Formal institutions include legal norms, administrative procedures, and codified regulatory arrangements, whereas informal institutions consist of norms of behaviour, customary practices, shared expectations, and culturally embedded patterns of conduct (Ostoj, 2012). Their role extends beyond regulating behaviour to reducing transaction costs associated with exchange, including costs related to information, contracting, monitoring, and enforcement (North, 1990). This distinction is particularly important in labour markets, where the effectiveness of formal regulation depends on its interaction with informal institutions: the two may complement each other, but they may also diverge, and such divergence can weaken enforcement and create conditions for institutional gaps (Fiedor, 2015).

From the perspective of the new institutional economics, regulatory effectiveness depends not only on the existence of formal rules, but also on the capacity to enforce them under conditions of bounded rationality and opportunism (Williamson, 1979, 1998). Where monitoring is weak and sanctions lack credibility, formal institutions may remain formally valid yet become ineffective in practice (Ostrom, 2005; Williamson, 1979). Compliance is therefore shaped not only by the content of regulation, but also by the costs of compliance, the probability of detecting violations, and the expected consequences of non-compliance (Kuiper et al., 2023; North, 1990; Williamson, 1979).

Under such conditions, economic actors may respond through strategic adaptation rather than full compliance. The pursuit of lower transaction and regulatory costs incentivises the selection of organisational and jurisdictional arrangements that minimise exposure to monitoring and sanctions (Coase, 1937; North, 2008). This creates a direct link between enforcement limitations and the emergence of regulatory arbitrage.

2.2. Multi-level Governance and Institutional Gaps

Contemporary regulatory systems increasingly operate within multi-level and hybrid governance structures, in which authority is distributed across global, regional, and national levels and shared between public and private

actors. While such arrangements enhance regulatory flexibility and reach, they also increase coordination and monitoring costs, blur accountability, and create conditions for uneven implementation (Hooghe & Marks, 2003; Williamson, 1998).

In this context, institutional gaps are understood as structural inconsistencies between formal rules, their interpretation, and their practical enforcement. These gaps may arise from fragmented competences, weak coordination, uneven enforcement practices, or tensions between formal requirements and operational realities (Bläse et al., 2024; Gruszevska, 2017; Hooghe & Marks, 2002). In hybrid systems, these challenges are amplified by the role of regulatory intermediaries, which perform supervisory functions on behalf of public authorities.

The delegation of authority may reduce the direct costs of state oversight, but it also introduces additional agency-related challenges (Jagodziński, 2019). Private intermediaries may face conflicting incentives between rigorous enforcement and the maintenance of commercial relationships with regulated entities. As a result, mechanisms intended to enhance enforcement capacity may simultaneously generate new institutional gaps, including selective application of standards, variable inspection quality, and diffused accountability (Abbott, 2017; Abbott et al., 2017).

Within multi-level systems, these gaps contribute to heterogeneous enforcement environments and increase uncertainty for regulated actors (Black, 2001; North, 2008). They also create structural conditions under which differences across regulatory systems can be strategically exploited.

2.3. Regulatory Arbitrage

Regulatory arbitrage refers to the strategic exploitation of differences and inconsistencies across regulatory systems. In the context of multi-level governance, it arises not only from individual violations, but from the interaction between fragmented competences, incomplete enforcement, and firms' incentives to minimise costs (Georgallis et al., 2021; Williamson, 1998).

From a transaction cost perspective, regulatory frameworks can be understood as inherently incomplete. Regulatory authorities are unable to anticipate all possible adaptive responses of regulated entities, while firms actively seek arrangements that preserve economic functions while reducing the costs of compliance, monitoring, and sanctioning (Fleischer, 2010; Weiss et al., 2013). Regulatory arbitrage therefore often involves the selection of organisational, contractual, or jurisdictional structures that provide more favourable regulatory treatment without necessarily violating formal rules.

In fragmented enforcement environments, actors respond not only to formal requirements but also to differences in monitoring intensity and the credibility of sanctions (Marjosola, 2021) or the ability of financial firms to

circumvent or neutralize rules, is a classic problem of financial regulation. This article draws on transaction cost economics (TCE). Where the expected cost of non-compliance remains low, incentives for arbitrage increase. Regulatory arbitrage should therefore be interpreted as a rational response to institutional incompleteness and uneven enforcement, as well as an indicator of the limitations of formally harmonised but operationally fragmented regulatory systems.

3. Methods

3.1. Research Design

This study adopts a qualitative, analytically driven research design grounded in institutional economics and governance studies. The analysis focuses on the institutional dimensions of regulatory arrangements governing labour standards in the maritime sector.

The Maritime Labour Convention (MLC, 2006) is examined as a case study of a transnational regulatory system implemented through a multi-level governance structure. The analysis concentrates on how regulatory norms established at the international level are translated into practice across different jurisdictions and institutional contexts. The study also incorporates a comparative perspective by examining discrepancies between formal regulatory frameworks and their practical implementation across institutional levels and among actors involved in maritime labour governance.

3.2. Analytical Framework

The analytical framework employed in this study draws on the literature on institutional economics, and multi-level governance. These approaches emphasise that regulatory systems operating across multiple jurisdictions generate coordination problems, enforcement asymmetries, and inconsistencies between formal rules and their practical application. In this study, the governance of labour standards in the maritime sector is conceptualised as a multi-level and hybrid institutional system involving both public regulatory authorities and private oversight actors, such as recognised organisations and inspection bodies. These actors operate under different incentive structures and accountability regimes, which may result in variations in enforcement intensity, coordination failures, and uneven application of regulatory standards. Within this framework, the implementation of the Maritime Labour Convention (MLC, 2006) is understood as a process unfolding across interconnected levels of governance—global, regional, national, and operational—while relying on a combination of state-based, delegated, and market-based

enforcement mechanisms. This institutional configuration reflects both the need for global standardisation and the practical constraints of enforcement in a highly mobile and transnational industry. Building on this perspective, the study identifies three types of institutional gaps that may emerge within such a system.

Vertical gaps arise between different levels of governance (global, regional, national, and operational), particularly where regulatory responsibilities are unevenly distributed or where supervisory functions are delegated to private actors. These gaps reflect inconsistencies between formally adopted international standards and their implementation within national legal and administrative systems (Galley, 2014; Ostrom, 2010; Roe, 2013a).

Horizontal gaps occur among actors operating at the same level of governance but under different regulatory or organisational logics. This includes differences between flag states, port state control regimes, recognised organisations, and private inspection systems. Such gaps are associated with variations in enforcement practices, standards, and coordination across jurisdictions and institutional arrangements (Fulconis & Lissillour, 2021) namely the classification and certification of ships. Paradoxically, the academic literature on the strategic behaviour of classification societies remains very limited. More often than not, the scope of prior research has been limited to the definition of their missions in the shipping ecosystem with an emphasis on their changing legitimacy as maritime accidents occur. Consequently, this paper aims at providing a better understanding of the specific role of classification societies in maritime safety and within the interorganisational dynamics of international shipping. The study is based on a conceptual framework provided by the behaviourist approach and applied to the inter-organisational dynamics of supply chains. This approach enables in-depth analysis of actors' strategic behaviours by focusing on four dimensions: power, leadership, conflict and cooperation. The main results highlight the increasingly central and paradoxical role of classification societies. This role encompasses, on the national level, classification and certification processes, and, on the supranational level, the creation of new rules and regulations. The study highlights the importance of their ability to master the official framework and institutional vocabulary, which enable them to strengthen their power and leadership in the shipping market. This capacity helps them to limit conflicts between actors and to encourage certain cooperative behaviours based on relationships of dependence and interorganisational interdependence.”;container-title”:”Journal of Shipping and Trade”.

Perceptual gaps refer to discrepancies between formal regulatory standards and their practical interpretation, perception, and lived experience by directly affected actors, particularly seafarers. They capture divergences between declared (*de jure*) compliance and observed (*de facto*) working conditions, as well as limitations of complaint mechanisms and enforcement

processes (Fulconis & Lissillour, 2021) namely the classification and certification of ships. Paradoxically, the academic literature on the strategic behaviour of classification societies remains very limited. More often than not, the scope of prior research has been limited to the definition of their missions in the shipping ecosystem with an emphasis on their changing legitimacy as maritime accidents occur. Consequently, this paper aims at providing a better understanding of the specific role of classification societies in maritime safety and within the interorganisational dynamics of international shipping. The study is based on a conceptual framework provided by the behaviourist approach and applied to the inter-organisational dynamics of supply chains. This approach enables in-depth analysis of actors' strategic behaviours by focusing on four dimensions: power, leadership, conflict and cooperation. The main results highlight the increasingly central and paradoxical role of classification societies. This role encompasses, on the national level, classification and certification processes, and, on the supranational level, the creation of new rules and regulations. The study highlights the importance of their ability to master the official framework and institutional vocabulary, which enable them to strengthen their power and leadership in the shipping market. This capacity helps them to limit conflicts between actors and to encourage certain cooperative behaviours based on relationships of dependence and interorganisational interdependence.”container-title”:”Journal of Shipping and Trade.

Taken together, these three categories serve as a conceptual tool for analysing how institutional complexity and hybrid governance structures generate inconsistencies in enforcement and create opportunities for strategic behaviour by market actors. In particular, they help explain how regulatory fragmentation and uneven enforcement capacities may enable the emergence of regulatory arbitrage within the maritime labour system.

3.3. Data Sources

The analysis is based on several categories of secondary data reflecting the hybrid governance structure of maritime labour regulation.

First, international and national regulatory and institutional documents related to the implementation of the Maritime Labour Convention (MLC, 2006) were analysed. These include the Convention itself, selected national provisions implementing the MLC, and institutional materials concerning its implementation and supervision. These sources represent the formal legal framework and the public governance dimension of the system.

Second, the study draws on inspection statistics and reports from Port State Control (PSC) regimes, published by regional Memoranda of Understanding (MoUs), including the Paris, Tokyo, Mediterranean, Indian Ocean, Black Sea, Riyadh, Caribbean, Abuja, and Viña del Mar. These datasets pro-

vide empirical evidence on the enforcement of regulatory standards in relation to vessels calling at ports within the respective regions. Due to their cross-sectional nature, they also allow for the identification of differences in enforcement with respect to flag states and recognised organisations (ROs) responsible for supervision. At the same time, PSC reports constitute one of the most detailed available sources for analysing the practical implementation of regulations at the global level. However, they do not provide a fully comprehensive picture, as not all regions are covered by MoU frameworks, and some countries (such as the United States) operate separate inspection systems (e.g., the Coast Guard) based on different institutional arrangements.

Third, the analysis incorporates industry and private sector reports on maritime labour markets, including publications by BIMCO and ICS—non-governmental organisations representing shipping industry stakeholders—as well as studies conducted by Drewry, a private maritime consultancy. These sources provide insights into market conditions, labour supply and demand, and structural characteristics of the sector, reflecting the role of private and industry actors in knowledge production.

Fourth, the study considers qualitative research findings and reports addressing seafarers' working conditions and their experiences with the implementation of the MLC, including reported barriers to lodging complaints. These sources capture the perspective of actors directly affected by the regulatory framework and allow for the identification of discrepancies between formal standards and practice.

Altogether, these diverse data sources reflect multiple dimensions of the hybrid governance system, combining public regulatory data, delegated and private oversight mechanisms, and experience-based evidence. Their triangulation enables a more comprehensive analysis of both formal institutional arrangements and their practical functioning.

3.4. Analytical Procedure

The analysis was conducted in three stages. First, the institutional structure of the MLC governance system was reconstructed based on legal and institutional documents. This stage focused on identifying the key regulatory actors, levels of governance, and formal responsibilities within the regulatory framework governing labour in the maritime sector.

Second, empirical data derived from inspection statistics, industry reports, and survey-based studies were analysed in order to identify discrepancies between formal regulatory standards and practices observed in the maritime labour market.

Third, the identified discrepancies were interpreted using the analytical framework of institutional gaps (vertical, horizontal, and perceptual). This stage aimed to explain how the complexity of the regulatory structure may

facilitate mechanisms of regulatory arbitrage and contribute to the uneven implementation of labour standards across jurisdictions.

4. Maritime Governance and Enforcement Structures

Maritime regulation is global in rule-making but decentralised in implementation and enforcement. Core standards are formulated primarily at the international level by the International Maritime Organization (IMO) and, in the field of labour, by the International Labour Organization (ILO), whereas responsibility for implementation and supervision rests largely with individual states. In practice, this responsibility is tied mainly to vessels registered under a state's flag. The result is a multi-level and polycentric governance system in which regulatory standards are established globally, further developed regionally, and enforced nationally and operationally (Roe, 2009, 2013a, 2013b). While this structure increases regulatory reach and flexibility, it also fragments responsibility and contributes to variation in enforcement practices across jurisdictions. Trade and investment relations between China and other industrialized nations have been put into question. As the key infrastructure of trade, shipping is a source of economic and political power in the global economy. Shipping is key for economic development and the facilitation of economic globalization. Shipping and naval superiority also play a role in power projections by states in the international arena. This is complicated by the fact that shipping services are a market with an ill-defined jurisdictional paradigm, its own dynamics of wealth creation, peculiar firm competition, and its own crisis tendencies. Global political conflicts have reflected on to the shipping industry on several occasions, closures in the Suez Canal or strikes in ports represent instances of the interrelation between political economy and shipping markets.

From an institutional perspective, such a governance structure generates substantial coordination and transaction costs. The dispersion of competences across global, regional, national, and operational levels makes it difficult to ensure consistent monitoring and accountability. At the same time, because decisions regarding flag choice and organisational arrangements remain largely in the hands of shipowners or ship managers, firms may respond strategically to differences in enforcement environments. This creates structural conditions for regulatory arbitrage, as economic actors may select jurisdictions and institutional arrangements that minimise compliance and monitoring costs. The tension between globally standardised rule-making and decentralised enforcement is therefore not incidental, but one of the defining characteristics of maritime governance and an important source of uneven regulatory outcomes.

A further characteristic of maritime governance is the coexistence of public, delegated, and market-based enforcement mechanisms. Flag State

Control (FSC) and Port State Control (PSC) constitute the two main public enforcement channels, but they are complementary rather than fully integrated in search of cheaper crews, have recruited ‘crews of convenience’ from developing nations. This paper examines the record of FOCs to analyse the effects of globalisation upon the working lives of seafarers. The method used will be to compare the regimes of FOCs, and this will be done by the analysis of a flag state conformance index (FLASCI). PSC frameworks were developed largely to compensate for weaknesses in flag state oversight, yet their effectiveness varies across regions (International Labour Organization, 2022a; International Labour Organization, 2022b). In parallel, recognised organisations (ROs), including classification societies and certification bodies, perform supervisory and certification functions on behalf of states, thereby expanding enforcement capacity while also creating principal–agent problems and potential conflicts of interest (Van Leeuwen, 2015). Alongside these delegated mechanisms, private vetting and rating systems may exert even more immediate economic pressure, as negative inspection outcomes can directly affect access to cargo, contracts, or insurance (Büthe, 2010; Knapp et al., 2011; Knapp & Franses, 2006). I introduce a conceptual model “beyond supply and demand,” which distinguishes three major subsets of stakeholders of global private regulation, which may (but need not). In this sense, maritime governance can be described as a fragmented but dense regulatory environment in which high formal regulation coexists with uneven enforcement and multiple, partly competing, compliance incentives (Van Leeuwen, 2015).

Figure 1 synthesises this institutional architecture by showing how public authorities, recognised organisations, private regulatory intermediaries, maritime business actors, and ships and crews are connected across global, regional, national, and operational levels. The figure also visualises the main channels through which regulatory influence, delegated authority, control, and enforcement are transmitted, thereby clarifying why institutional fragmentation is not accidental but structurally embedded in the governance of maritime labour.

5. The Maritime Labour Convention (MLC) as a Regulatory System

The Maritime Labour Convention (MLC) establishes global minimum standards for working and living conditions at sea and constitutes a central component of the international regulatory framework governing maritime transport (International Labour Organization, 2022; International Labour Organization, 2025). Its near-universal ratification implies that the Convention provides a broadly harmonised formal foundation for labour protection across the global fleet.

The MLC should be understood as a transnational regulatory system whose formal harmonisation operates within a fragmented maritime labour market. Its near-universal reach does not eliminate the institutional constraints created by dispersed employment chains, uneven bargaining power, and differentiated enforcement environments. Labour supply, ship ownership, fleet management, and ship registration are frequently distributed across different jurisdictions, which weakens the direct link between regulatory authority and economic control. In such a setting, the effectiveness of labour protection depends not only on the existence of harmonised standards, but also on how those standards are implemented and enforced across fragmented institutional environments.

Table 1 provides background on structural imbalances in the maritime labour market, showing the persistent shortage of officers alongside the recurrent surplus of ratings. These imbalances matter institutionally because they shape bargaining power and the distribution of compliance pressures across occupational groups. Table 2 complements this picture by illustrating the geographical dispersion of labour supply, ship ownership, management, and registration. Taken together, the two tables show that the labour market governed by the MLC is not only global but also organisationally disaggregated, which complicates accountability and weakens the direct connection between regulation and control.

The implementation of the MLC therefore takes place through a combination of public, delegated, and market-based mechanisms. At the international level, the Convention establishes global standards; at the national level, these standards are transposed into domestic legal and administrative systems and enforced primarily by flag states; at the regional level, additional layers of coordination or harmonisation may further shape implementation; and at the operational level, compliance is mediated by port inspections, certification systems, and organisational practices aboard ships. This means that the MLC does not function as a single, uniform enforcement mechanism, but rather as a network of interconnected structures operating under different incentive systems and varying enforcement capacities. As a result, the ship and its crew become the operational site at which formally harmonised standards may still fail to produce consistent outcomes.

Read together with Figure 1, the MLC should therefore be understood not simply as a set of labour standards, but as a regulatory system whose effectiveness is shaped by the broader governance architecture of global shipping. Differences in supervision intensity, inspection practices, flag-state capacity, and delegated oversight create space for strategic jurisdictional and organisational choices. This is precisely why formally harmonised rules may coexist with uneven enforcement outcomes and why the Convention provides a useful case for analysing institutional gaps and regulatory arbitrage.

6. Institutional Gaps in the Implementation of the Maritime Labour Convention (MLC)

6.1. Analytical Foundations in Institutional Theory

Building on the theoretical framework presented in Section 2 and the governance structure outlined in Sections 4 and 5, the MLC can be interpreted as a formally harmonised but operationally differentiated institutional system. Its implementation depends on the interaction between global standards, decentralised enforcement mechanisms, transaction costs, and the strategic behaviour of regulated actors. In such a system, institutional effectiveness is shaped not only by the content of rules, but also by the consistency of monitoring, the credibility of sanctions, and the alignment between regulatory authority and economic control. Figure 1 provides a schematic representation of this logic by locating the main governance actors across levels and by identifying the points at which vertical, horizontal, and perceptual gaps emerge. The figure is therefore not merely illustrative; it functions as the analytical bridge between the formal structure of the MLC and the empirical patterns of uneven enforcement examined below.

6.2. Empirical Asymmetry as an Indicator of Enforcement Failure

Inspection data from Port State Control (PSC) regimes operating under regional Memoranda of Understanding (MoUs) reveal a broadly consistent pattern: relatively high rates of MLC-related deficiencies coexist with comparatively low and unevenly reported detention rates (Abuja MOU, 2024; Black Sea MOU, 2025; Caribbean MOU, 2024; Viña del Mar Latin American Region, 2025; Indian Ocean MOU, 2025; Mediterranean MOU, 2024; Paris MOU, 2025; Riyadh MOU, 2024; Tokyo MOU, 2025).

Table 3 summarises this pattern across selected PSC regimes. Although the exact degree of comparability is limited by differences in reporting practices and aggregation methods, the overall picture remains clear. In 2024, MLC-related deficiencies accounted for between 2.32% and 22.36% of all deficiencies reported across the nine PSC regimes, with an average of 12.44% and a median of 11%. By contrast, the share of detentions explicitly linked to MLC-related deficiencies ranged from 0.3% to 2.05%. However, this category was not reported in four PSC regimes, so the detention data should be treated as incomplete rather than as evidence of the absence of such cases. For the available observations, the average share of MLC-related detentions was 0.96%, with a median of 0.7%. Taken together, these figures indicate that labour-related deficiencies are identified relatively frequently, whereas deten-

tions — the enforcement measure most closely associated with immediate economic cost — remain limited and unevenly reported across jurisdictions. This asymmetry is central to the article's argument, because it suggests that the MLC operates more effectively as a detection and monitoring system than as a consistently deterrent enforcement regime.

6.3. Vertical Gaps: Multi-level Fragmentation and Jurisdictional Mobility

As shown in Figure 1, vertical gaps emerge where regulatory authority and economic control are distributed across different governance levels. Although MLC standards are formally harmonised, their implementation depends on national legal systems, administrative capacities, and enforcement practices. As shown in Table 2, key maritime functions — labour supply, ship ownership, fleet management, and registration — are distributed across multiple jurisdictions, resulting in a separation between regulatory authorities and economic activities (Lloyd's Register, n.d.; UNCTAD, n.d.). This fragmentation increases jurisdictional mobility and enables actors to select regulatory environments that minimise compliance costs. From a transaction cost perspective, differences in enforcement intensity across levels create incentives for jurisdictional choice. Shipowners may select flag states and regulatory environments that reduce regulatory and enforcement costs, thereby engaging in regulatory arbitrage without formally violating legal rules. Even where additional layers of harmonisation are introduced, as in the European Union, their practical effect remains limited because enforcement continues to be decentralised and the organisational structure of shipping allows firms to circumvent more demanding regulatory environments through jurisdictional and contractual choices (EMSA, n.d.). The experience of shipping controlled or managed by EU-based actors therefore suggests that formal harmonisation alone is not a sufficient solution: as long as firms retain the ability to reorganise registration, management, and operational arrangements across jurisdictions, regulatory convergence does not necessarily translate into more effective implementation of the Convention.

6.4. Horizontal Gaps: Heterogeneous Enforcement Environments

As indicated in Figure 1, horizontal gaps emerge among actors operating at the same level but under different enforcement logics. In the case of the MLC, this concerns differences among PSC regimes, flag states, recognised organisations, and private inspection systems. PSC data reveal substantial variation in inspection intensity, deficiency patterns, and detention outcomes across different MoU regions.

This variation is further complicated by differences in data availability and reporting standards, including the partial or absent reporting of MLC-specific indicators in some regimes. Additional variation arises from differences between flag states and recognised organisations. Compliance outcomes depend not only on formal rules but also on the institutional environments in which they are enforced, including monitoring practices and organisational procedures.

The delegation of authority to recognised organisations illustrates the implications of hybrid governance. While it reduces the direct enforcement costs borne by states, it introduces principal–agent problems and potential conflicts of interest, as private entities are contracted and remunerated by the firms they regulate. At the same time, market-based mechanisms partially compensate for these gaps. Private inspection and rating systems generate direct economic consequences — such as access to cargo or insurance — thereby increasing the cost of non-compliance. In contrast to public enforcement, these mechanisms often operate continuously and are closely tied to commercial decision-making processes. This creates parallel enforcement environments with varying levels of stringency and credibility.

As a result, regulated actors operate across multiple enforcement contexts characterised by differing probabilities of detection and sanction, thereby reinforcing incentives for strategic behaviour. In such a setting, compliance becomes contingent not only on formal regulatory requirements but also on the relative strength and credibility of competing enforcement mechanisms.

6.5. Perceptual Gaps: Discrepancies Between Formal Compliance and Empirical Outcomes

Figure 1 also highlights a perceptual gap between formal ratification and observed conditions. In the case of the MLC, this gap reflects discrepancies between formal indicators of regulatory success, such as high ratification rates, and empirical evidence of persistent non-compliance (Jensen, 2023; Knapp et al., 2011).

While PSC data indicate frequent labour-related deficiencies, external data sources reveal continuing severe violations, including cases of seafarer abandonment (Sampson & Ellis, 2021). This divergence highlights the distinction between *de jure* compliance and *de facto* outcomes. From an institutional perspective, the formal adoption of regulatory standards reduces legal uncertainty but does not ensure effective enforcement when monitoring and sanctioning mechanisms remain weak or inconsistent. Perceptual gaps therefore expose the limits of formal compliance indicators as measures of regulatory effectiveness.

6.6. Synthesis: Institutional Gaps and Regulatory Arbitrage

The coexistence of vertical, horizontal, and perceptual gaps constitutes a structural feature of the MLC system. Taken together, these gaps reflect the interaction of incomplete institutional design, heterogeneous enforcement capacities, and the tendency of regulated actors to minimise costs (Exarchopoulos et al., 2018). These conditions create an environment in which regulatory arbitrage becomes a rational response. Shipowners may exploit jurisdictional differences across governance levels as well as variation within the same level, while weak enforcement reduces the expected cost of non-compliance (Alderton & Winchester, 2002; Knapp et al., 2011; Roe, 2013a).

As a result, the MLC system operates as a formally coherent but operationally fragmented institutional framework. It is capable of detecting labour-related issues but is less effective in ensuring consistent enforcement of compliance (Wu & Winchester, 2005). In this sense, institutional gaps should be understood not merely as implementation failures, but as structural conditions that lower the expected cost of non-compliance and thereby create space for regulatory arbitrage.

