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Department of International Trade
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Assessing entrepreneurial emotional intelligence: The development of the emotional intelligence in business questionnaire

Yuliia Fedorova, Olena Lutsenko, Anna Pilková, Juraj Mikuš, Marian Holienka

ABSTRACT

Objective: The article aims to present the 'Emotional Intelligence in Business' (EIB) questionnaire, developed using the four-component 4EI model of emotional intelligence.

Research Design & Methods: The EIB questionnaire is based on the 19 competencies of the 4EI Model, which builds on D. Goleman's mixed model of emotional intelligence. Its competencies are adapted to the business environment, and allow the identification of 4 components: 1) self-awareness (SA), 2) self-management (SM), 3) social awareness (SocA), and 4) relationship management (RM). One hundred fifty-eight respondents of different ages participated in the EIB questionnaire development procedures during 2020 and 2021. We validated the EIB questionnaire using classical test theory methods. We analysed data in MS Excel, SPSS, FACTOR, and R-Studio using techniques such as exploratory and confirmatory factor analyses, Cronbach's alpha, and non-parametric tests (Mann-Whitney U, Kruskal-Wallis).

Findings: The EIB questionnaire demonstrates robust psychometric properties, including high measurement accuracy and internal consistency. It also features a distinct factorial structure. Moreover, the tool demonstrates meaningful and theoretically congruent correlations with N.Hall's Emotional Intelligence Test and D.Lyusin 'AmIn' Questionnaire. The EIB questionnaire comprises 40 statements, each rated on a five-point Likert scale. According to the 4EI model, the EIB questionnaire is a reliable measuring tool for building an entrepreneur's EI profile.

Implications & Recommendations: The EIB questionnaire allows the building of profiles of entrepreneurs and tracking the dynamics of their EI components: SA, SM, SocA, and RM. Surveys with automatic follow-up recommendations can be easily conducted with the help of the user-friendly chatbot 'Emotional Intelligence in Business' specially created in Smart Sender.

Contribution & Value Added: This research offers a valuable tool for measuring EI competencies in the business environment. Based on individual EI profiles, optimising project teams and improving collaboration in entrepreneurship, including online projects, is possible.

Article type: research article

Keywords: emotional intelligence (EI); four-component instrumental model of emotional intelligence (4EI model, Emotional Intelligence in Business Questionnaire (EIB Questionnaire); entrepreneurship

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INTRODUCTION

Goleman (1995) characterises emotional intelligence (EI) as the capacity to recognise one's feelings and those of others, to motivate oneself, and to effectively manage emotions in oneself and others. Effective communication and problem-solving both necessitate high EI. Research into emotional intelligence has enriched fields such as psychology, business, leadership, and entrepreneurship. An examination of the

literature through the Scopus and Web of Science databases indicates an increase in articles focusing on EI within management. Crucial soft skills like resilience, stress tolerance, adaptability, leadership, and social impact may all be built on EI. EI enhances communication quality, offering a cooperative edge in the workplace. Innovative entrepreneurial endeavours are more likely to be undertaken by those with high EI scores. According to Çetin and Karakaş (2021), innovative dispositions foster innovation and exhibit more proactive knowledge-sharing behaviour. Leaders with high EI can unlock the potential in their followers, resulting in a collective talent that increases employee commitment. Project managers' EI fosters teamwork and speeds up attaining the intended outcomes (Zhang & Hao, 2022). A high level of metacognitive awareness in students (the ability to acquire knowledge and learn new skills) is related to a high level of EI (Perikova & Byzova, 2019). According to Karimi and Ataei (2022), developing and enhancing entrepreneurial abilities in students requires a better level of EI.

The interest in EI in management is growing due to a deep understanding of its impact on professional performance. However, there is a significant gap in research on EI in the business environment. Scholars have identified a lack of assessment tools that consider the specific characteristics of EI in the business context. The development of EI is grounded in three key theories: Bar-On's non-cognitive model, Mayer and Salovey's ability-based model, and Goleman's mixed model of emotional competence. Scholars have developed a variety of psychological tests based on these models. However, the most established and widely used instruments – such as the Mayer- Salovey-Caruso Emotional Intelligence Test (MSCEIT, MSCEIT 2.0); EQ-i (based on Goleman's work and Bar-On's measurements); ECI 2.0; EQ 360 2.0 (Ackley, 2016), Schutte Self Report-Inventory (SSRI), Trait Meta-Mood Scale (TMMS), Wong and Law's Emotional Intelligence Scale (WLEIS), and Trait Emotional Intelligence Questionnaire (TEIQue) (Bru-Luna *et al.*, 2021) – do not sufficiently account for the specific requirements of the business environment.