7. Discussion

The findings of this study suggest that the MLC should be understood less as a weak regulatory instrument than as a normatively strong but institutionally under-deterrent system. Its limitations do not result primarily from insufficient regulatory harmonisation, but from the interaction between fragmented governance structures, uneven enforcement capacities, and incentive environments that do not consistently impose high costs on non-compliance. This interpretation adds to the literature by showing that the persistence of labour-related deficiencies in shipping is not simply a matter of administrative weakness, but a structural feature of a multi-level regulatory system in which formal coherence coexists with operational fragmentation.

This also helps explain why public enforcement mechanisms and market-based controls may generate different compliance effects. While PSC regimes are effective in identifying a substantial number of labour-related deficiencies, private and market-based mechanisms may, in some contexts, impose more immediate and credible economic consequences. The analysis therefore suggests that the effectiveness of maritime labour regulation depends not only on the presence of public standards, but also on how different enforcement environments shape the expected costs of non-compliance.

More broadly, the article shows that Figure 1 is analytically consistent with the empirical evidence summarised in Table 3. The model predicts that

fragmented authority, delegated oversight, and multiple enforcement environments should weaken deterrence and create opportunities for strategic adaptation. The PSC evidence does not prove every causal mechanism directly, but it is consistent with this theoretical expectation: non-compliance is frequently detected, yet its translation into costly sanctions remains limited and uneven.

7.1. Limitations

This study has several limitations. First, the analysis relies primarily on PSC data, which serve as a proxy for enforcement effectiveness but do not capture all forms of non-compliance, particularly those that remain undetected or unreported. PSC inspections provide a snapshot of compliance at the time of inspection and may not fully reflect ongoing or concealed labour practices.

Second, the observed discrepancy between deficiencies and detentions may partly reflect the nature and severity of violations, as not all deficiencies justify the application of the most stringent enforcement measures. This implies that detention rates should be interpreted cautiously as indicators of enforcement intensity, rather than as direct measures of overall non-compliance.

Third, the study focuses on formal institutional arrangements, while informal institutions — such as cultural norms, organisational practices, and power relations — are not directly measured, despite their likely influence on compliance outcomes (Bhattacharya & Tang, 2013; Carey, 2017; Cui et al., 2025; DeAngelo, 1981; Fotteler et al., 2018; Gekara & Sampson, 2021; Hashim & Nasruddin, 2018; Helmke & Levitsky, 2004; Turgo, 2024; Wu & Winchester, 2005).

Fourth, firms' regulatory strategies, including flag choice, are shaped by a broader set of cost factors beyond labour standards, such as taxation, administrative requirements, and operational considerations (Alderton & Winchester, 2002; Ford & Wilcox, 2019; Goulielmos, 1998; Kovats, 2006; Li, 1999; Sletmo & Hoste, 1993; Thanopoulou, 1998; Toh & Phang, 1993; Zhang & Drumm, 2020) in search of cheaper crews, have recruited 'crews of convenience' from developing nations. This paper examines the record of FOCs to analyse the effects of globalisation upon the working lives of seafarers. The method used will be to compare the regimes of FOCs, and this will be done by the analysis of a flag state conformance index (FLASCI).

Finally, the empirical analysis is constrained by heterogeneity in PSC MoU reporting practices, including differences in formats, levels of aggregation, definitions, and thresholds. For this reason, the results should be interpreted as indicative of broader systemic patterns rather than as exact measures of cross-regional equivalence.

8. Conclusions

This study shows that the MLC is normatively strong but institutionally under-deterrent. Its limitations do not stem from the absence of labour standards, but from the system's limited capacity to translate the detection of non-compliance into sufficiently high, credible, and consistent sanctions. As a result, the Convention reduces formal uncertainty and establishes a common regulatory baseline, but does not always ensure uniform enforcement outcomes across jurisdictions.

The identified vertical, horizontal, and perceptual institutional gaps reflect both the fragmented governance structure of the maritime sector and the diversity of enforcement environments. Figure 1 captures the structural dimension of this problem, while Table 3 demonstrates its empirical manifestation in the asymmetry between detection and sanctioning. Read together, the model and the data support the conclusion that the main weakness of the MLC lies not in standard-setting, but in the institutional environment through which compliance is monitored and enforced.

From a policy perspective, improving the effectiveness of the MLC requires more than further expanding formal standards. What is needed is a stronger enforcement environment: greater consistency across governance levels, more credible sanctioning mechanisms, and better alignment between public supervision and the economic incentives facing regulated actors. In this sense, the future effectiveness of maritime labour regulation will depend less on the formal proliferation of rules than on the capacity of governance systems to make compliance more credible, more predictable, and more costly to evade. This challenge is likely to intensify in the context of the ongoing digital and green transformation of shipping, which may generate new forms of operational, psychosocial, and safety-related burden for ship crews.

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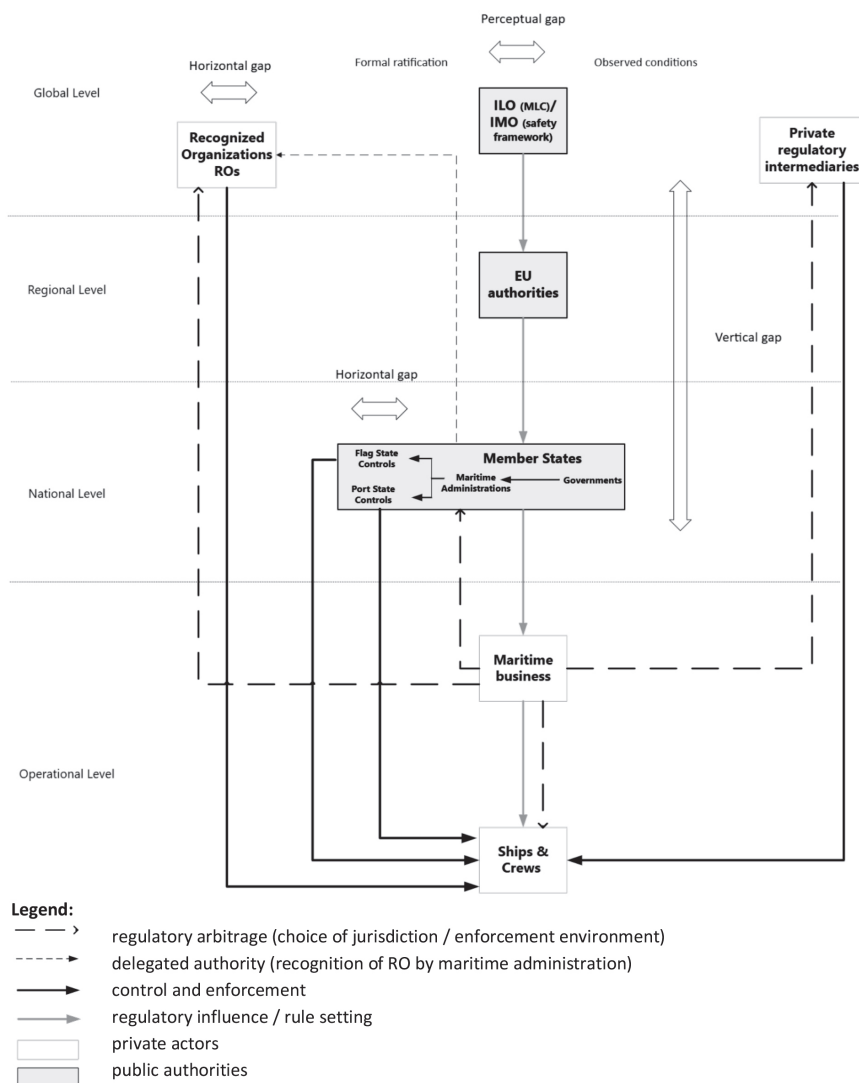
Appendix

Table 1. Labour Market Imbalances for Officers and Ratings (Selected Years)

Year	Officer shortage		Ratings surplus
	BIMCO/ICS	Drewry Maritime Research	BIMCO/ICS
2005	- 10,000	N/A	+135,000
2010	- 13,000	- 29,800	0
2015	- 16,500	- 22,000	+119,000
2020	- 26,240	- 20,450	+37,640
2025	N/A	-39,754	N/A

Source: Own elaboration based on BIMCO/ICS (2021) and Drewry Maritime Research (2024).

Figure 1. Multi-Level Governance and Institutional Gaps in Enforcement of the Maritime Labour Convention (MLC)



The figure illustrates the multi-level governance structure of the MLC and identifies vertical, horizontal and perceptual gaps in enforcement. It highlights the interaction between public authorities and private regulatory intermediaries, and demonstrates how fragmented enforcement environments contribute to regulatory arbitrage.

Source: Author's own elaboration based on the analytical framework developed.



Table 2. Top Five Countries in Key Segments of the Global Maritime System (labour supply, ship ownership, management and ship registration)

Seafarers (Labour Supply)		Maritime Business (Market Actors)		Flag States
Officers	Ratings	Shipowners	Ship managers	
Philippines Russia Indonesia China India	Philippines Russia China India Indonesia	Greece China Japan USA Singapore	Cyprus Greece Singapore Hong Kong Germany	Panama Liberia Marshall Islands Bahamas Singapore

Note: Rankings are indicative and based on widely cited industry sources (Lloyd's Register, UNCTAD).

Source: Own elaboration based on Lloyd's Register (various yearbooks) and UNCTAD Stat.

Table 3. MLC-Related Deficiencies and Detentions in Regional PSC Regimes (2024)

	Abuja MOU	Black Sea MOU	Carib- bean MOU	Indian Ocean MOU	Mediterranean MOU	Paris MOU	Riyadh MOU	Tokyo MOU	Viña del Mar
Year	2024								
Number of inspections (rounded to the nearest hundred)	3,200	2,700	400	5,300	6,000	16,500	4,800	32,100	8,900
MLC deficiencies ^a (%)	15.08	18.60	5.00 ^c	22.36	2.32	21.30	11.00	10.57	5.70
MLC detentions ^b (%)	1.41	2.05	N/A	0.37	0.70	N/A	N/A	0.30	N/A

Note: ^aDeficiencies refer to recorded non-compliances requiring correction. ^bDetentions indicate serious deficiencies leading to the temporary immobilisation of a vessel. ^cCaribbean MoU data are aggregated across all IMO instruments and do not allow isolation of MLC-related deficiencies.

Source: Own elaboration based on 2025 PSC annual reports for respective MoU.



The role of local government units in financing the protection and care of monuments

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Abstract

Motivation: As a result of legal modifications, changes have occurred in the management of cultural heritage in Poland. The tasks related to the protection and care of monuments have been decentralized. Currently, they are financed not only by the government sector but also by the local government sector, i.e. municipalities (communes), counties, and voivodeships.

These entities have various financing options for this task: through current or investment funds, as well as through own expenditures or grants allocated to entities outside the public finance sector

Aim: to determine how different types of local government units (LGUs) allocate funds for the protection and care of historic monuments.

Results: The system of financing monument protection in Poland is highly concentrated among large local government units (LGUs): voivodeships and cities with county rights

(CCR). Smaller LGUs, especially rural communes, have limited capacity to finance heritage protection, despite often having many valuable sites in need of support. This structure can lead to underfunding of monuments in rural areas and smaller towns. Over the long term, there has been an increase in total spending on cultural heritage, national and local government policies playing a key role.

Keywords: local government tasks, monument protection, care of monuments, own tasks of municipalities, own tasks of provinces

JEL: H72, H76, Z18, O21

1. Introduction

Monuments can play an important role as “strategic” resources for sustainable local development. A necessary condition is the appropriate conservation of cultural heritage, and the public sector plays a crucial role in this process. According to Barnes (2022, pp. 8–12), there is a negative quadratic relationship (inverted U-shaped) between public expenditure on the protection of cultural and natural heritage and per capita tourism revenues. This means that in the earlier stages of economic development, an increase in expenditure on heritage protection brings an increase in tourism revenues, while in more developed countries these effects decline until reaching a peak, which none of the countries studied has yet reached. The literature has not examined in detail the results of the actions of public entities involved in implementing the policy of protection and care of monuments (Finocchiaro Castro et al., 2011, p. 2). Few studies show a change in the approach of local authorities to culture (expenditures on culture and monuments are often presented together), which is reflected in perception of this sphere of the economy as a potential factor in the development of the commune, rather than an unnecessary budget expenditure (Suchecky, 2019, p. 43).

The evolution of cultural heritage management in Poland, resulting from the decentralization of responsibilities and the partial assignment of these tasks to local government units, has led to the emergence of a new formula for financing the protection and care of historic monuments. This new approach enables local government units to finance these activities in various ways. The identified research gap stems from the fact that although the Act enabling the financing of such activities has been in force for more than 20 years (having been adopted in 2003), no studies have so far examined the scale of these expenditures, the preferred financing schemes, or the differences between the various tiers of local government units—communes, counties and regions—as well as between different types of units within a given tier (rural, urban and urban–rural communes, as well as rural coun-

ties and cities with county rights). This research gap is addressed by the present article. Its aim is to determine how different types of LGUs allocate funds for the protection and care of historic monuments. In line with this objective, the main research hypothesis was formulated: the expenditure on the protection and care of cultural heritage sites differs both in quantitative and structural terms between various types of local government units.

The study distinguishes six types of local government units (description of the Polish local government structure – see Sekuła, 2015, pp. 916–917):

- rural communes (RC),
- urban communes (UC),
- urban-rural communes (URC),
- rural counties (also: rural districts RD),
- cities with county rights (CCR),
- voivodeships (V), also: regions or provinces.

To achieve the research objective, the following methods were used: descriptive statistics to compare the expenditures in the researched period, Kruskal-Wallis analysis to examine expenditure patterns, and single-variable linear regression to assess the impact of budget size on monument protection spending and its competition with other priorities were used. The study covers the years 2014–2023 (with 2014 as the first year of the EU's multiannual budget planning period and 2023 as the last year for which data were available at the time of collection) and includes all local government units. The research utilized data published on the Ministry of Finance website, originating from the Besti@ information system used for submitting financial reports by local government units.

The structure of the article aligns with its objectives and the verification of the research hypothesis, and includes:

- a discussion of the responsibilities of local government units (LGUs) at various levels in monument protection and care; a description of the financing principles for monument protection outlined in current legislation (Section 2).
- the research methodology, descriptive statistics, Kruskal-Wallis analysis for independent samples, and single-variable linear regression (Section 3).
- presentation and discussion of the results (Sections 4 and 5).

The findings address the question of how much and in what way financial resources are allocated by different types of Polish LGUs for monument protection. In practice, these results may assist public authorities in determining whether the current level and methods of funding are sufficient to maintain monuments in good condition.

2. Literature review

2.1. Implementation of tasks in the field of monument protection and care for historic monuments by Polish local government units

Monuments are the most important elements that constitute the tangible cultural heritage. The definition of a “monument” was formulated in the Act on the Protection and Care of Monuments (Act of July 23, 2003). This definition does not require that recording an object in the register of monuments to be recognized as a monument, which was previously the case (Antoszczyzyn, 2017, p. 3).

At the international level, most of the principles and guidelines regarding the treatment of monuments have been developed by two organizations: UNESCO (the United Nations Educational, Scientific and Cultural Organization) and ICOMOS (the International Council on Monuments and Sites) (Ahmad, 2006, pp. 292–300). In international legal documents, the term “monument” is not defined; instead, the broader concept of “cultural heritage” is used.

The Act on the Protection and Care of Monuments incorporated local government units into the monument protection system. The previous Act on the Protection of Cultural Property assigned monument protection tasks exclusively to the central government administration. Currently, the main sources of financing for the protection and care of monuments are the state budget and the budgets of local government units (Ofiarska, 2018, p. 12). Within local government, the difference concerns the scale:

- communes’ tasks, according to the principle of subsidiarity (Geertjes 2023, pp. 291–292), cover issues related to the protection and care of monuments of local significance,
- counties’ tasks also include the protection and care of monuments, but at a supra-commune level,
- the regional (voivodeship) government performs tasks related to the protection and care of monuments of regional significance.

A description of the tasks involving the protection and care of monuments is included in the Act on the Protection and Care of Monuments. The tasks listed there are preceded by the phrase “in particular,” which means that the list is not closed and other activities serving these purposes may also be undertaken.

2.2. The Polish system of financing the protection and care of monuments

Monuments in public space have many functions: artistic, symbolic, commemorative, social, political, religious and marketing (Cudny & Appelblad 2019, p. 286). The analysis of expenditures on monument protection provides information on which local government units contribute to the preservation of cultural heritage and to what extent, utilizing it as a developmental resource. The practice of financing the protection and care of monuments depends on two factors:

1. These are own tasks of municipalities, counties, and regional (voivodeship) governments;
2. The current system of monument financing that is defined in the Act on the Protection and Care of Monuments.

The first issue can be summarized by stating that matters related to culture, including monuments, are own tasks of LGUs, and therefore, their implementation should be financed as much as possible from their own resources. This approach is consistent with the theory of fiscal federalism, which concerns the allocation of functions, revenues, and fiscal relations among different tiers of government. It postulates that each level of local government should have legally assigned and independent sources of revenue, which directly feed their budgets and can be autonomously managed in terms of collection and structure (Sekuła & Basińska, 2016, p. 244). Furthermore, according to public choice theory, excessive public spending may lead to a fiscal crisis, since – as Oudenampsen (2025, p. 4) notes – democracies have “an inherent tendency to overspend,” and “the overload of the state by the demands of interest groups leads to a fiscal crisis.”

The second premise arises from the principles of financing the care of monuments, according to which the holder of a monument (a natural person or an organizational unit with legal title to the monument) is, on the one hand, responsible for its maintenance, but on the other hand, may receive a grant from the commune, county, or regional government for its upkeep. The origin of grants provided from local government budgets for tasks carried out by entities outside the public finance sector should be linked to the EU principle of subsidiarity (Faludi 2015, pp. 23–43).

Expenditures incurred by LGUs for activities related to the protection and care of monuments are classified, from the perspective of their purpose, as either current (related to the ongoing maintenance of the object) or investment (with a developmental purpose). According to the guidelines for the classification of expenditures, they are recorded in the following budget paragraphs:

- §272: targeted grants for financing or co-financing renovation and conservation works on historic objects for entities outside the public finance sector (PFS), e.g., foundations or associations;
- §273: as above, but granted to entities within the PFS e.g., other communes, counties, or voivodeships;
- §434: purchase of renovation and conservation services for historic objects used by budgetary units of communes, counties, and voivodeships;
- §656: targeted grants for financing or co-financing investment tasks for historic objects for entities in the PFS;
- §657: as above, for entities outside the PFS;
- §658: investment expenditures related to historic objects used by budgetary units of municipalities, counties, and voivodeships.

As the analysis of the above § shows, they can be divided according to their nature (current or investment) and the type of entity receiving the funds: entities outside the PFS (mainly third-sector organizations, i.e., associations and foundations) and those belonging to the PFS, further divided into “own” (budgetary units) and other communes, counties, or voivodeships. This classification is illustrated in Table 1.

3. Methods

The aim of the article is to identify how different types of LGUs allocate funds for the protection and care of historic monuments. It is assumed that each type of LGU follows a specific expenditure pattern for monument protection and care. Accordingly, the main research hypothesis states that expenditure on the protection and care of cultural heritage sites differs, both quantitatively and structurally, between various types of LGUs.

To achieve the research objective, the analysis covered all Polish LGUs in the years 2014–2023, with 2014 as the first year of the EU multiannual budget period and 2023 as the last year for which data were available at the time of collection. The study used data published on the Ministry of Finance website, originating from the Besti@ information system, which is used by LGUs to submit their financial reports. Expenditures related to the protection and care of monuments were identified based on the relevant budget classification paragraphs (§272, §273, §434, §656, §657, §658), distinguishing between current and investment spending, as well as between transfers to entities inside and outside the public finance sector.

Six types of LGUs were analysed: rural communes (RC), urban communes (UC), urban–rural communes (URC), rural counties (RD), cities with county rights (CCR) and voivodeships (V). The analysis was conducted in two dimensions: the absolute value of expenditures on monument protection and care, and their share in LGU budgets. This made it possible to compare both

the scale and the relative priority of heritage-related spending across LGU types.

The empirical strategy combined descriptive and inferential methods commonly used in studies of cultural activities and public sector expenditures, as reflected in the literature (Logan VanBlarcom & Kayahan, 2011; Sodangi et al., 2015; Prieto Ibáñez et al., 2017; Hailemeskel Teshome Abebe, 2019; Mekonnen et al., 2022; Tahoon et al., 2024; Hatice et al., 2024). These studies utilized quantitative analysis (descriptive statistics, budget analysis, comparative analysis), supplemented by correlation analysis and economic indicators. Linear regression was the dominant method for modeling the economic aspects of monument protection, although it often yielded low R^2 values ($<40\%$) due to the complexity of socio-economic factors. Analysis of variance was mainly used for the preliminary verification of hypotheses regarding the impact of categorical variables (e.g., type of LGU) on the condition of monuments.

In the methodology applied in the article, first, descriptive statistics and budget analysis were applied to characterise the level and structure of spending on monument protection and care across LGU types and over time.

In the next step, non-parametric methods were applied to compare expenditures on monument protection and care between LGU types. The distributions of both expenditure levels and budget shares were highly skewed and displayed heteroscedasticity across groups. Therefore, the Kruskal-Wallis test for independent samples was used as a rank-based test that does not require normality or homogeneity of variances (Schmidt et al. 2017, Montalto et al. 2019). When the global Kruskal-Wallis test indicated statistically significant differences between LGU types, post-hoc pairwise comparisons were conducted using Dunn's test with appropriate multiple-comparison adjustment (Dunn, 1964). To complement significance testing, effect sizes were reported using Glass's rank biserial correlation coefficient (Glass, 1965), which facilitates the interpretation of the substantive magnitude of differences between selected LGU categories.

Finally, single-variable linear regression (Fisher, 1922) was used to assess the impact of LGU budget size on expenditures related to monument protection and care, both in absolute terms and as a share of total spending. The choice of a single-variable rather than a multivariable regression model was deliberate. The primary aim was to identify the marginal effect of budget size on heritage-related expenditures and to present results that remain comparable across all types of LGUs. Including a broader set of socio-economic covariates would likely generate high multicollinearity and low, unstable R^2 values—an effect frequently reported in empirical studies on cultural and heritage-related spending (e.g. Vanblarcom & Kayahan, 2011). In line with the broader methodological literature (Gelman, Hill, 2006; Long, Freese 2006), which emphasises that modest coefficients of determination are typical and acceptable in complex social-science settings as long as effect directions and significance are interpretable, single-variable linear regression

was adopted as a transparent tool to capture the relationship between LGU budget size and both the scale and structure of expenditures on monument protection and care.

4. Results

In the period 2014–2023, both investment and current expenditures of the local government subsector on monument care were highly unstable (Chart 1). Expenditure trajectories do not follow a smooth trend but rather a sequence of expansions and contractions, which reflects the combined impact of economic conditions, legal changes and evolving funding mechanisms. Periods of accelerated spending coincide with increased availability of external support and special programmes dedicated to cultural heritage (mainly in 2018–2019 and 2021–2022, such as the Government Program for the Restoration of Monuments), whereas periods of fiscal consolidation or regulatory tightening are associated with marked slowdowns in outlays on monuments.

A particularly strong driver of this volatility was the changing availability of central government programmes targeted at heritage protection. When local government units (LGUs) could access sizeable investment schemes (e.g., through programs like Monument Restoration or regular competitions by the Ministry of Culture and National Heritage) – especially in 2018–2019 and 2021–2022 – investment expenditures on monuments increased sharply, in some cases by close to 100% year on year in 2018 and by around 75% in 2021. These funds were primarily channelled into major renovation projects and cultural infrastructure, such as comprehensive restoration of historic buildings or the adaptation of heritage sites for cultural and tourism functions. In contrast, in years with fewer external calls or more restrictive fiscal conditions, investment expenditures declined, sometimes quite abruptly. This pattern indicates that investment in monument protection is highly sensitive to programme-based financing and cannot be regarded as a stable, routine component of local investment policies.

Current expenditures on monument care also exhibited considerable fluctuation, although the mechanisms behind these changes were partly different. While external programmes play a role, current spending is more closely linked to LGUs' own revenues and their prioritisation of ongoing maintenance tasks relative to other statutory responsibilities. Over the decade, despite temporary increases in some years, current expenditures in 2023 remained roughly one third below the level recorded in 2014. This suggests that the capacity of LGUs to fund routine conservation activities, such as minor repairs, basic maintenance or smallscale restoration works, has diminished in relative terms, even as investment projects experienced episodic boosts.

Regulatory changes further contributed to these dynamics. The tightening of tax relief provisions for monuments as of 2023, which restricted eligible expenditures and postponed tax deductions until the completion of investments (Błaszczuk et.al., 2023), reduced the financial attractiveness of undertaking new conservation projects for private owners and investors. As a result, fewer applications for LGU grants were submitted, and the pipeline of cofinanced projects shrank. At the same time, organisational factors – including delays in announcing and resolving grant competitions, complex application procedures and uncertainty about future programme continuity – created additional frictions that translated into postponements or cancellations of planned works. Finally, fluctuations are also influenced by exceptional and one-off factors, such as the 100th anniversary of Poland's independence in 2018, when a record increase in expenditures was observed, and the COVID-19 pandemic, which caused a decline in expenditures in 2020. Taken together, these factors underscore the vulnerability of heritage protection to regulatory and administrative changes, especially when local spending heavily depends on cofinancing arrangements with private actors.