Considering the important role of sustainable entrepreneurship, given the increasing interest of management in EI in the scientific literature, we conducted a literature analysis of existing techniques for assessing EI in the business sector. We aimed to provide a detailed description of the EIB questionnaire, which allows entrepreneurs and managers to measure EI in a business environment. Hypothesis: Building on existing EI models, a reliable and valid questionnaire can be developed to assess essential EI in business, offering quantitative data and graphical profile interpretation.

The developed and successfully applied EIB questionnaire is valuable for assessing EI in a business environment. It is a convenient and practical tool that allows for the application of psychology in the business environment and thus enhances further interdisciplinary research.

This study contributes to the effective use of human capital in professional activities in a business environment. The detailed questionnaire is described that can be easily and conveniently applied to assess the EI of entrepreneurs in European countries.

The literature review and hypotheses development section presents a systematic literature analysis of existing EI assessment questionnaires in the business environment. The research methodology section describes the methodology for developing the EIB questionnaire. The results and discussion section outlines and compares the developed EIB questionnaire with existing EI assessment questionnaires.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The primary objective of the literature review was to systematise existing EI assessment methods and identify questionnaires suitable for EI assessment within the context of the business environment (considering fields of entrepreneurship, management, and economics).

We conducted the bibliographic search in two stages: an initial search to obtain information according to inclusion-exclusion criteria and a final selection to evaluate the results.

We conducted the literature search in April 2024 in the Web of Science (WoS) database and Scopus, including articles published from 2020 to 2024 (inclusive).

The inclusion criteria for the studies consisted of 1) being published in peer-reviewed journals, 2) being presented as full open-access articles, 3) containing testing and quantitative results, 4) being written in English, 5) containing tests (questionnaires) on EI, and 6) containing quantitative results of EI assessment.

The exclusion criteria for the studies consisted of 1) studies on EI of children, adolescents, and schoolchildren, 2) studies in which EI is only a small part of a comprehensive study, 3) research on the productivity and characteristics of health workers and nurses, and 4) studies that did not quantify results.

In the search strategy, we included the following terms: emotional intelligence, test, questionnaire, assessment, and evaluation. The search was not limited to WoS categories and was limited to Scopus subject areas: psychology, social sciences, business, management and accounting, and health professions. We used the combinations of terms: 'emotional intelligence AND test,' 'emotional intelligence AND questionnaire,' 'emotional intelligence AND assessment,' and 'emotional intelligence AND evaluation.' We selected and analysed only article-type studies that met the aforementioned criteria.

To ensure consistency, we defined the data extracted from each instrument in advance. Subsequently, we used a Microsoft Excel spreadsheet to compile the selected documents and identify duplicates. Figure 1 outlines the search, process including the number of studies included and excluded.