The distribution of expenditures by LGU type reveals a clear and persistent concentration of funds in larger units, above all voivodeships and cities with county rights (CCR). When aggregate expenditure over 2014–2023 is considered, communes (municipalities) record the highest total spending simply because they are the most numerous group. Communes incurred the highest total expenditures – PLN 924 million in the analyzed period, representing a share of 45% of all expenditures. Counties allocated PLN 650 million for this purpose, while voivodeships spent PLN 454 million, as shown in Chart 2. However, when expenditures are examined at the level of LGU types rather than individual units, voivodeships and CCR emerge as the main drivers of heritage funding. Voivodeships, starting from marginal amounts in 2014, steadily increased their investment and current expenditures, reaching a peak of nearly 94 million PLN in 2022 before experiencing in 2023 a decline to PLN 57.5 million representing a 39% reduction compared to the previous year. CCR also maintained a high and relatively stable level of involvement, particularly in investment categories.

Counties, especially rural counties, occupy an intermediate position. They allocated substantial sums to monument protection, but their role weakened in the later years of the period analysed, with a noticeable decline after 2018. Counties peaked in expenditures in 2018 (PLN 128 million), after which their involvement began to decline sharply, particularly in 2023, when expenditures dropped by about 39%.

Rural and urban communes, in turn, operate on much smaller budgets and dedicate comparatively lower amounts to heritage, even though they are responsible for a large share of the territory and numerous smaller heritage sites. This configuration leads to a situation in which the financial effort de-

voted to monument protection is strongly concentrated in a relatively small group of large, fiscally stronger LGUs.

Differences in heritage protection expenditures between large LGUs, such as voivodeships or cities with county rights, and smaller ones, particularly rural communes, have not only a statistical dimension but also tangible economic consequences. Smaller units often face budgetary constraints that prevent them from providing adequate funding. This, in turn, leads to the deterioration of conservation conditions and may weaken their developmental and tourism potential, and as the research results by Kostakis and Sarantis (2024, pp. 1231–1234) indicate, the development and exploitation of cultural heritage resources contribute to economic growth, with a greater impact visible in lower-income regions, which can lead to reducing interregional development disparities. Actions improving the quality and standard of heritage constitute an effective instrument of regional development policy.

2018 marked a turning point for all governance levels that recorded record-high or very high expenditures on monument protection. This was linked to the centennial celebration of Poland's independence, which brought additional funds for heritage restoration. In subsequent years, especially after 2020, the impact of external factors became evident, such as the COVID-19 pandemic, budgetary constraints, and changes in financing systems and the availability of EU funds.

The unequal distribution of resources is visible not only in total expenditure, but also in the structure of spending across individual budget paragraphs (Table 1; see Section 3 for details of the statistical tests). High-value projects and grants to nonpublic entities, particularly in paragraphs such as §657 (investment transfers to entities outside the public finance sector), are dominated by CCR and voivodeships. These units are able to support large-scale investments by foundations, associations, parishes or other nonpublic owners of monuments, often cofinancing extensive renovation or modernisation works. In contrast, rural communes and rural counties allocate far smaller amounts in these categories, which reflects both their limited fiscal capacity and the difficulty of mobilising matching funds for sizeable projects in less affluent areas.

Even in categories where rural communes appear to have relatively high shares – for example, in current grants to entities outside the public finance sector (§272) – the underlying amounts remain modest in absolute terms. This means that, despite a certain degree of engagement, the scale of support offered by small LGUs to local heritage owners is limited. Many necessary conservation works either do not receive funding at all or are implemented only partially, which can lead to a gradual deterioration of heritage assets, especially in smaller towns and rural areas. By contrast, CCR and voivodeships, with greater fiscal space and easier access to external programmes, can undertake large projects that substantially improve the condition and

attractiveness of key monuments. CCR and voivodeships dominated in terms of expenditure values, achieving the highest average ranks. For example, the average rank of current expenditures in voivodeships is as high as 6,284.89, while in rural communes it is only 2,642.71.

An analysis of the expenditure structure by their nature and by the entity ultimately responsible for implementing the task showed that the share of communes is significantly higher in each §, while the lowest shares of expenditures are in voivodeships. The effect size (r) between the extreme groups ranges from moderate to strong, which highlights significant disparities in the financial priorities of these units.

The pattern is similar in current and investment expenditures within the public sector. Paragraphs such as §273 and §434, which capture current grants and purchases of services for entities within the public finance system, show relatively higher shares for rural communes and rural counties in some cases, reflecting their responsibility for maintaining historic properties they own or manage directly. However, when total amounts are considered, voivodeships and CCR still dominate. Investment expenditures within the public sector (§656 and §658) are particularly concentrated in these larger units, where major modernisation and renovation projects are typically co-ordinated. In effect, the ability to undertake extensive, capitalintensive interventions in heritage is closely tied to LGU size, administrative capacity and fiscal strength.

The analysis of the relationship between monumentrelated expenditures and total LGU budgets reinforces this conclusion (Tables 2–3; see Section 3 for details of the statistical tests). In voivodeships and CCR, the association between total expenditures and spending on monuments is strong and positive, especially in key paragraphs such as §272 and §657. As overall budgets grow, allocations to heritage tend to increase as well, indicating that in these units heritage protection is woven into broader development and investment strategies. In rural and urban communes, the relationship is weaker and more uneven across expenditure categories. Even in years of budgetary expansion, increases in heritage spending are often modest, as additional resources are absorbed by other pressing priorities, including social services, infrastructure and education.

The role of education expenditures as a potential competitor for funds is generally limited at the aggregate level (see Tables 4–5 and Section 3 for details). For most LGU types, the relationship between the share of education in total expenditures and spending on monuments is weak or statistically insignificant. In CCR, a significant negative relationship between the share of education expenditures and expenditures on monuments was most often observed, especially in the main spending categories (§ 272, § 434, § 657), although the strength of this effect varied. In counties, an increase in the

share of education expenditures is usually associated with a reduction in funds for monuments; however, this effect is clear and statistically significant only in selected categories (particularly § 656 and § 658, which are investment §). In the case of communes, and especially in city counties, their own revenues are an important source of local funding for education (Guziejewska & Majdzińska, p. 535), which in turn means fewer resources available for monument protection. In other cases, the effect is weak or insignificant. In voivodeships, the relationship is ambiguous. This suggests that in larger urban units, where education systems are extensive and costly, discretionary room for additional spending on heritage can become constrained when education absorbs an increasing proportion of the budget. In rural communes and urban–rural communes, isolated statistically significant relationships appear, but their magnitude is small and does not point to a systematic tradeoff.

Overall, the empirical evidence indicates that the system of financing monument protection in Poland is characterised by two interrelated features: a high concentration of resources in voivodeships and cities with county rights, and substantial volatility of spending over time. Smaller LGUs – particularly rural communes and rural counties – face structural disadvantages that limit their ability to maintain and develop their heritage base. Their fiscal capacity is weaker, their dependence on external programmes is stronger, and the competition between heritage protection and other statutory tasks is more acute. As a result, they are less able to plan and implement longterm, multistage conservation strategies and to react quickly to emerging needs, such as urgent repairs or opportunities to adapt monuments for new uses.

From a policy perspective, these findings have several implications. First, the observed volatility suggests that heritage protection should not rely exclusively on timelimited programmes and ad hoc initiatives. More stable and predictable funding instruments are needed, especially for routine maintenance and smallerscale projects, which are crucial for preventing irreversible damage to historic fabric. Second, the strong concentration of funds in voivodeships and CCR highlights the need to address territorial imbalances. Without targeted mechanisms that support rural and smalltown LGUs – for example, dedicated grant schemes with higher cofinancing rates for financially weaker units, or technical assistance to help them prepare and implement projects – the existing disparities in conservation capacity are likely to widen. Finally, the results underline the importance of integrating heritage considerations into broader debates on fiscal equalisation and local government finance. If heritage protection continues to be treated as a noncore, discretionary task, smaller LGUs will remain structurally disadvantaged in this field, and many monuments outside major urban centres may gradually lose their cultural and developmental value.

5. Conclusion

The aim of the article was to determine how different types of LGUs allocate funds for the protection and care of historic monuments. The results of the analysis covering the years 2014–2023, together with the conclusions drawn on its basis, indicate that the aim of the study was achieved. The authors hypothesized that the expenditure on the protection and care of cultural heritage sites differs both in quantitative and structural terms between various types of local government units.

Based on the analyses, the following conclusions were formulated:

1. Expenditure on protection and care of monuments in the analyzed period was not stable – significant fluctuations resulted from the availability of external funds (e.g. government programs), legal changes (e.g. restrictions on tax relief for monuments from 2023), organizational factors (delays in grant competitions, complicated procedures) and extraordinary circumstances (celebrations of the 100th anniversary of regaining independence, Covid-19 pandemic).
2. There was a significant relationship between the type of LGU and the entity (located in the public sector or outside it) that ultimately spends the funds, with a clear predominance of large units – voivodeships and cities with county rights. Investment support non-public entities is also strongly concentrated in urban environments. Rural communes, even if there are monuments on their territory, are not able to provide an appropriate level of support from their budgets.
3. In the analyzed period, the role of voivodeships increased while the share of counties decreased and the involvement of communes remained stable. The analysis showed significant differences in the structure and amount of expenditure on monuments between types of LGUs. Voivodeships and CCR dominate both current and capital expenditure, mainly due to larger budgets and large projects. This means that the system of financing the protection of monuments in Poland is subsidiary in nature.
4. Smaller LGUs are more dependent on external support, which makes the system sensitive to changes in central or provincial policy, and also limits their independence in implementing monument protection tasks.
5. The size of the LGU budget is a significant factor determining expenditure on monuments, especially in large units (voivodeships, cities with county rights). The relationship between education and monuments expenditure is weak or insignificant in most LGUs, with the exception of cities with county rights, where expenditure on education limits the funds available for monuments.

6. Low R^2 values in studies concerning the financing of cultural heritage are characteristic due to the specificity of public data, which often reflect the multidimensionality and incompleteness of information (Eun, 2015; Gelman, Hill, 2007). It is acceptable to acknowledge low coefficients of determination in research models if the statistical model allows for the identification of significant relationships and directions of associations (Gelman & Hill, 2007; Freese, Peterson, 2017).

The obtained results allowed for the verification of the research hypothesis and the statement that the expenditure on the protection and care of cultural heritage sites differs both in quantitative and structural terms between various types of local government units, i.e. the recognition that the hypothesis has been confirmed.

The obtained results constitute a useful tool for public authorities in assessing and improving the management of the monument protection system and as an instrument for allocating financial resources. Central authorities, when modifying the system of financing local government, should take into account in particular the role of voivodeships and CCR in financing the protection of monuments, as well as the problems of rural communes in implementing this task. In the case of heritage sites of exceptional cultural value located within their territory, public policy should aim to ensure that their protection and care are financed from central government funds. This financing should not be dependent on the political parties in power and should not restrict the autonomy of local governments.

Limitations

A limitation of the study, which may have affected the results obtained, was that it considered only the expenditure side of local government budgets. An analysis of the revenue sources allocated to the protection and preservation of monuments would make it possible to identify the origin of the funds that communes, counties, and voivodeships spend on heritage protection. In other words, to determine whether internal sources (own revenues) or external ones — such as the state budget, the EU budget, or transfers from other LGUs — predominate. Further research is planned to incorporate these variables.

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Appendix

Table 1. Classification of expenditures incurred on historic objects under Polish law

Classification of Expenditure by Paragraph	Belonging to the Public Finance Sector			
	Yes		No	
	"Own" budgetary unit	Other public finance sector unit		
Type of expenditure	Current	§ 434	§ 273	§ 272
	Investment	§ 658	§ 656	§ 657

Source: Own preparation.

Table 2. Kruskal-Wallis test for dependent variables: *value of the expenditures and share of the expenditures*

§Num-ber	Dependent variable: value of the expenditures			Dependent variable: share of the expenditures		
	H statistic	significance (p)	partial effect size	H statistic	significance (p)	partial effect size
272	$H(5) = 1208.29$	< 0.001	$\eta^2H = 0.18$	$H(5) = 1074.41$	< 0.001	$\eta^2H = 0.16$



§Num- ber	Dependent variable: value of the expenditures			Dependent variable: share of the expenditures		
	H statistic	significance (p)	partial effect size	H statistic	significance (p)	partial effect size
273	$H(5) = 98.37$	< 0.001	$\eta^2H = 0.36$	$H(5) = 135.75$	< 0.001	$\eta^2H = 0.51$
434	$H(5) = 119.17$	< 0.001	$\eta^2H = 0.11$	$H(5) = 241.06$	< 0.001	$\eta^2H = 0.24$
656	$H(4) = 19.18$	< 0.001	$\eta^2H = 0.18$	$H(4) = 31.24$	< 0.001	$\eta^2H = 0.37$
657	$H(5) = 220.00$	< 0.001	$\eta^2H = 0.19$	$H(5) = 248.90$	< 0.001	$\eta^2H = 0.22$
658	$H(5) = 84.26$	< 0.001	$\eta^2H = 0.15$	$H(5) = 125.66$	< 0.001	$\eta^2H = 0.26$

Source: own study based on data from the Besti@ database for the years 2014–2023.

Table 3. Results of the analysis using Dunn's method and Glass's rank biserial correlation effect size coefficient

§Number	dependent variable: value of the expenditures			dependent variable: share of the expenditures		
	LGU with the highest share (Mrank)	LGU with the lowest share (Mrank)	Effect size (r)	LGU with the highest share (Mrank)	LGU with the lowest share (Mrank)	Effect size (r)
272	V(6284.89)	RC(2642.71)	V>RC ($r = 0.35$)	RC(3451,45)	V(1203,85)	RC vs V: $r = 0.54$
273	V(186.44)	RC(79.86)	V>RC ($r = 0.57$)	RC(206,38)	CCR(52,94)	RC vs CCR: $r = 0.83$
434	CCR(741.52)	RC(457.24)	CCR>RC ($r = 0.43$)	RC(598,03)	V(88,07)	RC vs V: $r = 0.62$
656	CCR(60.31)	RD(21.25)	CCR>RD ($r = 0.73$)	URC(62,2)	V(26,53)	URCvsV: $r = 0.60$
657	CCR(925.32)	RC(437.79)	CCR>RC ($r = 0.50$)	RC(618,29)	V(27,8)	RC vs V: $r = 0.58$
658	CCR(365.18)	URC(211.73)	CCR>URC ($r = 0.49$)	RD(290,83)	V(39,25)	RD vs V: $r = 0.49$

Source: own study based on data from the Besti@ database for the years 2014–2023.

Explanation of abbreviations: see Table 4 and 5

Effect size: weak ($r < 0.3$), moderate ($0.3 \leq r < 0.5$), strong ($r \geq 0.5$).

Table 4. Results of regression analysis between expenditures in various § and total expenditures in LGUs' budgets

Number §	No of observation	adj. R^2	t	significance (p)	β (stand.)
Urban Communes					
272	496	0.11	7.99	< 0.001	0.34
657	140	0.07	3.28	0.001	0.27
658	61	0.15	3.28	0.002	0.39
Urban-Rural Communes					
272	1680	0.10	13.81	< 0.001	0.32
273	24	0.50	4.95	< 0.001	0.73
657	315	0.02	2.76	< 0.001	0.15



Number §	No of observarion	adj. R ²	t	significance (p)	β (stand.)
Rural Communes					
272	2353	0.10	16.11	<0.001	0.32
273	26	0.46	4.68	<0.001	0.69
Rural Counties					
272	850	0.32	20.15	<0.001	0.57
273	58	0.57	8.84	<0.001	0.76
658	50	0.07	2.18	0.034	0.30
Cities With County Rights					
272	336	0.65	25.19	<0.001	0.81
273	33	0.13	2.43	0.021	0.40
434	159	0.32	8.72	<0.001	0.57
657	90	0.65	12.89	<0.001	0.81
658	85	0.38	7.27	<0.001	0.62
Voivodeships					
272	122	0.65	4.78	<0.001	0.81
273	104	0.42	8.66	<0.001	0.65
656	32	0.25	3.36	0.002	0.52

Source: own study based on data from the Besti@ database for the years 2014–2023.

Table 5. Results of regression analysis between expenditures in various § and share of expenditures on education in LGUs' budgets

Number §	No of observations	R ²	adj. R ²	B (direction)	t	p	β
URC							
272	1680	0.01	0.01	-1681,18	-3,09	0,002	-0,08
657	315	0.01	0.01	-4424,99	-2,05	0,042	-0,11
RC							
272	2353	0.00	0.00	-786,76	-3,21	0,001	-0,07
273	26	0.19	0.15	1630,66	2,36	0,027	0,43
CCR							
272	336	0.19	0.19	-246 964,56	-8,89	<0,001	-0,44
434	159	0.08	0.08	-55 358,73	-3,75	<0,001	-0,29
657	90	0.05	0.04	-66 095,79	-2,13	0,036	-0,22
RD							
272	850	0.01	0.01	-2087,52	-3,42	<0,001	-0,12
656	12	0.41	0.35	-5114,54	-2,63	0,025	-0,64
658	50	0.08	0.06	-21977,31	-2,07	0,044	-0,29

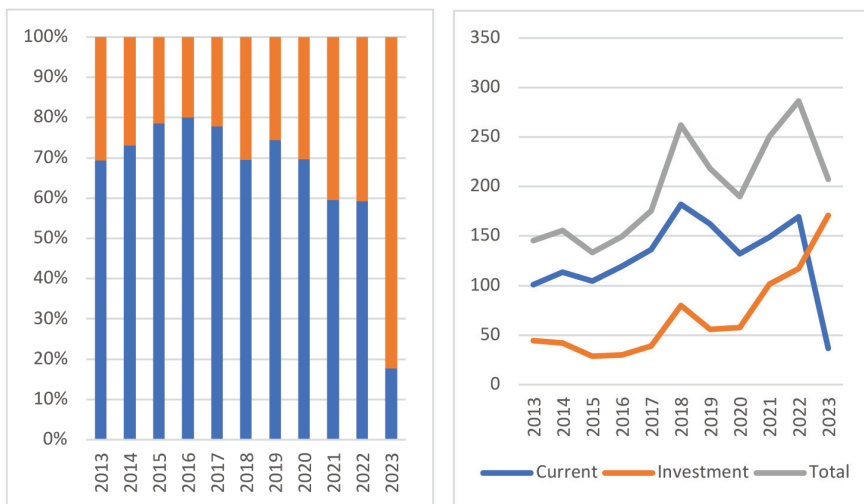
Number §	No of observations	R ²	adj. R ²	B (direction)	t	p	β
V							
272	122	0.08	0.07	476 535,88	3,17	0,002	0,28
657	20	0.21	0.16	-168 015,70	-2,16	0,045	-0,45

Source: own study based on data from the Besti@ database for the years 2014–2023.

Chart 1. Structure and value of LGUs expenditures in Poland for care of monuments in the years 2014–2023 (share of expenditures in %, value of expenditures in PLN million)

The structure of LGUs expenditure

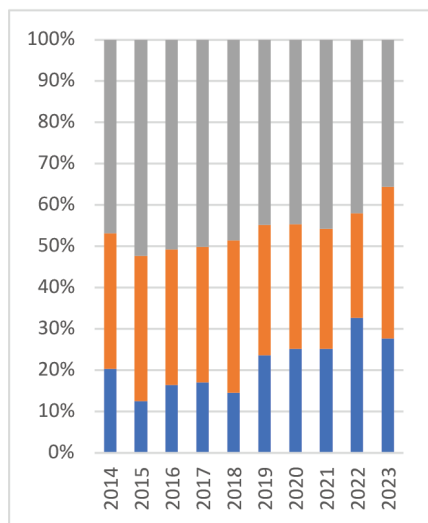
The value of LGUs expenditure in PLN million



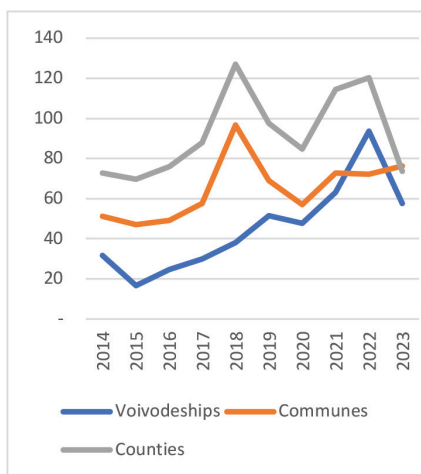
Source: own study based on data from the Besti@ database for the years 2014–2023.

Chart 2. Expenditures of various types of LGUs on the care of monuments (share of LGUs type in %, value of expenditures in PLN million)

Expenditure structure by LGU type



Expenditure by type of LGU in PLN million



Source: own study based on data from the Besti@ database for the years 2014–2023.



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Natural Resource Funds and Macroeconomic Stabilization: Evidence from Resource-Rich Countries

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Abstract

Motivation: The resource curse is a paradox of economic development often seen in resource-rich countries. A major contributing factor is these economies' reliance on the volatile global commodity market. To address this, many countries have established natural resource funds (NRF) to stabilize revenue. In recent years, the structure and number of such funds - especially in developing countries - have evolved significantly. However, existing research on their stabilization effectiveness remains inconclusive, signalling the need for further analysis.

Aim: This study aims to evaluate the effectiveness of NRF in performing their stabilization function in the context of counteracting the resource curse.

Results: A comprehensive empirical analysis was conducted, covering 49 resource-rich countries and 43 NRF over the period 2000–2023. A panel regression model was applied to assess the impact of these funds on macroeconomic stability. The analysis includes various dimensions, such as public and private expenditures, investment, macroeconomic performance, and trade conditions.

Results show that stabilization funds do not significantly impact the examined variables. In contrast, investment and savings funds exhibit stabilizing effects. Investment funds enhance domestic investment stability, while savings funds help stabilize government spending and terms of trade.

These outcomes indicate a shift in the role of resource funds. Traditional stabilization funds are losing relevance, whereas investment and especially long-term savings funds - often called future generations funds - are gaining prominence. This trend is reflected both in fund structures and founding years, as well as in the empirical findings of this study.

Keywords: natural resource funds, stabilization, resource curse, economic development, resource rich countries

JEL: F21, O11, O23, Q32, Q38

1. Introduction

The resource curse (RC) – the paradox whereby resource-rich countries (RRC) experience slower economic development and poverty reduction than less-endowed nations (Dymitrowska, 2023) – remains a critical issue. Its relevance has intensified amid recent global challenges, including the COVID-19 pandemic, inflation, armed conflicts, and ongoing volatility in strategic commodity prices.

The global commodity market has long been characterized by significant instability, a key macroeconomic driver of the RC. In response to revenue volatility from commodity exports, governments in the 1970s introduced natural resource funds (NRF) as buffers between global markets and domestic economies¹.

The earliest NRF were designed to stabilize domestic economies by shielding them from global market fluctuations, primarily decoupling national performance from external commodity price volatility. Over time, their role and structure evolved, and they are now broadly classified as stabilization (SFs), investment (IFs), or savings/future generation funds (SFGs)² (Table 2). IFs and SFGs have gained prominence, with over half of all SFGs established since 2005 and more than 70% after 2010 (Dymitrowska, 2023). An increasing number of emerging and developing economies are also adopting these funds.

The primary rationale for establishing NRF has been, and remains, the mitigation of the RC. Recently, scholars, international organizations, and RRC governments have shown increasing interest in assessing their effec-

¹ For consistency, the term Natural Resource Fund (NRF) is used throughout to refer collectively to all such funds.

² This is the most widely used NRF classification in the literature (Dymitrowska, 2020, 2023, 2026; Taguchi & Ganbayar, 2022).

tiveness in addressing RC-related challenges (Ouoba, 2020; Sugawara, 2014; Taguchi & Ganbayar, 2022; Tsani, 2015). This growing attention reflects the rising prominence of NRF in the global financial system, as they now constitute over half of all Sovereign Wealth Funds, whose combined assets total approximately USD 16.607 trillion (*SWFI*, n.d.).

The effectiveness of NRF in addressing the RC spans multiple domains - macroeconomic, social, political, institutional, cultural, and historical. In recent years, the institutional dimension has become particularly important, as the literature increasingly emphasizes that the effects of resource abundance depend on the quality of institutions and the political incentives created by resource rents (Mehlum et al., 2006; Robinson et al., 2006). This multidimensional nature of NRF effectiveness is reflected in the diversity of existing research approaches. Research includes broad comparative analyses (e.g., Bagattini, 2011; Ouoba, 2020; Sugawara, 2014; Taguchi & Ganbayar, 2022) and detailed case studies (e.g., Dymitrowska, 2023; Lücke, 2011), employing both qualitative (e.g., Kalyuzhnova, 2006; Le Borgne & Medas, 2021) and empirical (e.g., Bagattini, 2011; Ossowski et al., 2008; Ouoba, 2020; Shabsigh & Ilahi, 2007; Sugawara, 2014; Tsani, 2013, 2015) methods. These studies explore diverse aspects of fund operation, including fund types, governance mechanisms, and core functions.

Scholars remain divided on the effectiveness of NRF. Some confirm their success in achieving specific objectives (Bagattini, 2011; Sugawara, 2014; Taguchi & Ganbayar, 2022), while others contend that effectiveness depends on certain conditions (Allegret et al., 2018; Le Borgne & Medas, 2021). Others deem them largely ineffective (Davis et al., 2001; Ouoba, 2016) or express uncertainty (Barnett & Ossowski, 2021; Ossowski et al., 2008).

Given its significance for RRC economic development and global market stability, further detailed and methodologically rigorous research in this area is essential.

This study makes an initial attempt to assess the effectiveness of NRF in mitigating the RC. It constitutes the first stage of a broader research project by the author, outlined in Figure 1.

Key macroeconomic causes of the RC include commodity price volatility, Dutch disease, and economic dependence on resource extraction and exports. In this context, NRF are expected to fulfil core functions mitigating the RC – stabilization, investment, savings, and economic diversification³ (Figure 1).

This study focuses on assessing the stabilization function of NRF in mitigating the RC, with particular attention to differences across fund types. Its objective is to evaluate the effectiveness of NRF in performing this function.

³ The implementation of specific fund functions in mitigating the RC is discussed in detail by Dymitrowska (2020).

The empirical analysis focuses on the macroeconomic stabilization channel of the RC, reflected in the volatility of fiscal and private expenditure, investment, macroeconomic performance, and terms of trade. Institutional mechanisms, including rent-seeking, weak property rights, political instability, and governance failures, are acknowledged as important, but are not examined as separate dependent mechanisms. Instead, institutional quality is included through control variables, while the detailed role of institutional design and governance arrangements is left for future research.

Within this analytical scope, the study distinguishes between three main types of NRF – SFs, IFs, and SFGs – whose potential stabilizing effects may operate through different mechanisms. SFs mitigate economic fluctuations by saving surplus revenues from resource exports when prices exceed a threshold, later using the accumulated – typically short-term and liquid – assets to cover budget shortfalls when prices decline. In contrast, IFs and SFGs focus on long-term wealth creation through domestic and foreign investments. Although not primarily designed for stabilization, they indirectly strengthen fiscal resilience by generating returns that diversify income and build capital for the post-resource era.

Given the growing importance of IFs and SFGs – especially in emerging and developing economies – it is essential to determine whether these funds also perform a stabilization role. Accordingly, this study examines the effectiveness of both the general presence of NRF in a country and specific fund types.

In this study, an RRC is defined as a country specializing in the extraction and export of natural resources or whose economy is fundamentally resource-based. Following a critical literature review (Auty, 2004; Stevens, 2003; van der Ploeg, 2011), the RC is assumed to occur exclusively in such countries.

The study covers 49 RRC and 43 NRF (Tables 1 and 2) using a panel data econometric approach for 2000–2023. The funds were classified by type.

The main contribution of this study is its evaluation of specific fund types in fulfilling a particular function – the stabilization function. Previous research has largely focused on individual countries or regions, often examining NRF without differentiating between fund types.

Recent studies distinguishing between fund types typically assess each in relation to its intended function, such as whether SFs effectively stabilize the economy (Sugawara, 2014; Taguchi & Ganbayar, 2022). However, with the growing prominence of IFs and especially SFGs, and given the centrality of commodity price volatility to the RC, it is crucial to evaluate whether these funds also enhance economic stability. Theoretically, they should. This study thus tests whether funds not explicitly designed for stabilization nonetheless produce stabilizing effects in practice.

Another key contribution of this study is its econometric approach. Most prior research on NRF effectiveness has been qualitative, comparative, or conceptual (e.g., Luecke, 2011; Tsani, 2013), with only a few studies employ-

ing quantitative methods at the macroeconomic level (e.g., Bagattini, 2011; Ouoba, 2016; Shabsigh & Ilahi, 2007; Taguchi & Ganbayar, 2022).

The paper consists of three main sections, preceded by an introduction and followed by a conclusion. The literature review examines previous research on NRF effectiveness in fulfilling their stabilization function, while highlighting this study's contribution. The next section presents the research methodology, followed by the empirical results and their discussion.

To achieve its objective, the study primarily draws on English-language literature and materials from major international institutions, including the World Bank (WB), International Monetary Fund (IMF), Organization for Economic Co-operation and Development (OECD), World Economic Outlook, Natural Resource Governance Institute (NRGI), International Forum of Sovereign Wealth Funds (IFSWF), and the Sovereign Wealth Fund Institute (SWFI).

2. Literature review

To prepare for the empirical analysis, a separate methodological groundwork was conducted. A detailed critical literature review, consistent with the Systematic Literature Review (SLR) approach, was undertaken to align with the study's empirical focus and research objective. The review covered key publications from 1990 to 2025, encompassing both qualitative and quantitative studies on NRF effectiveness, particularly their stabilization function. In total, 211 publications were examined. In the final stage, eight empirical studies were analyzed in depth, five of which were identified as most representative (Table 3). These core studies were assessed in terms of methodology, including indicators of fund effectiveness, defined dependent variables, independent and control variables, research periods, main findings, and implications for future research.

All studies identified in the final SLR stage used panel data econometrics but varied considerably in sample size. The broadest scope was in Sugawara (2014), who analyzed 68 RRC and 32 NRF. Taguchi and Ganbayar (2022) examined 41 RRC and 54 NRF, reflecting the rapid rise in newly established NRF. Taguchi further emphasized the importance of classifying funds by their intended function, highlighting the increasing relevance of diverse fund types in development policy.

Earlier studies often focused on oil exporters (Ossowski et al., 2008; Shabsigh & Ilahi, 2007), aligning with broader analyses of fund performance (e.g., Allegret et al., 2018). However, as the RC affects both fuel- and mineral-dependent economies, including both improves comparative analysis.

Across the literature, NRF are viewed as countercyclical instruments that buffer commodity price shocks. Researchers have typically analyzed their

role in reducing macroeconomic volatility, using fiscal (Bagattini, 2011; Ossowski et al., 2008; Sugawara, 2014; Taguchi & Ganbayar, 2022) or monetary indicators (Shabsigh & Ilahi, 2007), consistent with the macroeconomic dimension of RC theory.

Most analyses examined the stability of government expenditure, occasionally including the primary balance (Ossowski et al., 2008; Taguchi & Ganbayar, 2022). Bagattini (2011) developed a composite SF Success Variable, while Shabsigh and Ilahi (2007) assessed monetary stability via money supply, CPI, and exchange rates. Measures of volatility also varied: Sugawara (2014) used discretionary spending volatility, whereas Taguchi and Ganbayar (2022) evaluated deviations from the mean expenditure-to-GDP ratio.

Several authors (Sugawara, 2014; Taguchi & Ganbayar, 2022; Ouoba, 2016) observed that funds must operate for five to ten years before their effects can be reliably assessed, yet only a few studies explicitly accounted for this lag.

Some studies focused specifically on SFs (Sugawara, 2014; Taguchi & Ganbayar, 2022), while others examined NRF more broadly. Bagattini (2011) distinguished between stabilization and savings purposes but offered no detailed comparison.

In all studies, the key independent variable was the existence of a resource fund, accompanied by controls capturing economic, structural, and institutional factors. Institutional quality consistently proved decisive in shaping fund effectiveness.

Most studies confirm that SFs reduce volatility. Bagattini (2011) associated their presence with improved fiscal performance; Sugawara (2014) and Taguchi and Ganbayar (2022) highlighted their stabilizing impact on expenditure; and Shabsigh and Ilahi (2007) noted moderate effects on monetary stability. Conversely, Ossowski et al. (2008) found no clear link between NRF presence and fiscal performance, indicating a lack of consensus in the literature. The results are mixed, underscoring the need for further empirical testing.

In recent years, there has been a clear trend toward establishing more IFs and especially SFGs. Several countries have restructured existing funds, shifting from traditional stabilization models to savings-oriented ones (e.g., Iran) or dividing a single fund into two (e.g., Chile) – and in some cases three (e.g., Nigeria).

Since commodity market volatility remains a key driver of the RC, it is crucial to assess whether these restructured funds continue to perform a stabilization function, regardless of type. Comparing the effects of different fund types further extends this inquiry and represents a distinctive contribution of this study. Moreover, the quantitative approach adopted here strengthens the empirical evidence on the subject.

3. Methods

The study proceeded in five stages. First, a detailed critical review of the literature was conducted using the SLR method to analyze existing empirical research (Dymitrowska, 2025, 2026). This enabled the definition of key concepts, identification of dependent and independent variables, control variables, and specification of the research period. Second, a group of RRC was identified. Third, individual NRF were examined and analyzed in detail. Fourth, a comprehensive database was compiled, incorporating a broad range of indicators from multiple international sources. Finally, panel regression analyses were performed in STATA⁴ using various combinations of variables and estimation techniques, followed by the presentation and interpretation of empirical findings.

3.1. Research sample

To ensure thorough preparation for the empirical analysis, a separate methodological and empirical groundwork was undertaken. Due to the extensive nature of the first three preparatory stages – namely, the literature review, the identification of the research group (RRC and the funds operating within them), and the development of methodological assumptions - the detailed findings from these stages will be presented in a separate publication.

Based on the results obtained, the following assumptions were adopted:

1. A RRC was defined as a country that meets at least one of the following criteria in at least half plus one of the years within the study period:
 - average annual revenues from the extractive sector exceeding 25% of GDP, or
 - natural resources accounting for at least 25% of average annual exports.
2. The study considers the following strategic commodities: fuel resources (oil, natural gas, and coal) and mineral resources (tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate).
3. The research period, spanning 2000–2023, aligns with the subsequent panel analysis. The year 2000 marks a turning point in NRF evolution, reflecting the growing global focus on IFs and SFGs, while 2023 was set as the endpoint based on data availability. This 24-year timeframe provides a robust foundation for empirical analysis.

Based on an analysis of selected indicators from the WB's World Development Indicators (WDI) database, the final research sample includes 49 RRC.

⁴ StataSE 18.

These countries were classified by level of economic development (per WB) and by type of extracted resources (Table 1).

In the next stage, a detailed analysis of NRF operating in the identified countries was conducted. A total of 43 funds were identified and classified by type – stabilization, investment, or savings (Table 2).

The next stage involved collecting data for the variables described in the following sections. After assessing data quality, significant gaps were identified for some countries. To ensure precision, the final sample comprised 28 RRC and 27 NRF, with funds operating in 19 of these countries.

The countries and funds included in the final analysis are highlighted in Table 2.

3.2. Variables and Data Collection

In line with the research framework (Figure 1), the identification of dependent variables was informed by both the literature review and a detailed analysis of the macroeconomic causes of the RC (Auty, 2004; Rosser, 2006; Stevens, 2003). Building on this foundation, the study assumes that an NRF fulfilling its stabilization function should operate as a buffer between volatile global commodity markets and the domestic economy.

To assess the effectiveness of these funds, the analysis addresses three key questions:

1. Do NRF stabilize public finances?
2. Do they stabilize the real economy, including GDP growth, investment, consumption, and inflation?
3. Do they contribute to stabilizing external indicators, such as the terms of trade (ToT)?

The first two research questions concern the spending effect, a consequence of the Dutch disease in RRC. Rising commodity prices typically increase government spending, domestic investment, and consumption, driving GDP growth and inflation. Conversely, falling prices reduce these indicators, exacerbating economic instability.

A country's dependence on the volatile global commodity market generates macroeconomic instability and can impede long-term economic development. NRF are designed to mitigate such volatility.

The third research question examines the ToT effect of the Dutch disease, which reinforces a country's overreliance on the resource sector and, ultimately, the RC. Rising commodity prices typically appreciate the domestic currency, improving ToT but reducing the competitiveness of non-resource sectors.

The presence of an NRF may ease exchange rate pressures and moderate currency appreciation by allocating surplus resource revenues to foreign investments. Moreover, such funds can help reduce extreme fluctuations in ToT.

This specific aspect has not been addressed in previous studies and therefore represents a novel contribution to the literature.

The study's main independent variable is the presence of an NRF within a country. Following the author's classification (Table 2), a general dummy variable was constructed, taking the value 1 if any NRF exists and 0 otherwise. This coding strategy allows for a consistent comparison across a broad panel of resource-rich countries over 2000–2023. Although it does not capture detailed differences in institutional design, such as governance structures, withdrawal rules, or rule enforcement, institutional quality is included through control variables, while these specific design features are left for future research.

Additionally, three distinct dummy variables were developed to differentiate SFs, IFs, and SFGs, each taking the value 1 if the respective fund type exists within the country.

Following Sugawara's (2014) approach, the study assumes that a fund becomes operational in the year after its establishment. Thus, if a fund was created in 2000, the corresponding dummy variable equals 0 for 2000 and 1 from 2001 onward.

In contrast to previous studies that lagged the main independent variables by five years (Sugawara, 2014; Taguchi & Ganbayar, 2022) or ten years (Oouba, 2016), this study adopts a different strategy. Multiple models were estimated by progressively lagging the fund presence variables from one to five years to determine when the effects of each fund type begin to materialize.

A maximum lag of five years was applied, as a ten-year lag would substantially reduce the reliability and explanatory power of the results within the 24-year research period.

In selecting control variables, the study considers country size (population), economic size (GDP), macroeconomic stability (inflation), resource dependence (resource rents and exports), global commodity prices, and institutional factors.

The first two variables – population and GDP – serve as standard controls in macroeconomic research, enabling the model to account for variations in country size and economic scale.

Inflation is a crucial indicator for RRC, as demand-driven inflation commonly arises from the spending effect associated with Dutch disease. Likewise, global commodity price trends are vital for explaining RRC macroeconomic conditions, serving as a key driver of the RC. Their inclusion in the model is therefore essential.

Many RRC exhibit strong dependence on the extractive sector, a fundamental source of the RC. Accordingly, two control variables were incorporated to capture the degree of resource dependence.

Finally, institutional quality – widely emphasized in recent literature on both the RC and NRF effectiveness – is a key determinant of economic

outcomes. Accordingly, the model includes three institutional indicators deemed most relevant to this research context.

To select appropriate indicators for the analysis, several databases were reviewed (accessed on 19 December 2024), including the IMF's World Economic Outlook (<https://www.imf.org/en/Publications/WEO>) and the WB's WDI (<https://databank.worldbank.org/source/world-development-indicators>), Worldwide Governance Indicators (WGI) (<https://www.worldbank.org/en/publication/worldwide-governance-indicators>), and Commodity Price Data (CPD) (<https://www.worldbank.org/en/research/commodity-markets>).

Following data quality assessment and preliminary empirical testing, indicators from the WB were used exclusively. This approach ensures consistency across variables and enhances the overall robustness of the empirical analysis.

Ultimately, the study includes: six dependent variables, four main independent variables of interest and nine control variables (Table 4). Additionally, each fund's performance was assessed according to its years of operation, ranging from 0 to 5 years.

To transform the dependent variables in a way that captures their volatility, two approaches were applied:

1. The method proposed by Sugawara (2014), which involves calculating the 5-year moving standard deviation of the annual growth rate of the dependent variables (as part of alternative dependent variable construction).
2. The approach used by Taguchi & Ganbayar (2022), which calculates the absolute value of the deviation from the period average of the dependent variables.

Applying both approaches – derived from two of the most recent and relevant studies on the topic – was intended to strengthen the robustness and depth of the empirical findings.

To address issues such as heteroskedasticity, non-linearity, and to enhance the clarity and stability of estimations, selected control variables – GDP, CPI, the Commodity Price Index, resource rents, and resource exports – were lagged. This approach is economically justified: GDP affects investment with delay, inflation has lagged effects, commodity prices influence the economy over time, and resource revenues are typically spent in subsequent years. To further improve data quality and model performance, the population variable was log-transformed (Table 4). Descriptive statistics for all variables are presented in Table 5.

3.3. Model Specification and Estimation Method

The empirical specification used in this study, following Sugawara (2014) and Taguchi & Ganbayar (2022), is formulated as follows:

$$effect_{i,t} = \alpha_0 + \alpha_1 fund_{i,t-k} + \alpha_2 X_{i,t} + \mu_i + \varepsilon_{i,t} \quad (1)$$

where i refers to the country and t to the year. $Effect_{it}$ represents the dependent variable capturing fund-related outcomes, while $fund_{i,t-k}$ denotes the independent variable of main interest measuring fund operation, lagged by $k=0$ to 5 years to examine delayed effects. X_{it} is a vector of control variables, some of which are lagged (e.g., GDP, CPI), and others contemporaneous (e.g., Control of Corruption, Government Effectiveness, Rule of Law). μ_i captures country-specific time-invariant effects. ε denotes the residual error term and $\alpha 0.2$ stand for the estimated coefficients (Table 6).

To prevent bias in the results, certain control variables were excluded due to their strong correlation with the dependent variables. Specifically, L1_GDP was omitted when analyzing gdp_vol and gdp_vol1 , and L1_CPI was excluded when analyzing cpi_vol and cpi_vol1 .

Given the broad scope of the study and to enhance the robustness of the results, the models were estimated using both Fixed Effects (FE) and Random Effects (RE) estimators, with robust standard errors applied to correct for heteroskedasticity.

The data analysis was conducted using StataSE 18.

4. Results

The econometric results are presented in Tables 7 and 8. Given the extensive number of models tested, the findings are summarized in a single comprehensive table to enable clear and concise comparison across specifications.

Cells marked with an “X” denote statistically insignificant results. Highlighted cells present statistically significant outcomes for each main independent variable, with the sign and magnitude of the estimated coefficient and the corresponding p-value.

For each dependent variable, the table reports results based on alternative methods of calculating volatility, along with estimates obtained under both FE and RE specifications.

One of the most striking findings is that the results neither confirm previous studies nor align with theoretical expectations regarding the stabilizing role of NR - particularly SFs - on public expenditure. Instead, the evidence indicates a statistically significant, albeit modest, destabilizing effect of these funds on government spending during their initial years of operation.

An especially noteworthy finding concerns SFGs. In several model specifications, these funds exhibited a statistically significant stabilizing effect on public spending during their first three years of operation. Although this effect becomes statistically insignificant thereafter, the negative coefficient signs persist, indicating a continued but weaker stabilizing tendency.

This underscores the need for continued monitoring of SFGs performance, particularly as many have only recently begun operating. The findings suggest that SFGs may evolve into a more effective mechanism for stabilizing public expenditure in RRC, potentially replacing traditional SFs in this role.

Regarding the impact of NRF on GDP growth volatility, the results reveal no significant effects. The only statistically significant outcome appears in the fifth year of operation for IFs, suggesting a stabilizing influence on economic growth; however, the effect is negligible and unsupported by other model specifications.

Comparable results were found for household consumption expenditure, where a slight short-term destabilizing effect – particularly for SFGs – was detected. Yet, its magnitude is minimal and unlikely to bear meaningful practical implications.

A particularly noteworthy finding concerns the stabilization of domestic investment levels. The effect is most pronounced for IFs, which exhibit a statistically significant and economically meaningful impact on the stability of real *per capita* gross fixed capital formation.

Although some tests revealed a slight short-term destabilizing effect of IFs, this pattern reversed after four years of operation, demonstrating a clear stabilizing influence. These findings suggest that IFs contribute to the long-term stabilization of domestic investment.

A statistically significant stabilizing effect was also identified for SFs in their fifth year of operation, although this effect emerges later than that observed for IFs.

Although IFs exhibit a stabilizing influence on domestic investment, they display a statistically significant destabilizing effect on inflation during their initial years of operation. This effect, however, is short-lived and dissipates by the fund's second year.

The analysis also indicates a slight short-term stabilizing effect on inflation for funds overall, though its magnitude is minimal and of limited practical relevance.

Notable insights arise from the analysis of ToT volatility and levels. Some results for NRF overall, as well as for SFs and IFs, suggest a slight destabilizing effect on ToT stability; however, the magnitude is minimal and diminishes over time for IFs.

Only IFs exhibit a statistically discernible influence on the ToT level. In the short term, they appear to improve ToT, but this effect reverses over time – after five years of operation, IFs are associated with a deterioration in ToT. Although this result approaches the threshold of statistical significance, the directional shift remains noteworthy.

In contrast, SFGs display a statistically significant and economically meaningful stabilizing effect on ToT from the outset of their operation –

a particularly important finding in assessing this fund type. The effect remains consistently negative over the entire five-year period, indicating a sustained and stable influence of SFGs on this indicator.

An overall analysis of the findings reveals a striking result: SFs – explicitly designed to serve a stabilization function – do not exhibit a consistent stabilizing effect on any of the dependent variables examined. The variable set employed in this study is broader than in most previous research and includes key indicators such as government expenditure, one of the most frequently analyzed measures in the literature.

This finding contradicts the conclusions of many earlier studies. One possible explanation is the more recent research period used in this study, which may better reflect current dynamics. Alternatively, it may signal a broader transformation in the global NRF landscape, where newer fund types – IFs and SFGs – are becoming increasingly prominent and may assume a greater role in mitigating the RC. One possible institutional interpretation is that the stabilizing role of IFs and SFGs may be linked to their longer time horizon and stronger intertemporal commitment. Compared with traditional SFs, these funds may be less exposed to short-term discretionary withdrawals, although this interpretation requires further institutional analysis.

Referring to the research framework in Figure 1, future studies should undertake a detailed assessment of NRF effectiveness across their other core functions, with particular emphasis on variations among fund types.

5. Conclusion

This study examined the effectiveness of NRFs in fulfilling their stabilization function in mitigating the RC. The analysis covered four fund categories – NRFs overall, SFs, IFs, and SFGs – and evaluated their stabilizing associations, both collectively and individually, with the macroeconomic conditions of RRCs.

Importantly, the analysis accounted for fund longevity, assessing the relationship between NRF presence and macroeconomic stability from the year of establishment through the fifth year. A broad set of dependent variables was examined, with volatility measured using two distinct methods. The study also introduced a variable not previously employed in this context – the stability of ToT – which represents an important dimension of Dutch disease and a key channel through which the RC may manifest.

Control variables were selected to capture the distinctive characteristics of RRCs, including the international commodity price index and measures of resource dependence – two major macroeconomic drivers of the RC alongside Dutch disease. The model also incorporated institutional quality indicators, whose importance is consistently underscored in the literature. This

comprehensive, multidimensional approach constitutes a novel contribution to the literature.

The findings indicate that SFs – though explicitly designed to stabilize economies exposed to resource volatility – do not exhibit a consistent stabilizing association with the variables analyzed, including public expenditure volatility. In contrast, IFs and SFGs are associated with selected stabilizing outcomes: IFs with greater stability of domestic investment, and SFGs with greater stability of public expenditure and ToT.

These results are consistent with a broader shift in the global NRF landscape. In recent years, traditional SFs have appeared to lose relative prominence, while many RRCs – developed, emerging, and developing alike – have established or transformed their funds into IFs or, increasingly, SFGs. This trend is reflected both in the structural characteristics and founding periods of existing funds (Table 2) and in the empirical evidence presented in this study.

The results also suggest that the formal objective of a fund may not be sufficient to determine its stabilization role. From an institutional perspective, the credibility of fund rules, the time horizon, and the extent to which they constrain discretionary fiscal behavior may be equally important. This may help explain why IFs and SFGs, although not primarily designed as stabilization funds, are associated with selected stabilizing outcomes in the empirical analysis.

Several limitations should be acknowledged. First, the final estimation sample is reduced due to data availability, which may affect the generalizability of the results. Second, although the analysis distinguishes between fund types, it does not directly model detailed institutional features such as governance arrangements, legal status, withdrawal rules, transparency, or political independence. These elements may significantly influence the *de facto* effectiveness of NRFs. Third, potential endogeneity and selection bias cannot be fully excluded, as countries with stronger institutions may be more likely both to establish NRFs and to experience lower macroeconomic volatility. Therefore, the findings should be interpreted as evidence of statistically significant associations rather than definitive causal effects. Finally, the classification of funds was based on a detailed review of their formal objectives and operational characteristics; nevertheless, the evolution of NRF mandates over time remains an important issue for future research.

Given the expanding role of IFs and SFGs, further research is needed to evaluate their effectiveness in performing other core functions – investment, long-term savings, and economic diversification, as outlined in Figure 1. Future studies should also examine whether and how specific institutional designs condition the stabilization outcomes identified in this study. In terms of policy implications, the findings suggest that policymakers in RRCs should not assume that stabilization funds automatically ensure macroeconomic

stability. The design of NRFs should account for the specific stabilization channels that a country aims to address, while the growing relevance of IFs and SFGs indicates that longer-term fund objectives may also contribute to selected stabilization outcomes. These implications should be interpreted together with the institutional context, since rule credibility, transparency, and enforcement may condition whether the expected stabilization role of a fund is achieved in practice. Understanding the broader impact of these newer fund types, as well as the institutional conditions under which they operate, will be crucial for future policymaking in RRCs.

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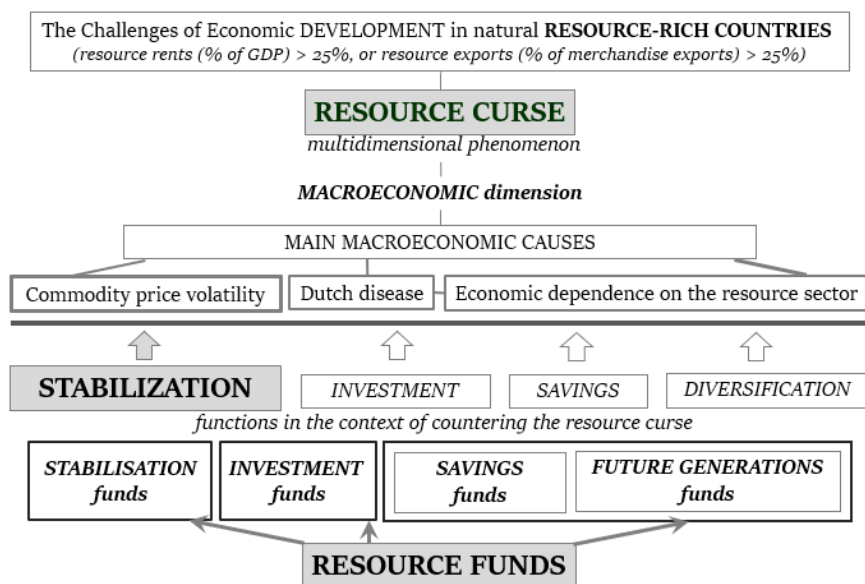
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Appendix

Figure 1. Research concept



Source: Own preparation.

Table 1. Resource-rich countries

Classification according to development (WB): H - High income (\$14,006 or more), LM - Upper middle income (\$4,516 to \$14,005), LM - Lower middle income (\$1,146 to \$4,515), L - Low income (\$1,145 or less).	MINERALS (12)	
	H	Chile
	UM	Armenia, Georgia, Jamaica, Montenegro, Namibia
	LM	Guinea, Lao PDR, Mauritania, Zambia, Zimbabwe
	L	Rwanda
	FUELS (24)	
	H	Brunei Darussalam, Kuwait, Norway, Oman, Qatar, Russian Federation, Saudi Arabia, Trinidad and Tobago, United Arab Emirates
	UM	Algeria, Azerbaijan, Colombia, Ecuador, Equatorial Guinea, Gabon, Iran, Islamic Rep., Iraq, Libya, Turkmenistan, Venezuela, RB,
	LM	Angola, Congo, Rep., Nigeria,
	L	Yemen, Rep.
	MINERALS & FUELS (13)	
	H	Bahrain, Canada
	UM	Indonesia, Kazakhstan, Mongolia, South Africa
	LM	Bolivia, Cameroon, Egypt, Arab Rep., Myanmar, Peru
	L	Mozambique, Niger
	Total: 49	

Source: Own preparation.

Table 2. Natural resource funds

	COUNTRY	FUND NAME	ESTABLISHED SF	FUND TYPE		
				IF	SFG	
1	Algeria	Revenue Regulation Fund	2000	X		
2	Angola	Fundo Soberano de Angola	2012			X
3	Armenia	none				
4	Azerbaijan	State Oil Fund of the Republic of Azerbaijan	1999			X
5	Bahrain	Future Generations Reserve Fund	2006			X
6	Bolivia	none				
7	Brunei Darussalam	Brunei Investment Agency	1983	X	X	X
8	Cameroon	Caisse de Stabilisation des Prix des Hydrocarbures	1974	X		
9	Canada	Alberta Heritage Savings Trust Fund	1976			X
10	Chile	Social and Economic Stabilization Fund	1985 (2006)	X		
		Pension Reserve Fund	2006			X



	COUNTRY	FUND NAME		ESTABLISHED SF	FUND TYPE		
					IF	SFG	
11	Colombia	Colombia Savings and Stabilization Fund		2012	X		
12	Congo, Rep.	none					
13	Ecuador	none					
14	Egypt, Arab Rep.	none					
15	Equatorial Guinea	Fund for Future Generations		2002			X
16	Gabon	Sovereign Wealth Fund of the Gabonese Republic		1998 (2012)			X
17	Georgia	none					
18	Guinea	none					
19	Indonesia	none					
20	Iran, Islamic Rep.	Oil Stabilization Fund		2000–2010	X		
		National Development Fund of Iran		2011		X	
21	Iraq	none					
22	Jamaica	none					
23	Kazakhstan	National Fund of the Republic of Kazakhstan		2000	X		
		National Investment Corporation		2012			X
24	Kuwait	Kuwait Investment Authority		1953			X
25	Lao PDR	none					
26	Libya	Libyan Investment Authority		2006			X
27	Mauritania	National Fund for Hydrocarbon Reserve		2006	X		
28	Mongolia	Fiscal Stability Fund		2011	X		
29	Montenegro	none					
30	Mozambique	none					
31	Myanmar	none					
32	Namibia	none					
33	Niger	none					
34	Nigeria	Excess Crude Account		2004–2010	X		
		The Nigeria Sovereign In- vestment Authority	Stabilization Fund	2011	X		
			Future Generations Fund	2011			X
			Nigeria Infrastructure Fund	2011		X	
35	Norway	Government Pension Fund Global		1990			X



	COUNTRY	FUND NAME		ESTABLISHED SF	FUND TYPE		
					IF	SFG	
36	Oman	State General Reserve Fund		1980–2019	X		
		Oman Investment Fund		2006–2019		X	
		Oman Investment Authority	Future Generations Fund	2020			X
			National Development Fund	2020		X	
37	Peru	Fiscal Stabilization Fund		1999	X		
38	Qatar	Qatar Investment Authority		2005	X	X	X
39	Russian Federation	Russia's Stabilization Fund		2004–2007	X		
		Reserve Fund		2008–2018	X		
		The National Wealth Fund		2008	X	X	X
40	Rwanda	none					
41	Saudi Arabia	Public Investment Fund		1971		X	X
42	South Africa	none					
43	Trinidad and Tobago	Interim Revenue Stabilization Fund		2000–2006	X		
		Heritage and Stabilization Fund		2007	X		X
44	Turkmenistan	Stabilization Fund		2008	X		
45	United Arab Emirates	Abu Dhabi Investment Authority		1976		X	X
		Mubadala Investment Company		2002		X	X
46	Venezuela, RB	Macroeconomic Stabilization		1998–2003	X		
		Fondo de Desarrollo Nacional		2005		X	
47	Yemen, Rep.	none					
48	Zambia	none					
49	Zimbabwe	Mutapa Investment Fund		2014	X	X	

Additional information. **SF** – stabilization fund, **IF** – investment fund, **SFG** – savings fund (fund for future generations).

Source: Own preparation based on the data provided by the NRGI, IFSWF, SWFI and official websites of individual funds.



Table 3. Literature review

AUTHOR			Shabsigh & Ilahi (2007)	Ossowski et al. (2008)	Bagattini (2011)	Sugawara (2014)	Taguchi & Ganbayar (2022)
Sample			9 NRF, 15 OEC	21 OEC	12 countries with SF	32 NRF, 68 RRC	54 NRF, 41 RRC
Period			1973–2003	1992–2005	1992–2007	1988–2012	1996–2020
DEPENDENT VARIABLES			Money volatility; CPI; REER; CPI growth	Non-oil primary balance; Expenditure growth; Expenditure-to-oil revenue change ratio	SF success variable; Non-resource GDP, exports, revenues, balance; Government revenues, expenditures, balance; Public debt	Government expenditure volatility	Government expenditure, primary balance volatility
INDEPENDENT (Explanatory) VARIABLES	main	Existence of: oil fund	X	X			
		SF			X	X	X
	control	Population				X	X
		GDP		X	X	X	X
		GDP growth	X			X	
		HDI			X		
		Inflation		X		X	X
		Fiscal position		X	X	X	
		Trade			X		X
		Financial market	X			X	
		Resource dependence	X	X	X	X	X
		Oil price	X	X			
		Fund wealth /position		X	X		
		Institutional quality		X	X	X	X
		Form of government				X	
		Location				X	

Additional information. SF – stabilization funds, OEC – oil exporting countries, RRC – resource-rich countries, HDI – Human development index.

Source: Own preparation.

Table 4. A list of variables

Variable	Description	Sources
DEPENDENT VARIABLES		
spend_vol	5-year rolling standard deviation of the logarithmic annual growth rate of general government final consumption expenditure <i>per capita</i> , expressed in constant 2015 US\$	WDI
	general government final consumption expenditure <i>per capita</i> , expressed in constant 2015 US\$, absolute value of the deviation from the period average (spend_vol1)	
gdp_vol	5-year rolling standard deviation of the logarithmic annual growth rate of GDP <i>per capita</i> growth (annual %)	
	GDP <i>per capita</i> growth (annual %), absolute value of the deviation from the period average (gdp_vol1)	
inv_vol	5-year rolling standard deviation of the logarithmic annual growth rate of real <i>per capita</i> gross fixed capital formation, expressed in constant 2015 US\$	
	real <i>per capita</i> gross fixed capital formation, expressed in constant 2015 US dollars, absolute value of the deviation from the period average (inv_vol1)	
cons_vol	5-year rolling standard deviation of the logarithmic annual growth rate of real <i>per capita</i> household and NPISHs final consumption expenditure, expressed in constant 2015 US\$	
	real <i>per capita</i> household and NPISHs final consumption expenditure, expressed in constant 2015 US\$, absolute value of the deviation from the period average (cons_vol1)	
cpi_vol	5-year rolling standard deviation of the logarithmic annual growth rate of inflation, consumer prices (annual %)	
	inflation, consumer prices (annual %), absolute value of the deviation from the period average (cpi_vol1)	
tot_vol	5-year rolling standard deviation of the logarithmic annual growth rate of the net barter ToT index (base year = 2015)	
	net barter ToT index (base year = 2015), absolute value of the deviation from the period average (tot_vol1)	
INDEPENDENT – main interest variables		
Fund	NRF dummy: = 1 if resource fund exists	Own study
StabFund	SF dummy: = 1 if SF exists	
InvFund	IF dummy: = 1 if IF exists	
SavFund	SFG dummy: = 1 if SFG exists	
INDEPENDENT – control variables		
ln_Population	Population, total, log term, one lagged	WDI
L1_GDP	GDP <i>per capita</i> , PPP (constant 2021 international \$), one lagged	
L1_CPI	Inflation, consumer prices (annual %), one lagged	
L1_ResourceRents	Resource rents (% of GDP) (sum of oil rents, natural gas rents, coal rents, mineral rents (all in % of GDP), one lagged	
L1_ResourceEx	Resource exports (% of merchandise exports) (sum of fuel exports and ores and metals exports (all in % of merchandise exports), one lagged	



Variable	Description	Sources
DEPENDENT VARIABLES		
L1_CommodPI	Commodity Price Index (Real), one lagged	CPD
Corup	Control of Corruption	WGI
GovEffect	Government Effectiveness	
RuleLaw	Rule of Law	

Source: Own preparation.

Table 5. Descriptive statistics

Variables	mean	sd	min	max
spend_vol	.0479642	.0584984	.0001389	.677602
spend_vol1	216.8059	295.3857	.0578569	2383.884
gdp_vol	.0263506	.0181926	.000177	.1207942
gdp_vol1	2.501486	2.480742	.0039592	20.05583
inv_vol	.0939963	.0650135	.0016076	.3786816
inv_vol1	520.5809	756.9704	.1337957	5917.19
cons_vol	.038284	.0387752	.0016616	.3472749
cons_vol1	950.3432	1918.834	1.492428	14224.49
cpi_vol	.0267113	.0418703	.000029	.3998039
cpi_vol1	4.141219	13.49502	.0027276	281.3779
tot_vol	.1160446	.0809488	.00114	.4550724
tot_vol1	17.74346	14.08349	.0157974	65.41672
ln_Population	16.39181	1.50668	12.69595	19.44612
L1_GDP	25558.64	25224.22	1015.794	103226.9
L1_CPI	6.3832	16.61357	-2.489793	324.9969
L1_ResourceRents	13.94907	13.16961	0	57.70979
L1_ResourceEx	55.30006	26.27061	0	99.9613
L1_CommodPI	84.67231	22.65979	49.02574	121.3484
Corup	-.1720138	.8957926	-1.48399	2.286928
GovEffect	-.0796016	.8119283	-1.381049	2.058892
RuleLaw	-.2092441	.8412034	-1.633344	2.024315
Observations: 672				

Source: Own preparation.

Table 6. Description of the Equation Components

Components	Explanation		
i	sample country		
t	sample year		
effectit	the indicators of funds' evaluation and comprises volatility of:		
	spend_vol	government expenditure	expected sign of the coefficients: negative
	gdp_vol	economic growth	
	inv_vol	investment	
	cons_vol	household consumption expenditure	
	cpi_vol	inflation	
	tot_vol	trade	
	the indicators of funds' evaluation and comprises:		
	ToT	trade	
fundit,t-k	shows funds' operation and comprises the funds (lagged by k=0 to 5 years):		
	Fund	NRF, any kind	
	StabFund	SF	
	InvFund	IF	
	SavFund	SFG	
X	denotes the control variables and includes indicators (some are lagged, and others contemporaneous):		
	ln_Population	population	
	L1_GDP	economic growth	
	L1_CPI	inflation	
	L1_ResourceRents	resource dependence	
	L1_ResourceEx		
	L1_CommodPI	resource prices	
	Corup	quality of institutions	
	GovEffect		
	RuleLaw		
μ_i	captures country-specific time-invariant effects		
ϵ	residual error term		
$\alpha_0 \dots 2$	estimated coefficients		

Source: Own preparation.



Table 7. A summary of results – NRF overall, SF

fund age (years)		NRE, ANY KIND										SF				
		0	1	2	3	4	5	0	1	2	3	4	5			
the indicators of funds' evaluation and comprises volatility of:																
spend_vol	government expenditure	fe	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	spend_vol1	re	0.02; 0.019	0.02; 0.012	X	X	X	X	X	X	X	X	X	X	X	X
gdp_vol	economic growth	fe	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	gdp_vol1	re	X	X	X	X	X	X	X	X	X	X	X	X	X	X
inv_vol	investment	fe	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	inv_vol1	re	X	X	X	X	X	X	X	X	X	X	X	X	X	-142,53; 0,033
cons_vol	household consumption expenditure	fe	0.02; 0.045	0.02; 0.015	0.02; 0.024	X	X	X	X	X	X	X	X	X	X	X
	cons_vol1	re	X	X	X	X	X	X	X	X	X	X	X	X	X	X
cpi_vol	inflation	fe	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	cpi_vol1	re	-0.02; 0.048	-0.01; 0.038	-0.008; 0.072	X	X	X	X	X	X	X	X	X	X	X
tot_vol	trade	fe	0.04; 0.030	0.04; 0.041	0.05; 0.013	0.05; 0.036	X	X	X	X	X	X	X	X	X	X
	tot_vol1	re	0.06; 0.001	0.06; 0.001	0.06; 0.001	0.06; 0.001	0.05; 0.007	0.04; 0.022	X	0.04; 0.030	0.04; 0.024	0.04; 0.049	X	X	X	X
the indicators of funds' evaluation and comprises:																
ToT	trade	fe	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	ToT	re	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Additional information. **X** – no significant impact, **Colored field** – significant impact (sign and magnitude of the coefficients; p-value), **fe** – fixed effects, **re** – random effects. Source: Own preparation.

Table 8. A summary of results – IE, SFG

fund age (years)		0	1	2	IF			4	5	SFG				
the indicators of funds' evaluation and comprises volatility of:														
spend_vol	govern-	fe	X	X	X	X	X	X	X	X	X	X	X	X
	ment	re	0.02; 0.033	0.02; 0.028	0.02; 0.048	X	X	X	0.04; 0.020	0.03; 0.021	X	0.03; 0.032	X	X
spend_vol	expendi-	fe	X	X	X	X	X	X	X	X	X	X	X	X
	ture	re	X	X	X	X	X	X	X	-53.07; 0.044	-52.17; 0.027	-41.03; 0.089	X	X
gdp_vol	economic	fe	X	X	X	X	X	X	X	X	X	X	X	X
	growth	re	X	X	X	X	X	X	X	X	X	X	X	X
gdp_vol		fe	X	X	X	X	X	X	-0.70; 0.030	X	X	X	X	X
		re	X	X	X	X	X	X	X	X	X	X	X	X
inv_vol		fe	0.03; 0.025	X	X	X	X	-0.03; 0.021	-0.04; 0.006	X	X	X	X	X
		re	0.03; 0.003	0.02; 0.02	X	X	X	X	-0.02; 0.071	X	X	X	X	X
inv_vol	investment	fe	-38.34; 0.029	-75.28; 0.038	X	-29.33; 0.086	-311.80; 0.066	-287.63; 0.083	X	X	X	X	X	X
		re	X	X	X	X	X	X	X	X	X	X	X	X
cons_vol	household	fe	X	X	X	X	X	X	X	0.02; 0.047	X	X	X	X
	consump-	re	X	X	X	X	X	X	0.02; 0.029	0.02; 0.015	0.02; 0.040	X	X	X
cons_vol	tion expen-	fe	X	X	X	X	X	X	X	X	X	X	X	X
	diture	re	X	X	X	X	X	X	X	X	X	X	X	X
cpi_vol		fe	0.03; 0.053	0.03; 0.047	X	X	X	X	X	X	X	X	X	X
		re	0.03; 0.046	0.02; 0.043	X	X	X	X	X	X	X	X	X	X
cpi_vol	inflation	fe	3.38; 0.036	3.55; 0.049	X	X	X	X	X	X	X	X	X	X
		re	3.08; 0.033	3.24; 0.050	X	X	X	X	X	X	X	X	X	X
tot_vol		fe	0.06; 0.013	0.05; 0.005	0.05; 0.001	0.04; 0.001	X	X	X	X	X	X	X	X
		re	0.07; 0.000	0.07; 0.001	0.06; 0.001	0.05; 0.001	0.04; 0.008	0.03; 0.058	X	X	X	X	X	X
tot_vol	trade	fe	X	X	X	X	X	X	-5.15; 0.021	-5.95; 0.050	-4.43; 0.079	X	-6.92; 0.051	-6.19; 0.022
		re	X	X	X	X	X	X	-2.99; 0.083	-3.65; 0.052	-6.89; 0.098	X	-4.33; 0.066	-3.71; 0.058
the indicators of funds' evaluation and comprises:														
ToIT	trade	fe	X	5.76; 0.049	X	X	X	X	-10.01; 0.060	X	X	X	X	X
		re	X	4.74; 0.035	X	X	X	X	X	X	X	X	X	X

Additional information. **X** – no significant impact, **Colored field** – significant impact (sign and magnitude of the coefficients; p-value), **fe** – fixed effects, **re** – random effects. Source: Own preparation.



Building the resilience of logistics companies through selected stakeholder groups

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Abstract

Motivation: Logistics companies are a vital link in most global supply chains and improve the performance of their partners by optimising costs, increasing delivery reliability and flexibility of operations, and improving logistics organisation. It is important to note that the logistics industry, through its role in serving other sectors of the economy, is susceptible to any disruption that causes the slowdown in those sectors. The topic of organisational resilience is addressed in the context of the logistics industry but in a particularised and fragmentary way. Stakeholders' involvement in creating logistic companies' resilience is rarely mentioned or researched.

Aim: This article is the Authors' attempt to fill the identified gap and aims to examine organisational resilience implications for logistics industry stakeholders. This article focuses on both internal and external stakeholders. The analysis was conducted on data from a survey study based on an original questionnaire, carried out among managers and workers of logistics companies. Methods dedicated to examining dependencies between qualitative variables were used, in particular: the Kruskal-Wallis test, and Spearman's rank correlation coefficient.

Results: It was possible to confirm and clarify the identified research gap: that the awareness and declarations of the need to engage stakeholders in building the resilience of logistics companies do not always translate into real actions in this direction. Further actions are necessary to encourage companies to really engage their stakeholders in activities that build resilience. Further research should be focused on exploring the differences in existing relations with different stakeholders in order to boost the resilience of logistics companies.

Keywords: resilience, logistics, transport, stakeholders, cooperation

JEL: L29, L91

1. Introduction

The unpredictability of changes in the environment has led to increased interest among researchers and decision-makers in the resilience of entities and systems to disturbances resulting from difficult-to-predict global and local events. Resilience can be considered from various perspectives—individual organizations, economic sectors, or systems - and is also of interest to various fields, including economics, management sciences, engineering, psychology, and many others. The logistics sector and the entities operating within it play an important role in supporting other sectors of the economy by ensuring the smooth flow of raw materials, semi-finished products, and finished goods. Companies in the logistics sector are just as vulnerable as other sectors to disturbances resulting from unpredictable events in their environment. In addition, these companies are indirectly affected by the disturbances arising in the sectors of the economy they serve. Research on the resilience of companies in the logistics industry, although increasingly

popular, does not address all the issues identified as important by research on resilience in other industries. One such gap, identified by León-Mateos et al. (2021) and Nguyen et al. (2023b), is the lack of a comprehensive approach to the importance of stakeholders in building resilience in the logistics sector. On June 17, 2025, the Council of Ministers adopted a deregulation measure concerning Environmental, Social, and Governance (ESG) reporting for companies. This obligation for small and medium-sized enterprises (SMEs) listed on the stock exchange was postponed from the original date of 2027 (for the 2026 financial year) to 2029 (for the 2028 financial year). From the perspective of the present study, the most compelling issues pertain to the Social (S) component, which focuses on the relationship between the enterprise and its employees and communities.

In order to fill the identified research gap, the authors undertook to examine organizational resilience implications for logistics industry stakeholders. Based on a literature review, it was decided to examine the level of involvement of the most frequently mentioned internal (employees) and external (suppliers and customers) stakeholder groups in the activities of logistics companies, especially in the area of resilience building. The following research questions were posed:

1. Do companies in the logistics sector involve their stakeholders in their activities?
2. Are declarations regarding the involvement of selected stakeholder groups in building the resilience of companies in the logistics industry reflected in the actions actually taken?
3. Are there any differences between the management and workers in terms of the actions declared and taken to involve stakeholders?

In addition to a systematic literature review, the article also draws on the results of primary research conducted among managers and workers of logistics companies in Poland. Statistical methods and tests were used to analyse the data, in particular the Kruskal-Wallis test and Spearman's rank correlation coefficient.

A review of the literature on stakeholder engagement and the identification of research gap in this regard in the logistics sector is described in section 2. Section 3 presents a brief description of the research conducted, as well as the variables representing the questions in the survey questionnaire, which relate to both declared and actual activities aimed at building the company's resilience. This section also indicates the statistical methods used in the analyses. Section 4 describes the results of the analyses, which are then referred to in section 5 in relation to other authors' studies on stakeholder engagement. Section 6 summarizes the results and presents conclusions.

2. Literature review

The starting point for the discussion in this section of the article is a systematic review of scientific articles on stakeholder involvement in building business resilience. The literature review draws on scientific articles from two journal databases, Scopus and Web of Science, covering the years 2019-2024.

First, the research problem was presented in various industries and sectors, and only then did we focus directly on the logistics industry. Among the 60 articles found, attention should be paid to those that take into account, on the one hand, the creation of resilience and, on the other hand, the participation of stakeholders in activities or recommendations for their actions.

Kazancoglu, Sezer et al. (2024) point out that one of the most important factors in coping with increasing supply chain resilience in the manufacturing industry is cooperation with stakeholders. In their article, they indicate that closer cooperation with stakeholders in supply chains results in quality assurance through increased security.

Odonkor and Urefe (2024), on the other hand, studying the SME sector, conclude that relationship management and stakeholder engagement are key to building resilience. Strong links with stakeholders are crucial. An important aspect is listening to customers to reduce dropouts and engaging employees by creating a positive working environment.

Using a comparison of cooperative enterprises, Billiet, Bruneel, and Dufays (2023) show that stakeholder engagement facilitates long-term organizational resilience and stakeholder protection in times of crisis. In addition, they point to the need for further research on the reasons why organizations engage in stakeholder relationships.

Guisse and co-authors (2024) identified and categorized healthcare system stakeholders that influence resilience in healthcare and mapped stakeholder relationships that are important for the functioning of the healthcare system.

Another area where research on resilience has been conducted is the tourism industry. Williams, You, and Joshua (2020) used Instrumental Stakeholder Theory (IST), which is the basis for analysing value creation and competitive advantage through stakeholder relationships.

The aim of the study by Qazi, Appolloni, and Shaikh (2024) was to examine the impact of stakeholders on supply chain resilience (SCR) and organizational performance (OP) using stakeholder theory in manufacturing and the service industry. It was pointed out that close coordination and cooperation contribute to the development of resilient supply chains and positive business performance. It was noted that close cooperation with suppliers can help build SCR. On the other hand, information exchange increases customer involvement at an early stage of product development.

Interestingly, Nguyen et al. (2023a) noted that, to date, few studies have focused exclusively on responding to the influence of external stakeholders in project management. Strategies that companies can adopt include adaptation, compromise, avoidance, rejection, and influence. The authors focused their research on external stakeholders and found that negotiation or concession approaches are used by managers in situations where stakeholders have critical input and use restraint or compromise strategies.

In some industries, it is very difficult to analyse stakeholder involvement in building resilience. One such example is the pharmaceutical industry. Vann Yaroson et al. (2023) stated that given the complexity of the PSC (pharmaceutical supply chain), research on resilience has been limited. One of the interesting conclusions from the article is that reactive strategies are less effective due to power-based behaviours and the complexity of the PSC. They also found that power-based behaviours increase partner dissatisfaction.

As already mentioned, the literature review on stakeholder engagement in resilience building was supplemented with an analysis of works on the topic of resilience in the logistic industry. The analysis covered 43 articles published in the last five years (2019–2024), indexed in the Scopus and Web of Science scientific journal databases. A full-text analysis of the articles showed that, as in the pharmaceutical industry (Vann Yaroson et al., 2023), there is also a lack of a clear approach to stakeholder engagement in resilience building in the logistics industry. Stakeholders in resilience research in the logistics industry appear as factors supporting resilience, factors reducing resilience, or as a component of measures and indicators determining the resilience of companies or supply chains.

Research by Azam et al. (2023) points to cooperation and information sharing with other links in the supply chain as critical success factors in ensuring supply chain resilience. Competencies in obtaining information and learning from partners and competitors in the market were important for the resilience of logistics service providers during the COVID-19 pandemic (Dovbischuk, 2022). This was also the case for other disturbances – Orengo-Serra and Sánchez-Jauregui (2021) pointed to the crucial importance of communicating with customers as a factor increasing the resilience of companies.

The results of research by Asafo-Adjei et al. (2023) on the complexity of dependency networks for companies in the logistics industry pointed to the importance of strong relationships with suppliers and customers as factors mitigating the risk of disturbances and creating network resilience. Monitoring and predicting customer needs and behaviors can help to avoid or respond more effectively to emerging disturbances. Zarbakhshnia and Karimi (2024) also point to collaboration with customers of logistics companies as a factor influencing supply chain resilience. Sundarakani and Onyia (2021), studying the disturbances caused by the COVID-19 pandemic and their impact on the resilience of the logistics industry in the UAE, emphasized the

importance of customer satisfaction as a factor in maintaining resilience, which is also perceived as a measure of a company's resilience.

Stakeholders (suppliers and customers) can both support resilience in the logistics industry and be a risk factor, as indicated by Pahwa and Jaller's (2023) research on last-mile deliveries. Research on disturbances in the logistics sector has highlighted the importance of employees as a factor in building business resilience both before (McVeigh and MacLachlan, 2019) and during the COVID-19 pandemic (Pauksztat et al., 2022; Garola et al., 2023). In the case of autonomous maritime transport, suppliers and employees were clearly identified as a factor limiting resilience (Fjørtoft et al., 2023).

The lack of a comprehensive approach to involving stakeholders in resilience-building activities in the logistics industry reported by some researchers (León-Mateos et al. 2021; Nguyen et al., 2023b) was the premise for undertaking research on stakeholder engagement in building resilience in logistics companies. Stakeholder groups most frequently identified in previous studies, both internal (employees) and external (suppliers and customers), were selected for the study.

3. Methods

The analysis conducted for the purposes of this article used data from a diagnostic survey, which employed a proprietary questionnaire developed as part of an interdisciplinary research project entitled "The role of an inclusive approach in building organizational resilience on the example of the TSL sector (2023–2025)." The research instrument consisted of 16 core closed-ended questions for all respondents (employees and managers) and 9 demographic questions (closed and semi-open). Given their expertise, managers answered a further 8 questions of a closed and semi-open nature. The pilot research was carried out from late June to early August 2024. The survey was conducted using CAWI and CATI techniques from October 2024 to January 2025 among 303 workers and 109 managers of companies in the logistics industry. The surveyed sample was quota-based and reflects the population structure in terms of enterprise size. Small enterprises were the most numerous (65.3%), followed by medium enterprises (18%), micro enterprises (9.2%), and large enterprises (7.5%). A significant majority of the companies (71.1%) operate on a national scale. Furthermore, 87.1% of the analysed enterprises have been active in the market for more than 5 years, with 52.7% operating for over 10 years and 22.1% for over 20 years. Due to the specific nature of the subject matter addressed in the article, it was decided to further divide the workers into those working in micro and small enterprises (226 people) and in medium and large enterprises (77 people). Therefore, most of the results presented in the article, are divided into these three groups of respondents.

It should be recalled that one of the research tasks of the article was to show the relationship between declarations and actual actions aimed at building company resilience through the involvement of selected stakeholder groups. For this reason, the study used two groups of questions relating to declarations (Q1.1, Q1.2, Q1.3 and Q5, Table 1) and the actual actions of respondents (Q2.1, Q2.2, Q3.1, Q3.2, Q4.1, Q4.2 and Q4.3, Table 1). Furthermore, as the respondents' answers to each question were expressed on a 5-point Likert scale, aggregated variables were constructed to show the average opinion of the respondents on the aspects under study. The reliability analysis confirmed the possibility of constructing such variables, which will be referred to as indices in the further part of the article (Table 2). In this way, the following were obtained:

- Index 1: declared commitment to the company's activities by selected stakeholders: customers, employees, and suppliers (Q1.1, Q1.2, Q1.3);
- Index 2: actions to engage customers in building the company's resilience (Q2.1 and Q2.2);
- Index 3: actions to engage employees in building the company's resilience (Q3.1 and Q3.2);
- Index 4: effectiveness of measures to build the company's resilience in times of crisis (Q4.1, Q4.2, and Q4.3).

In the first part of the analysis, the Kruskal-Wallis test and post-hoc analysis (Kruskal, Wallis, 1952) were used to show whether managers and workers differ in terms of their declared activities involving selected stakeholder groups. In the next part, the relationships between declarations and actual actions aimed at engaging stakeholders in building the company's resilience were examined. Due to the ordinal scale of the variables, Spearman's rank correlation coefficient (Spearman, 1904) was used, which allowed not only to identify a significant relationship, but also to determine its strength and direction.

All calculations and statistical analyses were conducted using IBM SPSS Statistics version 29 (IBM Corp., Armonk, NY, USA).

4. Results

In response to the research questions, a study was conducted to determine: (1) whether companies in the logistics industry engage internal and external stakeholders in building their own resilience, (2) to what extent the involvement of employees, customers, and suppliers is merely a declaration and to what extent it is an actual activity of companies, and (3) how these declarations and activities are perceived by people in managerial positions and by employees. For this reason, most of the research was divided into three groups of respondents: managers, workers in medium-sized and large com-

panies, and workers in micro and small companies, as the specific nature of the position held and the size of the company can significantly influence the perception of the aspects under study. The analysis used respondents' answers to the questionnaire, as well as aggregated variables – indices (described in Section 3).

In all groups surveyed, respondents declared that they involved stakeholders in building resilience. However, significant differences were observed between the individual groups. Managers more often declared a high level of engagement with customers (93.6% of respondents gave answers “4” and “5” combined), employees (85.4% combined), and suppliers (74.3% combined) than the workers surveyed (Table 3). Furthermore, the Kruskal-Wallis test used in the study (Table 4) and post-hoc analysis (Table 5) indicate that the declared commitment (towards customers, as well as employees and suppliers) in the group of managers is significantly higher than among workers. Furthermore, there are no significant differences in this respect between workers of medium/large and micro/small enterprises (Table 5).

A comparison of statements regarding stakeholder engagement with responses about actual activities reveals some discrepancies. The largest discrepancies were observed in managers' responses regarding customer engagement, where optimistic statements clearly predominate (Chart 1C). Significant differences between declarations and actions were also found in managers' responses regarding employee engagement in building business resilience (Chart 2C). These differences are significantly smaller in the responses of workers of micro and small companies (Chart 1A and 2A), while among workers of medium and large companies, declarations and actions are almost the same (Chart 1B and 2B). One possible explanation is that respondents, especially managers, may declare a high level of stakeholder engagement because they perceive such activities as good management practice and an element of building a positive image of the company. Declarations may therefore reflect expectations or the desired perception of the company rather than its actual practices. This is especially true for managers who, being responsible for strategy, may place greater emphasis on customer focus in their statements. Their potentially less direct contact with customers, compared to workers, may further lead to an overestimation of the actual level of engagement.

Despite these discrepancies, the values of the calculated Spearman's rank correlation coefficient showed a positive correlation, although not always significant, between the declared commitment of customers and employees and their actual involvement in resilience building (Tables 6 and 7). In particular, the results of the analyses carried out on both groups of workers (i.e., from micro/small and medium/large companies) show a moderately positive correlation in this regard. This suggests that companies that declare a higher level of engagement are likely to attach greater importance to it and, as a rule,

take more action than companies declaring a low level. The declared intention, therefore, seems to translate into a certain level of actual action. It can also be hypothesized that customer engagement mechanisms are potentially easier to implement than deep, systemic employee engagement, which often requires organizational cultural change. This may explain the stronger correlation observed in the case of customers.

Interesting results were obtained by analysing the priorities indicated by respondents in their declared crisis measures. Although customers are consistently identified as the most important priority, it was observed that the stronger the respondents' declaration regarding meeting customer requirements in a crisis, the less likely they were, on average, to take customers' opinions into account in their actions or to translate them into action. This is reflected in the negative or insignificant Spearman's correlation coefficients calculated between questions Q5 and Q2.1 and Q2.2 (Table 8). In a crisis situation, companies seem to focus primarily on immediate operational survival, security, and financial liquidity. Previously declared concern for customers' opinion may take a back seat to time and resource pressures. The concept of the customer as a priority in a crisis is likely to be understood as maintaining continuity of supply to the customer or protecting the company, seen as an action for the benefit of customers in the future, but not necessarily as actively seeking customers' feedback during the crisis.

Continuing with activities that build the company's resilience in times of crisis and uncertainty (Index 4), we checked whether they are related to the declared commitment of stakeholders to these activities (Index 1). The analysis of the correlation between these indices showed a moderate positive relationship, but it was only significant in workers' groups (Table 9). This means that, according to workers, stakeholder engagement in the activities of a logistics company seems to have a positive impact on the level of operational resilience, measured, among other things, by the level of services provided, and, as a consequence, may build the overall resilience of the company.

A more detailed analysis of the results reveals several important facts. The calculated correlation coefficients vary depending on the group of respondents and the type of stakeholders involved (Table 10). The diversity of these results, primarily in terms of significance but also in terms of the strength of the relationship, suggests that:

- workers, especially those working for micro and small logistics companies, perceive the involvement of various stakeholders as a measure supporting the maintenance of logistics service quality in times of crisis;
- workers of medium-sized and large companies generally do not see how statements about them translate into actual actions in times of crisis;
- managers are most likely to translate statements about suppliers into actual actions (although this correlation is still weak).

Different perceptions of the role of stakeholder engagement in a crisis may stem from different managerial and workers' perspectives. Managers, focusing on control, efficiency, and operational continuity according to established procedures, may perceive engagement (especially external engagement) as time-consuming, unpredictable, and hindering quality assurance, and therefore likely prefer top-down decisions. On the other hand, workers, directly confronted with problems, may see stakeholder engagement as a key adaptive mechanism – essential for obtaining information, solving problems, and maintaining adequate service quality in changing conditions, and its absence as a barrier to effective action.

5. Discussion

To the best of the authors' knowledge, at the time of conducting the described study on stakeholder engagement in building resilience by companies in the logistics sector, no other studies in this sector addressed this issue. Stakeholders were considered one of the elements important for the resilience of entities in the logistics industry, but no attempt was made to examine whether and how the declared actions translate into actual actions in times of disturbances. The previously cited works by León-Mateos et al. (2021) and Nguyen et al. (2023b) even pointed to a lack of a comprehensive approach to the importance of stakeholders for resilience in the logistics sector. The lack of research whose results can be directly compared with those presented in our article confirms the identified research gap, which the authors aimed to fill with the present study.

The authors considered the validity of comparing the obtained results with those concerning stakeholder involvement in building business resilience in other industries, but decided against it due to the specific conditions of the logistics sector. Another factor in favour of not directly comparing the results obtained with those from other sectors was the subject matter and scope of the study. The stakeholder groups included in our analyses (employees, customers, and suppliers – most frequently identified in studies on resilience in the logistics sector) were not examined in this way in other sectors, as these studies focused on stakeholder groups specific to the sectors in question (e.g., Guise et al. (2024) studying stakeholders in the healthcare system or Vann Yaroson et al. (2023) in the pharmaceutical industry). The subjective scope adopted in our research, which involved both managers and workers of logistics companies, also makes it difficult to compare the results with those from other industries.

A comparison with earlier studies on the role of stakeholders in building resilience in logistics companies, unfortunately, without considering their involvement, reveals several similarities with previous studies. A number

of studies, including Zarbakhshnia and Karimi (2024) and Sundarakani and Onyia (2021), point to the importance of customers for resilience, especially in terms of effective communication with them (Orengo-Serra and Sánchez-Jauregui, 2021). Our results confirm that customers are perceived as the most important priority for companies (declarations), but this is not always reflected in the actions taken during disturbances/crises. These seemingly contradictory results can be related to the relationship observed by Asafo-Adjei et al. (2023) between the complexity of the customer network and its positive or negative (depending on the fragmentation of the customer base) impact on resilience during disturbances. Also, in the case of the high declared importance of supplier and employee engagement, reference can be made to earlier studies pointing to the importance of these stakeholder groups for building resilience in the logistics sector (for suppliers, again Asafo-Adjei et al. (2023) and Pahwa and Jaller, (2023); for employees, McVeigh and MacLachlan (2019) and Garola et al. (2023)).

6. Conclusion

The research conducted and the results obtained allowed us to achieve the set goal and answer all the research questions concerning stakeholder engagement in building resilience of companies from the logistics sector. Among the most important conclusions, it should be noted that:

- workers and managers generally point to high stakeholder engagement in building the company's resilience. Managers are the most optimistic in this regard;
- at the same time, Spearman's rank correlation coefficients generally show a moderate relationship between declared and actual activities involving customers and employees in building the company's resilience. Interestingly, the lowest, and sometimes even insignificant, relationship is observed among managers;
- also, in times of crisis, the commitment declared by workers, which is moderate at best, translates into actual actions, i.e., maintaining delivery times, delivering products in the same condition, and ensuring the same level of service as in times of stability. Among managers, there is only a positive correlation between declarations and actions concerning suppliers;
- it can also be said that it is in workers' groups that declarations are most strongly translated into actions aimed at building resilience through stakeholder engagement. However, it is not possible to clearly indicate whether this trend is significantly stronger among workers of micro and small companies or among those of medium and large companies.

The main contribution of the described research is the exploration of an identified research gap concerning stakeholder engagement in building resilience of companies in the logistics industry. The obtained and presented results may contribute to further research in this area.

Based on the study's findings, which highlight a significant gap between the declared importance of stakeholder engagement and the actual implementation of related activities, we recommend that managers and workers in the logistics sector intensify their efforts in stakeholder relationship management to enhance business resilience. To effectively translate these declarations into action, managers should develop and implement formal frameworks for collaboration. This includes establishing stakeholder advisory boards with representatives from key customer and supplier groups to participate in strategic planning, particularly in joint risk assessment and the co-creation of contingency plans. Furthermore, creating shared communication platforms can ensure a transparent and continuous flow of information, which is crucial for building trust and aligning resilience priorities between managerial perspectives and workers' on-the-ground experiences.

However, further research is needed to prepare more detailed recommendations. Only by identifying the types and quality of links between individual stakeholders and their effects – both formal and informal – can strategies be prepared that ensure effective stakeholder engagement in building business resilience. This identification is crucial because any stakeholder can be both a factor supporting a company's resilience and a source of new requirements or limitations. Ultimately, understanding the real needs of stakeholders and involving them in the resilience-building process is fundamental for fostering trust and managing expectations.

Of course, it should be noted that our study is not without certain limitations. One of them is the selection of the sample – the study covered the entire logistics industry, which includes very diverse entities, both in terms of their characteristics (e.g., size, time on the market, number of customers served) and areas of activity (e.g., transport, distribution, warehousing). Furthermore, the research was conducted among Polish enterprises, but since they also operate on the international market, the results may reflect the situation in a broader context. Another limitation is the focus of the study on only three – or as many as three – groups of stakeholders who may be involved by companies in the process of building resilience. One more potential limitation of this study stems from the responses provided by managers, who have not yet been legally obligated to engage in formal ESG reporting. Their responses may be subject to social desirability bias, as there is currently no mechanism to verify their stated positions against the enterprise's actual practices in this domain. While the implementation of sustainable practices within an enterprise demonstrably impacts its long-term success (affecting both its image and investment attractiveness), managers who emphasize fair business practices, diversity, and the inclusion of various

stakeholders in the enterprise's activities may inadvertently construct an overly positive image within the community. This discrepancy between reported and actual performance represents a constraint on the objective interpretation of the managerial data.

Further research directions relate directly to the limitations identified and may include areas such as: 1) comparative studies with logistics sectors in other countries; 2) focusing either on a specific type of entity in the logistics industry or on a selected area of the market served; 3) conducting a case study in several enterprises; 4) extending the study to other stakeholder groups; 5) narrowing and deepening the study to relations with only one stakeholder group; or 6) narrowing the research only to large companies which already comply with ESG reporting requirements.

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Note: the results of this study were presented in another form, such as a presentation at a conference.



Appendix

Table 1. Questions from the survey questionnaire concerning declarations and actual activities that build the company's resilience through stakeholder engagement

Declarations			Activities		
No.	Question		No.	Question	
Q1	To what extent does your company engage the following stakeholder groups in different areas of its operations?		Q2	To what extent does your organization take the following actions towards its customers?	
	1.1	customers		2.1	it identifies customers' needs at the service design stage
	1.2	employees		2.2	it involves customers in making backup plans.
	1.3	suppliers	Q3	To what extent does your organization take the following actions toward employees?	
Q5	In your opinion, is meeting customers' requirements a priority for your company in times of crisis or unforeseen events?			3.1	it engages in dialogue on problem solving within the organization
				3.2	it involves employees in making backup plans
			Q4	During times of crisis or disturbances, are you able to...	
			4.1	maintain pre-crisis delivery times	
			4.2	deliver products in the same condition as during periods of stability	
			4.3	ensure the same level of customer service as always	

Source: Own preparation based on Authors' research.

Table 2. Results of reliability analysis

Index	Combined questions	Cronbach's Alpha Value
Index 1	Q1.1, Q1.2, Q1.3	0.738
Index 2	Q2.1, Q2.2	0.626
Index 3	Q3.1, Q3.2	0.737
Index 4	Q4.1, Q4.2, Q4.3	0.728

Source: own calculations based on Authors' research.

Table 3. Cumulative percentage of responses *to a large extent* and *to a very large extent* to questions concerning the involvement of selected stakeholders in the company's activities aimed at increasing its resilience (Q1.1, Q1.2, Q1.3)

Declared commitment to:	Cumulative percentage of responses to a large and to a very large extent		
	Workers of micro and small companies [%]	Workers of medium and large companies [%]	Managers [%]
Q1.1: customers	66.3	70.1	93.6
Q1.2: employees	64.6	63.7	85.4
Q1.3: suppliers	61.1	57.2	74.3

Source: own calculations based on Authors' research.



Table 4. Results of the Kruskal-Wallis test

Question	Kruskal-Wallis test	p-value	Decision
Q1.1: customers	66.3	< 0.001	Significant differences in response patterns between the study groups
Q1.2: employees	64.6	< 0.001	
Q1.3: suppliers	61.1	< 0.001	

Source: own calculations based on Authors' research.

Table 5. *Post-hoc* analysis results

Compared groups	Test statistics			p-value
	Q1.1	Q1.2	Q1.3	
(1) workers of micro and small companies (2) workers of medium and large companies	-8.2	2.6	-5.8	1.0
(1) workers of micro and small companies and (3) managers	107.1	46.9	62.2	< 0.05
(2) workers of medium and large companies and (3) managers	98.9	44.2	56.4	< 0.05

Source: own calculations based on Authors' research.

Table 6. Spearman's correlation coefficients showing the relationship between statements (Q1.1) and actual customer engagement activities (Index 2)

	Index 2: actions to engage customers		
	Workers of micro and small companies	Workers of medium and large companies	Managers
Q1.1: statements about customer engagement	0.492***	0.495***	0.045

p-value: $p < 0.001$, then ***; $0.001 \leq p < 0.01$, then **; $0.01 \leq p < 0.05$, then *

Source: own calculations based on Authors' research.

Table 7. Spearman's correlation coefficients showing the relationship between statements (Q1.2) and actual employee engagement activities (Index 3)

	Index 3: actions to engage employees		
	Workers of micro and small companies	Workers of medium and large companies	Managers
Q1.2: statements about employee engagement	0.451***	0.488***	0.437***

p-value: $p < 0.001$, then ***; $0.001 \leq p < 0.01$, then **; $0.01 \leq p < 0.05$, then *

Source: own calculations based on Authors' research.

Table 8. Spearman's correlation coefficients showing the relationship between the company's declared priority actions (Q5) and actual customer engagement activities (Q2.1, Q2.2)

	Q2.1: identification of customers' needs at the service design stage			Q2.2: customers' involvement in making backup plans		
	(1)	(2)	(3)	(1)	(2)	(3)
Q5: meeting customers' requirements in times of crisis	-0.354**	-0.075	-0.082	-0.378**	-0.177	-0.222*

Legend: group (1) – workers of micro and small companies, (2) – workers of medium and large companies, (3) – managers; p-value: $p < 0.001$, then ***; $0.001 \leq p < 0.01$, then **; $0.01 \leq p < 0.05$, then *; Source: own calculations based on Authors' research.

Table 9. Spearman's correlation coefficients showing the relationship between statements (Index 1) and actual actions involving stakeholders in building the company's resilience in times of crisis (Index 4)

	Index 4: effectiveness of measures to build the company's resilience in times of crisis		
	Workers of micro and small companies	Workers of medium and large companies	Managers
Index 1: declared commitment of the stakeholders	0.538**	0.535**	0.118

p-value: $p < 0.001$, then ***; $0.001 \leq p < 0.01$, then **; $0.01 \leq p < 0.05$, then *

Source: own calculations based on Authors' research.

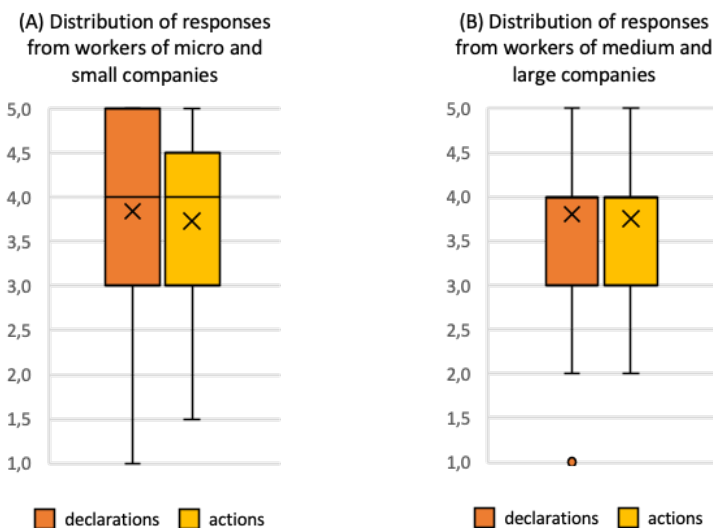
Table 10. Spearman's correlation coefficients showing the relationship between statements regarding stakeholder engagement (Q1.1, Q1.2, Q1.3, and Index 1) and the company's actual actions during times of crisis (Q4.1, Q4.2, and Q4.3)

	Company's actions during times of crisis compared to periods of stability								
	Q4.1: maintaining delivery times			Q4.2: delivering products in the same condition			Q4.3: ensuring the same level of customer service		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Q1.1	0.38**	0.20	-0.25**	0.51**	0.41**	0.00	0.30**	0.36**	-0.01
Q1.2	0.30**	0.20	0.13	0.28**	0.22	-0.05	0.27**	0.17	-0.01
Q1.3	0.36**	0.49**	0.22*	0.45**	0.46**	0.04	0.15*	0.40**	0.27**
Index1	0.44**	0.38**	0.13	0.50**	0.49**	-0.01	0.29**	0.43**	0.16

Legend: group (1) – workers of micro and small companies, (2) – workers of medium and large companies, (3) – managers; p-value: $p < 0.001$, then ***; $0.001 \leq p < 0.01$, then **; $0.01 \leq p < 0.05$, then *

Source: own calculations based on Authors' research.

Chart 1. Comparison of response distributions regarding declared customer engagement (Q1.1) and actual customer-focused activities (Index 2) in three groups of respondents



(C) Distribution of responses
from managers

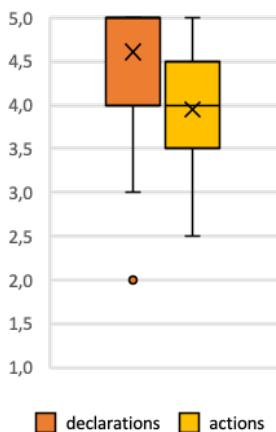
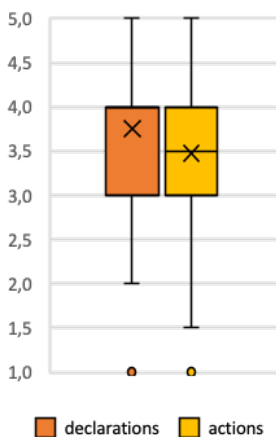


Chart 1. Comparison of response distributions regarding declared customer engagement (Q1.1) and actual customer-focused activities (Index 2) in three groups of respondents

Source: Own preparation based on Authors' research.

Chart 2. Comparison of response distributions regarding declared employee engagement (Q1.2) and actual employee-oriented activities (Index 3) in three groups of respondents

(A) Distribution of responses
from workers of micro and
small companies



(B) Distribution of responses
from workers of medium and
large companies

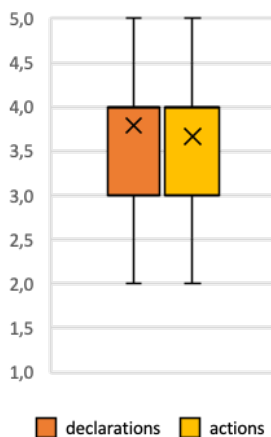
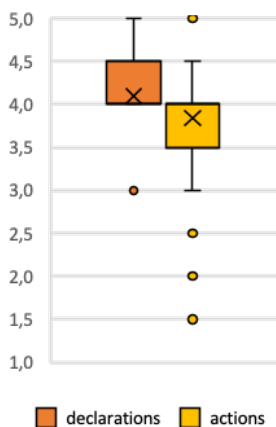


Chart 2. Comparison of response distributions regarding declared employee engagement (Q1.2) and actual employee-oriented activities (Index 3) in three groups of respondents

(C) Distribution of responses
from managers



Source: Own preparation based on Authors' research.



When Does a Hospital Receive State Aid? The Private Investor and Private Creditor Test in Management Practice

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Abstract

Motivation: The Polish healthcare system has long faced financial challenges, prompting public entities to support hospitals through recapitalization, debt forgiveness, or guarantees. However, under EU law, state aid is generally prohibited if it distorts competition. The private investor test and private creditor test assess whether public entities act as rational market operators. Conducting these tests for hospitals presents legal and managerial challenges.

Aim: This article examines the practical difficulties in developing private investor and private creditor tests in hospital financing. It focuses on methodological challenges, considering both legal and economic aspects, with emphasis on assessing the rationality of public financial decisions. The article uses a case study on the regulations in question based on the authors' practical experience. The content of The Private Investor and Private Creditor Test

in Management Practice is discussed, taking into account possible difficulties from the perspective of medical entities

Results: The article provides a structured approach to evaluating public support for hospitals against market criteria, ensuring compliance with state aid regulations. It highlights key challenges such as the lack of market benchmarks, complex hospital financing, and the need for an integrated legal-economic perspective. The findings offer practical insights for policy-makers, hospital managers, and financial experts, enhancing financial decision-making and regulatory compliance.

Keywords: state aid; hospital financing; private investor test; private creditor test; financial distress; management in health care

JEL: I11; I19; K23

1. Introduction

Public hospitals in Poland, regardless of their legal and organisational form, are facing serious financial difficulties. The most common structures are independent public health care institutions (SPZOZ), which account for 27.7% of the sector, and limited liability companies with the participation of the State Treasury or local government units, which account for 35.5% (Rynkometr, n.d.). The indebtedness of these entities often requires intervention by public bodies exercising ownership control – i.e. founding bodies in the case of SPZOZ, and shareholders or partners in the case of commercial companies. This support takes the form of subsidies, debt guarantees or capital injections. However, financial support from public authorities may be subject to restrictions under state aid rules. Such support may be classified as illegal state aid. This is because the granting of public aid that distorts competition and affects trade within the European Union's single market is prohibited. In particular, doubts of interpretation arise with regard to independent public health care institutions, whose legal status does not always allow a clear determination of whether they qualify as undertakings. However, if they carry out activities of an economic nature, the support they receive may be considered as state aid and therefore subject to the requirements of EU law.

The specific nature of the public health sector, which consists of health entities managed by public authorities exercising ownership control, significantly complicates the assessment of the compatibility of financial support with State aid rules. A fundamental problem is that public authorities operate simultaneously in two different spheres: the dominium, as founders, shareholders or partners of healthcare entities, and the imperium, as managing authorities bound by public law obligations, including the principles of non-discrimination and the prohibition of unlawful State aid. The convergence of these roles creates a structural risk that actions taken in an ownership capac-

ity may, either unintentionally or deliberately, infringe the rules of fair competition applicable in the European Union, even if their objective remains the continuity of healthcare services and the pursuit of the public interest.

Against this background, the development and proper application of the private investor and private creditor tests become essential tools in assessing whether the intervention of a public body exercising ownership control falls within the bounds of permissible market conduct. Conversely, the outcome of these tests is pivotal in determining whether financial support constitutes unlawful state aid, which could result in an obligation to return the granted aid, along with substantial penalties. Notwithstanding the significance of this issue, the doctrine evinces a discernible lacuna, as there is a paucity of studies that address the practical application of these tests, particularly in relation to the particularities of the healthcare sector. The present research endeavour is, therefore, driven by the objective of addressing this lacuna by means of an exhaustive examination of the methodological and interpretive challenges inherent to the subject. The purpose of this article is to identify the main challenges associated with the development and application of these tests in the management of health care entities, with a particular focus on the methodological and interpretive difficulties that arise at the intersection of law and economics. The analysis takes into account the specific characteristics of the public healthcare sector, where the risk of support being challenged as unlawful state aid is systemic.

2. Literature review

The prohibition of State aid is laid down in Article 107(1) of the Treaty on the Functioning of the European Union, which states that any aid granted by a Member State or through State resources which distorts competition by favouring certain undertakings and affects trade between Member States is incompatible with the internal market. Under European Union law, the concept of an undertaking is broad and functional. It includes any entity engaged in economic activity, i.e. offering goods or services on the market, regardless of its legal form, organisational structure or source of financing (Banaszewska & Modro, 2015, pp. 121–122; Raduła, 2015, pp. 210–212).

According to the European Commission, an entity may be considered an undertaking even if it operates in a public law form, provided that it offers services for remuneration on the market (European Commission, 2016, Section 2.1). With regard to the healthcare system, it is pointed out that hospitals offering healthcare services for remuneration – including those financed by public funds – may be classified as undertakings within the meaning of Article 107(1) TFEU (European Commission, 2016, Section 2.4). This position has been confirmed by the case law of the Court of Justice of the European

Union (CJEU, C-180/98-C-184/98, 2000; CJEU, C-222/04, 2006). Accordingly, public hospitals may be considered undertakings within the meaning of Article 107(1) TFEU when they engage in commercial activities consisting in the provision of health services on market terms, outside the statutory health insurance system and outside the scope of financing under contracts with the National Health Fund, which implements the principles of a solidarity-based health care model. These are services provided for full remuneration, accessible to an unlimited number of recipients in an open market in which foreign entities may also operate. If such activity is not properly separated in organisational and financial terms, there is a risk of cross-subsidisation of commercial activity with public funds, which may result in the support being classified as state aid (UOKiK, n.d.).

Therefore, in the case of healthcare entities operating in the form of capital companies with the participation of the State Treasury or local government units, as well as in the case of independent public healthcare institutions, there is a real risk that certain forms of support granted by public entities may be classified as unlawful State aid. These forms of support may include, in particular, the granting of loans to finance the purchase of new medical equipment, the modernisation or expansion of infrastructure, the acquisition of shares in increased share capital or the provision of guarantees for liabilities. The risk of unlawful aid also arises in situations where such entities have existing debts to public bodies, in particular where the claims are of a public law nature, such as taxes or local charges, and the public body, acting simultaneously as creditor, decides to write off, defer or reschedule such obligations. In this context, particular attention should be paid to the operation of SPZOZ, in relation to which Article 59(2) of the Act on Medical Activity allows the founding body to cover their net losses. This mechanism, when applied to entities engaged in commercial activities, may lead to market distortions and have characteristics of state aid (Gonet, 2020, pp. 227–228, 240–241).

State aid may also arise in connection with the implementation of an arrangement approved in a restructuring procedure governed by the Act of 15 May 2015 – Restructuring Law. The content of the arrangement may include various measures relating to the debtor's obligations, such as the financing of ongoing operations, debt-to-equity conversion, partial debt write-offs, deferral of payment deadlines or instalment repayment plans (Zimmerman, 2024). The solutions adopted in the arrangement proposals may therefore lead to situations where public funds are used in a way that requires assessment under state aid rules (Article 140 of the Restructuring Law). It should be noted, however, that legal scholars have different views on whether independent public health care institutions have the legal capacity to undergo restructuring under the above-mentioned Act. The core issue is whether these entities qualify as entrepreneurs within the meaning of the Civil Code (Article 4 of

the Restructuring Law in conjunction with Article 431 of the Civil Code), which is a prerequisite for the application of the provisions of the Restructuring Law (Głód & Langer, 2022, pp. 394–396). Due to the scope and complexity of this issue, it will not be further analysed in this article.

3. Methods

The present study employs a formal-dogmatic method, consisting of the analysis of EU legal provisions and the case law of the Court of Justice of the European Union (CJEU) and the General Court (GC). Furthermore, a case study approach is employed to illustrate the practical application of the private investor and private creditor tests in the healthcare sector. The amalgamation of these methodologies facilitates the identification of both legal and economic challenges that emerge when assessing the rationality of public financial interventions in the context of hospitals.

In order to assess whether the actions of a public body constitute State aid, analytical tools known as the private investor test and the private creditor test are applied. These tests determine whether, in comparable circumstances, a market-oriented entity would have taken the same decision as the public authority.

The private investor test applies to situations where public intervention takes the form of a capital injection, such as the acquisition of shares or equity, the provision of capital injections or the transfer of assets. The decisive criterion is whether a private investor, acting under market conditions and guided by a rational assessment of the risks and rewards, would be willing to enter into the same transaction. The assessment takes into account, among other things, the information available at the time the decision was taken, the transparency of the decision-making process, the expected return on the investment and the existence of alternative options. It is also essential that the conduct of the public authority does not deviate from the commercial standards observed in the market (European Commission, 2016, section 4.2; European Commission, 2024, paragraphs 5-7; CJEU, C-482/99; CJEU, C-124/10).

The private creditor test applies when a public entity is acting as a creditor and is considering measures such as debt write-offs, conversions or deferrals. The key question is whether a private market operator, in possession of the same information and in a comparable situation, would have accepted similar terms for the rescheduling of debt. This test involves an analysis of, *inter alia*, the likelihood of debt recovery under alternative scenarios (such as judicial enforcement), the value of the collateral, and the overall balance of risks and potential losses or benefits (European Commission, 2016, section 4.3; European Commission, 2024, para. 5; GC, T-268/08 and T-281/08).

Based on the principles presented regarding the application of the private investor test, a hypothetical case study will be presented to identify the main challenges associated with its implementation. It is assumed that a healthcare entity will undertake an investment project involving the purchase and installation of a digital X-ray machine at a total cost of PLN 1.5 million. The entity operates in the form of a limited liability company, with a public body as its sole and principal shareholder. Due to the healthcare entity's inability to generate sufficient free cash flow to finance the investment, the public owner has decided to cover these expenses through a capital injection into the company.

4. Results

The question of the application of the private investor and private creditor tests in the context of public healthcare entities remains largely unexplored in academic literature. Existing research has been found to focus either on general principles of State aid or on specific case studies involving commercial undertakings, without addressing the distinct operational and structural features of public medical providers. Despite the fact that certain studies have examined these tests in the context of restructuring law, particularly in relation to insolvency proceedings (e.g., Piątek & Konat-Staniek, 2018), there is a paucity of practical guidance on how to prepare and apply such tests in standard financial decision-making processes within the healthcare sector.

This absence of direction engenders a state of uncertainty for public authorities and healthcare managers, particularly when evaluating compliance with State aid regulations in scenarios involving capital injections, debt restructuring, or the allocation of public resources. The findings presented in this article demonstrate that the implementation of both market economy tests necessitates not only legal and economic expertise, but also sector-specific benchmarks and procedural clarity.

In the context of the situation described, it is necessary to prepare a private investor test. According to the adopted assumptions, which should be further specified in detail, the test should focus on answering the question of whether the capital injection into the company is justified and whether a private investor, in the position of the public owner, would have acted in a similar manner.

In consideration of the authors' practical experience in the application of state aid rules in the healthcare sector, it is proposed that the private investor test prepared for the case under analysis should focus on the following aspects:

- the characteristics of the planned investment project in terms of its implementation, operation, and impact on the local and regional medical services market;

- the assessment of the current and projected financial situation of the healthcare entity;
- the financial evaluation of the planned investment project;
- the identification of risk factors associated with the investment project and the recommended preventive measures.

The elements of the private investor test presented above, together with the description of the necessary substantive actions and potential challenges, are summarised in the table 1 in the Appendix.

The selected aspects of the individual elements of the private investor test presented in the table may provide the basis for in-depth analyses in the future due to the paucity of comprehensive studies in this area at present. It is evident that the specificity of the planned investment activities exerts a considerable influence on the configuration of the analyses. Nevertheless, the fundamental elements that have been delineated constitute the underlying foundation of these analyses.

The sequence of proposed and required analyses in this area is fairly standard. They primarily concern the projected financial position of the healthcare provider, with the revenue and cost implications of the planned investment activities then superimposed on this forecast. Given the changing conditions affecting the healthcare sector in Poland, these activities require scenario planning.

In addition to the private investor test, the private creditor test may also be relevant in certain cases. The application of this test is contingent upon the existence of claim held by a public body against a debtor. In such cases, the relevant public body may consider a range of measures, including but not limited to: partial write-off, deferral, instalment repayment, or conversion of the debt. The purpose of the assessment is to determine whether, in comparable circumstances, a private creditor, acting in its own financial interest and in possession of the same information, would have consented to terms for modifying or reducing the debt that are similar to the present terms.

In the healthcare sector, this issue is particularly complex due to the frequent overlap of roles: the same public authority may simultaneously act as the owner (or founding body) of the healthcare provider and as a public-law creditor, for instance in relation to tax or local charges. In such cases, financial decisions on debt restructuring may blur the line between ownership responsibility and creditor autonomy, which significantly complicates the impartial application of the private creditor test.

The reliability of such an assessment is contingent upon a structured analysis of the debtor's payment capacity, the value and enforceability of existing collateral, and the potential for recovery under alternative legal or enforcement scenarios (including insolvency proceedings). The evaluation process must also encompass a comprehensive assessment of the total risk

exposure, and a comparative analysis of the potential outcomes under various approaches, including the enforcement of legal proceedings.

In practice, the effective implementation of this test in the healthcare sector is hindered by a lack of market benchmarks and the coexistence of financial and public-service objectives (Hancock, 2020; Sepetis, 2019; Tabish, 2024). As has been demonstrated in the extant literature, effective financial restructuring in the healthcare sector necessitates analytical consistency, appropriate categorisation of liabilities, and organisational readiness to execute coordinated and transparent financial decisions (e.g., Głód, 2010; Gabutti, Colizzi & Sanna, 2023).

In this context, the preparation of a credible private creditor test should include, at minimum, the following elements:

- identification of all liabilities subject to potential modification, with classification according to their legal nature (e.g. public-law claims, secured debts, unsecured obligations),
- proper categorisation of liabilities and assignment to appropriate creditor groups,
- formulation of reasonable debt modification terms (e.g. deferral, write-off) specifically for the public-law creditor,
- valuation of the debtor's assets listed in the inventory and estimation of realisable value based on liquidation scenarios,
- verification that adequate material and financial resources are available to support the execution of the adopted recovery measures.

These steps are essential to ensure that the decision taken by the public body reflects the logic of a rational creditor acting under market conditions, rather than the preferences of a public administrator fulfilling policy objectives.

5. Conclusion

The present article has explored the legal and managerial challenges associated with applying the private investor and private creditor tests to publicly controlled healthcare entities. The analysis confirms that despite the formal role of these tests in State aid assessment, there is a lack of sector-specific methodologies to support their effective implementation. In view of these findings, it is recommended that practical guidance and standardised procedures be developed to assist public authorities in preparing reliable test documentation. . This is a significant issue in light of the calls for the implementation of objective mechanisms for evaluating investments in the healthcare system in Poland (Skwira, 2024) and Europe (Locurcio et. al., 2022). The utilisation of comparative insights from other regulated sectors, such as energy or transport, has the potential to facilitate this process. It is evident that

further interdisciplinary research is required in order to address these gaps and to support sound financial decision-making in the healthcare sector.

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Appendix

Table 1. Elements of the Private Investor Test with an Assessment of Practical Implications

Element of the private investor test	Content description	Identified issues
Characteristics of the planned investment in terms of its implementation, operation, and impact on the local and regional healthcare services market.	– description of the planned investment with substantive (medical) justification; – time schedule of the planned investment; – description of the local/regional market of medical services in the context of the activity conducted by the medical entity; – estimation of the operating costs of the investment (costs of current maintenance – operating and service costs; possible employment of additional people, adopted depreciation rates in accordance with the category of fixed assets).	– the possibility of obtaining a different purchase price for a fixed asset as a result of a tender procedure, – difficulties in obtaining detailed information on the activities of competing companies on the local/regional market of medical services – in the field of more replacement investments, this will not significantly increase the supply of X-ray services.
Assessment of the current and projected financial situation of the healthcare entity.	– performing a classic financial analysis of a medical entity for the period of the last 3 years – analysis of medical services provided with the use of an X-ray machine for the period of the last 3 years.	– the need to organize detailed data on the settlements of medical services with the National Health Fund and possible commercial services.
Financial evaluation of the planned investment project.	– preparation of assumptions for the calculation of basic indicators in this area, i.e. NPV/IRR; – determination of the discount rate needed to calculate the updated value of cash flows; – due to the replacement nature of the investment, indication of possible opportunity costs in the event of lack of access to the services of the X-ray machine, i.e. the use of outsourcing or the inability to perform/settle some medical services.	– determining the interest rate used for calculations in a proper manner (using the published base rate of the European Commission through the Office of Competition and Consumer Protection); – the need to organize detailed data on the settlements of medical services with the National Health Fund and possible commercial services related to the use of the X-ray machine in the performance of medical procedures (ICD-9); – identification of outsourcing costs in the field of X-ray services.
Identification of risk factors associated with the planned investment and recommended preventive actions.	– preparation of a risk register for the planned investment; – determination of significant factors affecting the projected financial situation of the healthcare entity in terms of its business.	– dilemmas in the field of forecasting the financial situation in the face of the unstable situation in the Polish healthcare sector (the issue of the amount of contracts, payment for the so-called overperformance, regulations on the minimum wage in health care.

Source: author's own research.



Legal and institutional framework of ESG as a strategic and competitive conditions for the development of financial institutions

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Abstract

Motivation: According to Principles for Responsible Investment (PRI), the number of ESG regulations in the global economy amounted to 460 in 2024. Therefore, it is important to identify the main directions of the impact of these regulations on the conditions of functioning of institutions and their effects.

Aim: To present the impact of ESG regulations on changes in the conditions of operation of financial institutions in the global economy based on the analysis of disclosure results in the years 2017–2023, in terms of theme, sector, region and capitalization.

Results: ESG regulations are shaped at the global, regional and national levels. The legal and institutional dependencies in the ESG area at financial institutions result from the extent to which they are subject to specific legal regulations and oversight by supervisory authorities. According to the ESG Regulation Hub of Sustainalytics, international institutions are the leading actors in ESG regulatory activity, while at the regional level the most active regulators include those from the EU, the Americas, and Asia. Larger financial institutions are observing a strong impact of ESG regulations on operations, investments, and competitive

rivalry, while smaller institutions are also experiencing a significant impact on strategic activities. Many transnational corporations are striving not only to comply with applicable regulations but also to accelerate transformation processes. This stems from treating ESG as a new strategic element and competitive tool, with legal and institutional infrastructure playing a key role.

Based on the TCFD and IFRS Foundation, the analysis of ESG disclosures from 3,814 entities for 2017–2023 showed that the highest disclosure rates were observed for governance-related topics, the insurance and banking sectors, Europe and North America, and institutions with a market capitalization exceeding USD 3.2 billion.

Keywords: ESG, reporting; disclosures, strategies; financial institutions; TCFD, ISSB, FSB.

JEL: G15; G18; Q54; K22; K23

1. Introduction

Sustainability issues (environmental, social, corporate governance, ESG) and the related opportunities and risks are present in many aspects of financial institutions' operations today, and they are expected to intensify further in the future. The obligation to incorporate ESG factors into operations and reporting stems from legal regulations that impact the economic performance, reputation, competitiveness, and corporate social responsibility (CRS) of institutions. ESG factors reveal opportunities, challenges, and also increased risk of reputational damage, investor confidence, and losses for many financial market participants.

The importance of undertaking theoretical and empirical analyses of sustainable development is significant given the dynamic growth of regulations in this area. According to Principles for Responsible Investment (PRI), the number of regulations directly and indirectly related to ESG in the global economy increased from 133 in 2014 to 460 in 2024 (PRI, 2025). Furthermore, in line with the implementation schedules of many ESG regulations, they will cover an increasingly broader group of new institutions and economic entities (including smaller ones) in the future.

In parallel with the regulations on sustainable development, the regulations on non-financial reporting are being adapted to ensure a complementary and effective implementation process (TCFD, 2024).

ESG issues are particularly important in the context of the role of financial institutions in the financial market, including investment financing, capital accumulation and risk hedging, financial stabilization, and the implementation of micro- and macro-acute supervision. ESG regulations reveal new risks, stimulate the creation of new products and services, and drive changes in operational processes and strategies.

Institutions such as banks, insurance companies, investment funds, and pension funds (considered public trust institutions) are subject to specific sectoral regulations, and additional regulations regarding ESG, taxonomy, and reporting have been introduced, posing additional challenges for the financial sector. These issues give sustainability analyses of financial institutions and their operations significant analytical, research, and practical value.

The aim of the article is presenting the impact of ESG regulations on changes in the operating conditions of financial institutions in the global economy based on the analysis of the results of disclosures in the years 2017–2023, in terms of theme, sector, region and capitalization.

Four research questions were formulated:

- Q1. What are the legal and institutional relationships in the ESG area and what differences exist between regions in the global economy?
- Q2. Which regulators are most active in ESG legislation?
- Q3. What areas of financial institutions' strategies require the greatest adaptations to ESG regulations?
- Q4. What is the competition like in the ESG area and which regulatory authorities and financial institutions are leaders in it?

The article examined changes in ESG and climate-related disclosures on the basis of findings reported by the FSB (2023), IFRS Foundation (2024), TCFD (2020–2024), Sustainalytics (2024), and EBA (2025).

The presented analytical results cover the global, regional, and national dimensions. The main research period covers primarily the years 2017–2023, supplemented with additional data from 2024.

The article is structured in seven parts. The introduction presents key premises for the importance of ESG risk analysis in financial institutions. The second chapter provides a literature review. The third chapter presents an overview of the legal infrastructure at the global, regional, and national levels. The fourth chapter outlines the research method and results. The fifth chapter presents discussion aspects, and the sixth chapter presents key conclusions (answers to the questions posed) and considered directions for future research. The last chapter presents the limitations of research and future directions of analysis.

2. Literature review

The concept of sustainable development dates back to the 1970s. One of the first documents referring to the concept of sustainable development was the Report "The Limits to Growth", published in 1972 by the Club of Rome (Meadows et.al., 1972). In 1987, the World Commission on Environment and Development (the so-called Gro Harlem Brundtland Commission) introduced the concept of sustainable development into the mainstream of inter-

national debate. The Brundtland Commission Report, titled “Our Common Future” (Our Common Future), defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Davidson, Dence, 1988).

In 1992, at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, 179 countries adopted the Rio Declaration and the global agenda for sustainable development (Agenda 21), which aimed to promote sustainable development worldwide.

Other documents that form the basis of this concept at the international level include the UN 2030 Agenda for Sustainable Development and the European Green Deal, adopted by the European Commission in 2019, whose overarching goal is to achieve climate neutrality in Europe by 2050 (Kørnøv, Lyhne and Davila, 2020).

Sustainable development is a concept present in the literature of both the social sciences (economics and finance, management and quality, and law) and the natural sciences (earth and environmental sciences). The contemporary concept of sustainable development focuses on three pillars: environmental, social, and governance (ESG).

In the last decade, many financial markets around the world have been taking into account ESG factors when making investment decisions (Almeyda, Darmansya, 2019; González-Bueno, Riaño, Moreno, 2025). ESG issues have become key factors for both institutional and retail investors, allowing them to assess the sustainability of companies and their risk exposure. This attitude has led companies to fundamentally restructure their ESG profiles in order to meet the needs of stakeholders and acquire long-term capital (Jafar, Basuki, Windijarto, 2024; Kosztowniak, 2023a).

The importance of board structure and institutional ownership in driving ESG transformation across the corporate sector and developing strategies they emphasize, among others: Kozhuharov, Mitrofanova, Zlateva, (2024), Ould Daoud Ellili (2020); Rath, Kurniasari, Deo (2020); Velte, 2020 and Juhmani (2013). The impact of companies’ ESG situation on motivations to undertake mergers and acquisitions is emphasized by, e.g., Tampakoudis, Noulas, Kiosses, Drogalas (2021).

The role of ESG reporting in achieving transparency of companies’ operations is also emphasized by Qayoom, Chisti, 2025. Furthermore, Charai and Zuraida (2021), Lagasio, Cucari (2019) point out that ESG disclosures in non-financial reporting determine investor perception and the creation of the company’s image.

The importance of the impact of ESG practices on the financial standing of enterprises is also highlighted by Kim and Li (2021).

ESG disclosures are particularly important in dirty industries such as mining, fuel, steel, transportation, and other sectors, as assessed by investors and the banks that finance these companies (da Cunha, Policarpo, de

Oliveira, 2025; Kosztowniak, 2023b). Banks, insurance companies, and investment institutions now routinely consider companies' ESG scores when making investment decisions (Kosztowniak, 2025; Lunawat, Lunawat, 2022) to potentially reduce exposure to financial risk. However, empirical research has not yet provided a definitive answer to the direct impact of ESG disclosures on changes in ROA, ROE, or increased financial risk.

However, the increase in traditional banking risks (credit, counterparty, liquidity, solvency) in the conditions of exposure to ESG risks, including climate risk, is pointed out by, for example: Tian, Zhao, (2025), Survilaitė-Venskienė, Stankevičienė (2024), Kosztowniak, Kozak (2023) .

It is worth noting that ESG risk, unlike traditional financial risk, is not neutral in nature, but focuses on the negative, indicating the risk of negative effects resulting from the impact of ESG factors on the financial results or solvency of an entity or a state EBA/GL/2025/01).

A literature review shows that ESG risk in financial institutions is commonly understood as the risk of negative financial consequences resulting from the impact of ESG factors on customers, counterparties, or balance sheet items. The goal of ESG risk management is to support sustainable development and build long-term value in financial institutions through integrated management of the impact of ESG factors.

The above-mentioned reasons for financial institutions to undertake ESG transformation confirm their importance both currently and in the long term. The course of this ESG transformation process depends primarily on the scope of legal regulations and various guidelines, the implementation schedule, and monitoring and enforcement by supervisory institutions.

3. Legal and institutional infrastructure

Among the main disclosure regulations according to the ESG Regulation Hub of Sustainalytics (2024) classification, they have:

1. Global regulations:
 - ISSB standards (ESG and climate disclosures).
 - TCFD disclosures (climate).
 - Taskforce on Nature-related Financial Disclosures (TNFD) Recommendations (climate).
2. Regional regulations, e.g. EU area:
 - Corporate Sustainability Reporting Directive (CSRD) (ESG disclosures).
 - CRR and CRD (EBA Pillar III disclosure and CRD6) (ESG and climate).
 - ESMA guidelines for funds names (Min. Portfolio ESG standards).
 - EU Benchmark Regulation (ESG).
 - EU Taxonomy (ESG and climate).

- MiFID II/IDD/European ESG Template. Sustainability Preferences (ESG).
- The Corporate Sustainability Due Diligence Directive (CSDDD)
- 3. National regulations (implementations):
 - EU countries, e.g. Poland: CSRD, CSDDD, EBA/GL/2025/01 (ESG and climate).
 - Canada – (Guidance B-15) (climate).
 - US (California) – The Climate Corporate Data Accountability Act “SB 253” and Greenhouse Gases: Climate-Related Financial Risk “SB 261” (California SB 253 and 261) (climate).
 - US – Sec Climate Risk Disclosures (climate).
- 4. Other: in some regions/countries ESG disclosures are treated broadly, as combined **ESG and climate disclosures** apply, e.g. in:
 - Canada (Canadian Sustainability Disclosure Standards, CSDS).
 - Japan (TCFD, ISSB, Amended Supervisory Guidelines for ESG Investment Trusts).
 - EU countries (CRR and CRD (EBA Pillar III disclosure) and CRD6; EU Taxonomy).

EU ESG regulations, in the form of directives, regulations, and implementing acts, are characterized by a broad scope of entities and subject matters, as well as numerous references to other sectoral regulations. The most important regulations include:

- Non-Financial Information Disclosure Directive (NFRD) (Directive 2014/95/EU).
- Regulation on the Disclosure of Information on Sustainable Finance (SFDR) (Regulation (EU) 2019/2088).
- Regulation (EU) 2020/852 of the European Parliament and of the Council, the so-called Taxonomy on the establishment of a framework to facilitate sustainable investment, and Regulation 2021/2178.
- CSRD (Directive (EU) 2022/2464).
- European Sustainability Reporting Standard (ESRS, Commission Delegated Regulation (EU) 2023/2772).
- CSDDD (Directive (EU), 2024/1760).
- EBA Guidelines on the management of environmental, social and governance risks (EBA/GL/2025/01).

Moreover, ESG objectives in the strategies of financial institutions focus on:

- environmental target – including green asset indicators (*Green Asset Ratio, GAR*), the indicator of compliance of the banking portfolio with the EU Taxonomy (*Banking Book Taxonomy Alignment Ratio, BTAR*) and the number and volume of financing that meets the environmental objectives set out in Article 9 of the Taxonomy Regulation (2020/852) and the calculation of the bank’s carbon footprint (at levels 1, 2, 3);

- social purpose – e.g. activities for the benefit of the community and society, employee relations and improvement of working conditions, customer protection and product liability, human rights;
- corporate governance objectives – including ethical considerations, risk strategies and management, inclusiveness and transparency (Kosztowniak, 2025).

Regulations regarding reporting by financial institutions in the area of sustainable development are supplemented by, among others:

- *Global Reporting Initiative (GRI Standards) reporting standard* (GRI Sustainability Taxonomy, 2025).
- *Integrated Reporting Guidelines (International Integrated Reporting Council, IIRC) (2025)*.
- recommendations of the Working Group on Climate-related Financial Disclosures (TCFD) (2017).

The above-mentioned regulations and numerous recommendations regarding ESG reporting confirm the need for financial institutions to carry out a wide range of activities.

ESG issues in the global economy are determined at the global and regional levels (e.g. in the Americas, Asia or European Union countries) and implemented at the national level, taking into account the specificities of individual countries.

Taking into account the levels of functioning of key institutions, it is necessary to:

1. Global institutions (worldwide):
 - Financial Stability Board (FSB) (publishes reports to monitor disclosures, FSB, 2023).
 - International Financial Reporting Standards (IFRS) Foundation (from 2024 onwards, it took over the monitoring of progress in climate disclosure, at the request of the FSB, after the TCFD was completed).
 - Taskforce on Climate-related Financial Disclosures (TCFD) (publishes status reports on the progress of companies in disclosures)(TCFD Status Report 2023).
 - Sustainability Accounting Standards Board (SASB).
 - International Sustainability Standard Board (ISSB).
 - International Organization of Securities Commissions (IOSCO).
 - International Auditing and Assurance Standards Board (IAASB).
 - International Ethics Standards Board for Accounts (IESBA).
2. Regional institutions (blocks/groups of states) e.g.:
 - The European Union (EU) – European Commission (EC), European Banking Authority (EBA), European Securities and Markets Authority (ESMA).
3. National institutions (individual countries), e.g.:
 - Japan – The Japan Financial Services Agency (FSA).

- The United States – US Securities and Exchange Commission's (SEC)
- United Kingdom – Financial Conduct Authority (FCA), Financial Reporting Council (FRC).
- Poland – Ministry of Finance, The Polish Financial Supervision Authority.

4. Research methodology and results

The analysis of the impact of ESG regulations on changes in the operating conditions of financial institutions focused on the assessment of disclosures published by and TCFD (2017; 2020–2024), IFRS Foundation (2024).

According to the TCFD (2017) recommendations and guidelines entities should disclose data in **11 areas** in total, divided into the **four categories** mentioned:

- 1. Governance** – disclosed the organization's governance around climate-related risks and opportunities, refer to:
 - a) the board's oversight of climate-related risks and opportunities;
 - b) management's role in assessing and managing climate-related risks and opportunities.
- 2. Strategy** – disclosed the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material:
 - a) the climate-related risks and opportunities the organization has identified over the short, medium, and long term;
 - b) the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning;
 - c) the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.
- 3. Risk Management** – disclosed how the organization identifies, assesses, and manages climate-related risks):
 - a) the organization's processes for identifying and assessing climate-related risks;
 - b) the organization's processes for managing climate-related risks;
 - c) how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.
- 4. Metrics and Targets** – disclosed the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material):
 - a) the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process;
 - b) e Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.

- c) the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

According to the IFRS Foundation (2024) and TCFD recommendations (2017), financial institutions (FCs) such as banks, insurance companies, assets owners and assets Managers should focus their disclosures on the following categories:

- Strategy (banks – 2a and others FCs 2b–c);
- Risk management (banks – 3a, and others FCs 3b–c);
- Metrics and targets (banks 4a; asset owners and managers 4a–b).

On the other hand non-financial institutions (NFCs) operating in the following sectors: Energy, Transportation, Materials and buildings, Agriculture, food, and forest products should concentrate myself on strategy (b, c) and metrics and targets (4a) ranges (Table 1).

In terms of **the research method**, in accordance with TCFD and IFRS Foundation date, artificial intelligence (AI) technology was used to check the quantity and accuracy of disclosures for the seven years 2017–2023, in line with the 11 recommended climate and ESG reporting guidelines, respectively for public sector:

- 1,701 companies (2017–2020),
- 1,651 companies (2021),
- 1,365 companies (2022),
- 1,365 companies and 25,127 reports (2022),
- 3,814 companies and 26,637 reports (for 2023) (Table 2).

Four scopes of presentation of research results were adopted (Table 3–6):

- *Four thematic areas of disclosure*: Governance; Strategy; Risk Management; Metrics and Targets.
- *Disclosures according to sectors*: financial institutions (FCs): Banks, Insurance companies and non-financial companies (NFCs): Energy, Transportation, Agriculture, Food and Forest, Technology and Media, Consumer goods.
- *Regional disclosures* broken down by company in five areas: Asia-Oceania, Europe, Africa, North America, Latin America and Caribbean.
- Disclosure by company size (Market Capitalization).

The results of institutions' ESG and climate disclosures across the global economy over the seven years (2017–2023) covered by the study showed that the percentage of companies disclosing TCFD recommendations increased in 2023 compared to 2017 respectively (TCFD, 2020–2024):

- 82% of companies disclosed at least one recommendation compared to 52%;
- at least five recommendations were disclosed by 44% of companies compared to 13%;
- all eleven disclosures were published by 2% of companies compared to previously below 1%.

In 2023, the most companies published TCFD disclosures in terms of metrics and targets (63% GHG emissions and 53% Climate-related targets), governance (55% Board oversight). Companies disclosed information in the field of Strategy (11% Resilience of strategy) and Risk management (18% Integration into overall risk management) the least. Upward trends in disclosures in the field of Metrics and Targets have been established since 2017 (29% for Climate-Related Metrics). Although in 2017, the most disclosures concern strategies (40% Risks and Opportunities) (Table 3).

The results of disclosures by **sector** in 2019–2023 clearly indicate that both in the financial sectors (banks, insurance) and in the non-financial sectors (energy or transport), the pillars of disclosures are governance scopes and the strongly developed range of Metrics and Targets, with its components such as: Scope 1,2,3 GHG Emissions; Climate-Related Metrics and Climate-Related Targets (Table 4).

In terms of the five analyzed **regions**, the highest percentage of companies in 2019–2023 was disclosed from Europe and North America. Although European companies are the main leader, companies from other regions have doubled their disclosure ranges. Regionally, in the scope of 11 thematic scopes, the pillars are climate disclosures (including in the range of 1–3 GHG Emissions) (Table 5).

Disclosures by company size based on **market capitalization** indicate that in 2019, most small (\$2.8B), medium <(\$2.8–10B) and large (>\$10B) companies focused mainly on governance and Metrics and Targets (albeit to a lesser extent). 2023 did not change priorities for small and medium-sized businesses, which maintained a similar distribution of disclosures, although they increased them compared to 2019. And changes have taken place among large companies.

The highest level of reporting among large companies (above US\$12.3 billion) in 2023 was for GHG emissions (70%), followed by climate-related metrics and targets at approximately 60%. Average companies (US\$3.2–12.3 billion) reported most frequently on GHG emissions at 65% and on climate-related metrics and targets at 56%. Reporting of GHG emissions by less companies (than US\$3.2 billion) was at 46%, whereas the rate of reporting on climate-related metrics and targets was at 40%. Moreover, companies of all sizes reported on board oversight of climate-related risks and opportunities at approximately 50% or higher (Table 6).

With regard to EU countries, important information is provided by, among others, indicators of the share of loans in green assets (Green Asset Ratio, GAR) based on EBA data (2025), which allow for the assessment of the degree of activity in the area of economy transformation financed by the financial sector. For 2024, the average share of green loans in total assets (Loan GAR, %) of financial institutions in the EU and the euro area (EU/EEA) was 6% for all countries.

The leaders in this area (GAR – stocks (loans and advances) were:

- Netherlands (14.1%),
- Norway (8.9%),
- Greece (7.4%).

The lowest share of loan GAR (%) was shown by:

- Cyprus, Iceland and Bulgaria (at 0.1%).

In other countries this share was as follows:

- France (6.5%),
- Italy (5.4%),
- Poland (1.9%).

5. Discussion – main challenges and opportunities

Due to the multidimensional nature of ESG risk factors, it is not isolated but integrated with existing risk management systems. Therefore, it requires significant and adequate support from legal regulations and supervisory institutions.

Financial institutions treat ESG with the same attention as traditional financial and non-financial risks. ESG risk management is treated as a cross-cutting risk that, to varying degrees and through different transmission channels, affects risks within institutions, such as credit, operational, and reputational risks (EBA, 2021; Battiston and Monasterolo, 2019).

The growing importance of ESG factors, especially climate factors, in the global economy determines their strong impact on current operations, as well as on business models, operational strategies and value creation (Adrian et.al., 2022; Battiston et.al., 2017; Kalkuhl, 2020; Monasterolo, 2020; Monasterolo and Battiston, 2020; Kosztowniak, 2023c). The impact of climate factors on the financial stability of institutions also remains an important issue (Giuzio et.al., 2019).

Moreover, many financial institutions point to climate change as one of the greatest challenges to sustainable development. *The Network of Central Banks and Supervisors for the Greening of the Financial System* (NGFS, 2024), which brings together central banks and supervisors, points out that climate-related threats are a source of financial risk, and central banks and supervisors are tasked with ensuring the resilience of the financial system to these threats (ECB, 2022; NGFS, 2020; ESRB, 2016).

The importance of climate risk was also confirmed by the results of *the Global Risk Report* (WEF, 2024), pointing to environmental factors as the main source of global risks. Climate change-related risks (physical and transformational) will require increasingly clear and comprehensive consideration in the management of financial and non-financial institutions, as their impact on financial performance will become increasingly significant (EBA, 2021; ESRB, 2020).

For investment funds, the challenge is the impact of asset price shocks resulting from adverse scenarios, including climate-related risks, direct declines in the value of assets managed by funds, or portfolio rebalancing by managers following the disclosure of price declines (ECB 2020; ESRB, 2020).

The analysis of the literature and empirical results of the disclosures shows that, the main challenges related to ESG include:

- a broad scope of legal regulations (global and regional), a lack of harmonized regulations that take into account the specificities of individual countries, for example, within the EU;
- other challenges include the complexity of the required adaptations in institutions' ongoing and strategic ESG activities, as well as limitations in staffing ESG experts and practitioners, and gaps in data for ESG monitoring (models, stress tests, portfolio management etc.);
- other problems include a lack of coordination between institutional disclosures and supervisory reporting, and problems with the comparability of ESG provider ratings.

Implemented ESG management strategies can be an opportunity and a tool for strengthening competitiveness in the domestic and global markets by building a brand, strengthening reputation, and differentiating in the market. The evolution of financial institutions' strategies primarily involves incorporating ESG risk into existing risk management systems, taking adaptive measures in organizational structures, using ESG strategies as a competitiveness tool (Kosztowniak, 2025; WEF, 2024).

6. Conclusions

The legal and institutional dependencies in the ESG area at financial institutions stem from the scope of their subjection to specific legal regulations and oversight by specific supervisory authorities.

The main conclusions are as follows:

1. International standards issued by institutions (ISSB, SASB, IAASB, IESBA), recommendations (TCFD) and supervisory institutions (IFRS Foundation, IOSCO) apply to transnational corporations and smaller institutions operating in multiple markets. Internationalization of operations forces companies to comply with regulations both in the country of their headquarters and in host countries. The ESG framework is structured by legal regulations, regulatory bodies, and supervisory authorities at three levels: global, regional, and national. Differences in the subject matter and scope of ESG regulation requirements occur primarily at the regional and national levels. Differences in the development of financial market segments, as well as internal priorities (regional or national), determine the intensification of ESG implementation in individual sectors. Advanced implementation procedures oc-

- cur in the banking and insurance sectors (EU, USA) and pension and investment funds, asset and fund managers (US, Asia).
2. Regulatory activity in the ESG field has intensified over the past decade. However, international institutions establishing global regulations have been particularly active and regional institutions, EU, US, and Asian regulators are implementing a wide range of adaptations.
 3. The scope of ESG regulations is multifaceted, therefore impacting the entire operations of institutions. However, the pillars of change are the areas of risk management, planning, investing, and reporting. Many adjustments have already been made to management and reporting. Strategies and risk management, on the other hand, require intensification of activities, as evidenced by lower disclosure scores (Table 3). In larger financial institutions, subject to regulatory requirements, the changes apply to both operational and strategic activities, while in smaller ones, they primarily focus on strategic planning. Financial institutions (banks, insurance companies, and investment funds) require special attention to reporting, disclosure, and due diligence in the supply chain.
 4. Competition in the ESG area concerns, on the one hand, regulatory authorities, which strive to implement regulations as broadly and often quickly as possible. Examples of leaders in this area include EU regulatory authorities (EC, EBA, ESMA). On the other hand, entities implementing ESG regulations also participate in this competition. Many transnational corporations strive not only to comply with applicable regulations but also to accelerate transformation processes within their entities. This stems from treating ESG as a new element of competitiveness. Implementing ESG processes often allows for improving reputation, strengthening the brand, and differentiating from other entities by demonstrating a positive impact on the environment and society (Table 6).

In sum, TCFD, FSB and IFRS Foundation data indicate that many banks and insurance companies in the EU and North America are ESG leaders, while banking, insurance, energy and construction show the highest reporting and competitiveness levels.

The relevance of ESG regulation in the financial sector stems from its rapid global growth, regulatory differences and the risk of disclosing financial losses that may be negatively assessed by investors.

Key implementation challenges include the multidimensional scope of ESG actions, lengthy legislative processes, uneven regulatory progress across regions, and limited financial and human resources. Enhanced cooperation among legislative and regulatory authorities is necessary to harmonise key provisions, since legal and institutional disparities may disrupt operations and adversely affect financial and socioeconomic outcomes. Appropriate

changes to legal regulations should be initiated by bodies with legislative and regulatory powers, such as the European Parliament and the Council of the EU, the EC or the European supervisory authorities (ESMA, EBA, EIOPA).

7. Limitations of research and future directions of analysis

The presented preliminary results of the disclosure assessment have several limitations. These data refer to the first results of the disclosures, covering a short period (2017–2023) of data collection resulting from reporting obligations, introduced in stages towards institutions. These data are aggregated data, not detailed data. The short implementation period may also indicate some problems with the quality of this data.

There are different problems at different levels of ESG regulation. Globally, the problem is the lack of full regulatory harmonisation, institutional fragmentation, and low comparability and quality of ESG data. Regionally, the difficulties arise from the uneven level of development of financial markets, differences in supervisory capabilities and the tension between climate and economic goals. In Europe, the main challenge is the complexity and overlap of regulations, high compliance costs and interpretation uncertainty. In Poland, the limited maturity of the ESG market, the economy's dependence on carbon-intensive sectors and the lack of established practice of applying new regulatory obligations are additionally important.

Future research should include the development of a multi-level methodology for ESG regulatory and institutional analysis, combining legal, comparative and strategic approaches. In order to identify future directions of regulatory changes and their potential impact on the business models of financial institutions, it would be important to assess trends such as the consolidation of ESG law, the development of mandatory data attestation, the linking of ESG to financial risk, the development of taxonomy, and the tightening of supervision over greenwashing.

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Appendix

Table 1. Supplemental Guidance for the Financial Sector and Non-Financial Groups

Industries and Groups		Governance		Strategy			Risk Management			Metrics and Targets		
		a	b	a	b	c	a	b	c	a	b	c
Financial	Banks			x			x			x		
	Insurance Companies				x	x	x	x		x		
	Asset Owners				x	x	x	x		x	x	
	Asset Managers				x		x	x		x	x	
Non-Financial	Energy									x		
	Transportation				x	x				x		
	Materials and Buildings				x	x				x		
	Agriculture, Food and Forest Products				x	x				x		

Source: TCFD (2017).

Table 2. Types and number of analysed companies

Sectors	2017–2020	2021	2022	2023
Banking	286	282	235	534
Insurance	138	132	117	150
Energy	274	267	205	444
Materials and buildings	414	404	345	1,398
Transportation	162	158	126	242
Agriculture, food and forest products	147	142	115	288
Technology and media	113	106	91	364
Consumer goods	167	160	131	394
Total	1,701	1,651	1,365	3,814

Source: TFCD (2020–2024), IFRS Foundation (2024).



Table 3. TCFD-Aligned Disclosures for 2017–2023 (%)

Recommendations	Recommended Disclosure	2017	2018	2019	2020	2021	2022	2023
Governance	Board Oversight	16	21	24	39,0	56,0	48,0	55,0
	Management's Role	20	24	28	23,0	37,0	31,0	34,0
Strategy	Risks and Opportunities	40	42	41	36,0	55,0	34,0	38,0
	Impact on Organization	29	32	35	26,0	37,0	33,0	37,0
	Resilience of Strategy	4	5	7	4,0	9,0	9,0	11,0
Risk Management	Risk ID and Assessment Processes	14	19	25	14,0	26,0	25,0	28,0
	Risk Management Processes	15	21	25	19,0	33,0	30,0	34,0
	Integration into Overall Risk Management	8	11	17	11,0	21,0	16,0	18,0
Metrics and Targets	Climate-Related Metrics	29	32	35	58,0	66,0	46,0	54,0
	Scope 1,2,3 GHG Emissions	22	24	26	50,0	60,0	53,0	63,0
	Climate-Related Targets	17	30	33	42,0	59,0	48,0	53,0

Source: TFCF (2020–2024), IFRS Foundation (2024).

Table 4. Disclosure by sectors in 2019Y and 2023Y (% of companies)

	Banking		Insurance		Energy		Materials and buildings		Transportation		Agriculture, food and forest products		Technology and media		Consumer goods	
Disclosure	2019Y (286)	2023Y (534)	2019Y (138)	2023Y (150)	2019Y (274)	2023Y (444)	2019Y (414)	2023Y (1,398)	2019Y (162)	2023Y (242)	2019Y (147)	2023Y (288)	2019Y (113)	2023Y (364)	2019Y (167)	2023Y (394)
Board Oversight	23	47	24	71	42	70	26	54	16	55	20	51	6	55	11	48
Management's Role	24	33	35	57	45	46	31	33	20	34	21	33	8	25	17	27
Risks and Opportunities	32	41	49	57	65	50	39	37	30	31	41	33	27	25	27	35
Impact on Organization	27	26	21	44	54	49	43	40	30	40	35	39	16	34	25	31
Resilience of Strategy	12	7	8	15	15	18	4	11	2	7	1	13	0	7	2	8
Risk ID and Assessment Processes	25	31	36	48	39	34	26	27	15	24	21	26	7	23	16	22
Risk Management Processes	23	33	28	53	38	42	26	33	18	29	26	31	11	33	14	24
Integration into overall Risk Management	19	27	26	31	30	24	14	15	10	17	14	14	4	13	7	14
Climate-Related Metrics	27	45	26	50	41	68	43	57	37	61	35	51	23	48	31	49
Scope 1,2,3 GHG Emissions	21	52	19	61	27	75	35	66	27	62	28	62	19	60	24	58
Climate-Related Targets	19	40	22	59	44	65	41	54	35	60	38	59	19	49	29	48

Note: The numbers in parentheses represent the size of the review population.

Source: TFCF (2020–2024), IFRS Foundation (2024).



Table 5. Disclosure by region in 2019Y and 2023Y (% of companies)

	Asia-Oceania		Europe		Africa		North America		Latin America and Caribbean	
Disclosure	2019Y (346)	2023Y (1,754)	2019Y (441)	2023Y (717)	2019Y (83)	2023Y (113)	2019Y (779)	2023Y (1,111)	2019Y (52)	2023Y (119)
Board Oversight	22	47	36	70	17	50	18	59	21	43
Management's Role	26	24	47	56	14	29	20	38	15	28
Risks and Opportunities	24	24	43	52	22	28	50	53	38	27
Impact on Organization	29	37	60	52	27	34	25	31	13	23
Resilience of Strategy	7	8	11	22	4	9	4	8	10	4
Risk ID and Assessment Processes	25	19	43	57	14	21	15	25	27	23
Risk Management Processes	25	30	43	50	18	30	15	29	15	29
Integration into overall Risk Management	16	13	30	29	10	17	10	20	8	20
Climate-Related Metrics	31	52	58	80	23	50	25	42	25	44
Scope 1,2,3 GHG Emissions	29	62	49	84	17	56	14	52	12	50
Climate-Related Targets	27	45	52	83	17	47	27	49	15	43

Note: The numbers in parentheses represent the size of the review population.

Source: TFCF (2020–2024), IFRS Foundation (2024).

Table 6. Disclosure by Company Size (Market Capitalization, %)

		2019Y			2023Y		
Recommendations	Disclosure	<\$2.8B (613)	\$2.8–10B (539)	>\$10B (549)	<US\$3.2B (929)	US\$ 3.2B– 12.3B (879)	>US\$12.3B (2,006)
Governance	Board Oversight	11	23	39	48	61	56
	Management's Role	15	26	43	29	36	36
Strategy	Risks and Opportunities	31	40	53	39	42	35
	Impact on Organization	20	30	55	24	38	43
	Resilience of Strategy	2	6	12	8	10	12
Risk Management	Risk ID and Assessment Processes	12	24	41	24	33	28
	Risk Management Processes	13	22	40	25	36	36
	Integration into overall Risk Management	7	16	28	15	23	17
Metrics and Targets	Climate-Related Metrics	20	30	56	40	56	60
	Scope 1,2,3 GHG Emissions	16	25	40	46	65	70
	Climate-Related Targets	19	28	52	40	56	58

Source: TFCF (2020–2024), IFRS Foundation (2024).