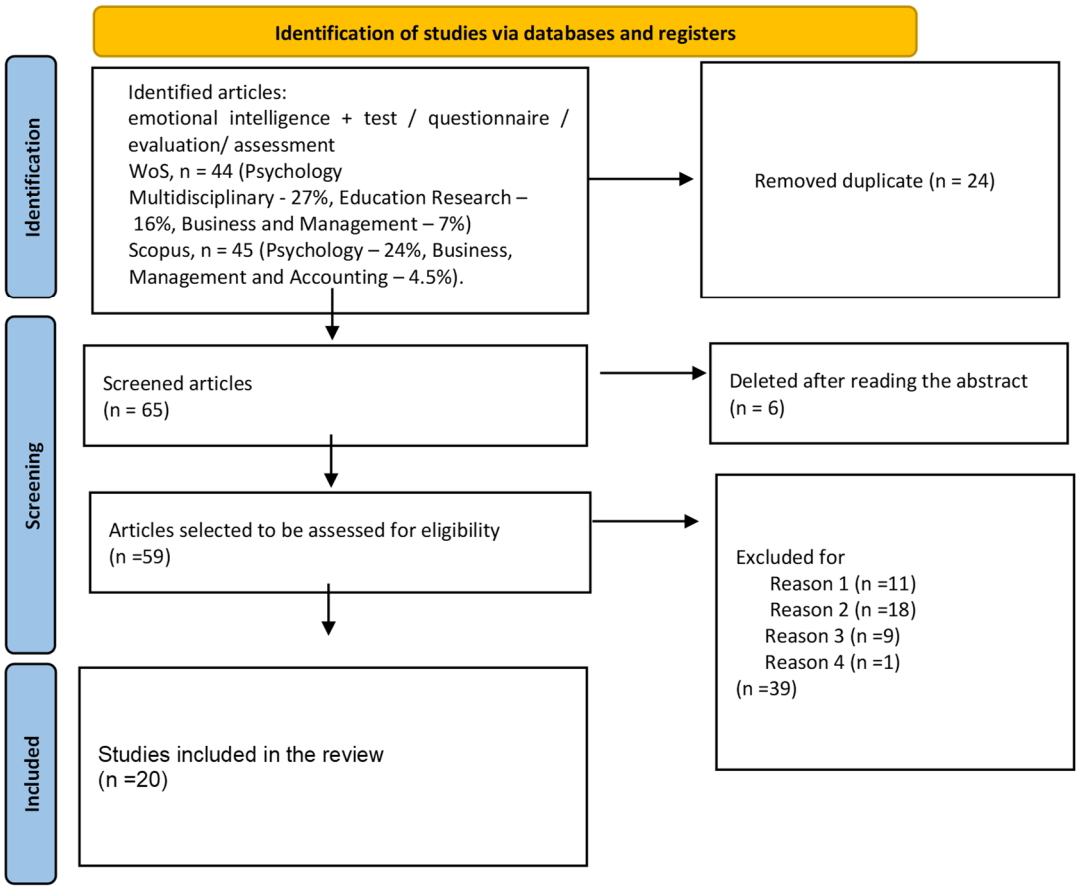

Figure 1. Flowchart according to PRISMA

Source: own elaboration based on the research results in April 2024 in WoS database and Scopus categories.

The literature review identified a total of 20 articles, reflecting a growing interest in the assessment of EI. Most often, researchers identify groups of questionnaires for measuring EI according to three main EI Models: ability-based model, trait-based model, and mixed approach model (Bru-Luna *et al.*, 2021; Butler *et al.*, 2022; Sweis *et al.*, 2022).

Ability models (primarily the Mayer and Salovey model) focus on comparatively separate mental processes related to emotional information. These models emphasise cognitive ability and see EI as intelligence that can process and interpret emotional information. Ability-based assessments help determine emotional identification skills. They are typically unfalsifiable because each question has a correct response. However, ability-based measurements assess only the understanding of emotion. The main disadvantage of ability-based EI measures is the lack of workplace relevance of the items (Schlegel & Mortillaro, 2019). Therefore, these tests may not be entirely sufficient. They may be helpful

in the initial stages of personnel selection and in courses on understanding emotions. The most popular ability-based measures instruments validated in the English language are the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT), USA; Trait Meta-Mood Scale (TMMS), USA; Schutte Self-Report Inventory (SSRI), USA; Multidimensional Emotional Intelligence Assessment (MEIA), USA; Three Branch Emotional Intelligence Forced Choice Assessment (TEIFA), USA; Self-Rated Emotional Intelligence Scale (SREIS), USA; Emotional Intelligence Self-Description Inventory (EISDI), USA; Multifactor Emotional Intelligence Scale (MEIS), USA; Wong and Law's Emotional Intelligence Scale (WLEIS), China; Workgroup Emotional Intelligence Profile-3 (WEIP-3), Australia; Situational Test of Emotion Management (STEM), Australia; Situational Test of Emotional Understanding (STEU), Australia; Audiovisual Test of Emotional Intelligence (AVEI), Israel (Bru-Luna *et al.*, 2021). These tests are attractive for respondents as they contain tasks, puzzles, and images (O'Connor *et al.*, 2019).

Trait models are based on recognising emotional abilities. Trait-based measurement instruments are based on self-assessment and, therefore, have related drawbacks. The respondent may deliberately want to get better grades in the eyes of the employer, or the respondent may unintentionally underestimate or overestimate their EI (Fiori & Vesely-Maillefer, 2018; Petrides, 2010). Trait-based measures have a distinct advantage over ability-based measurements because they track student experiences and learning outcomes. They measure emotional self-efficacy. However, their disadvantage is bias in self-reports, which is often due to the desire of the test taker to show better results (for example, during hiring). The primary tools in this concept are the Trait Meta-Mood Scale (TMMS), the Trait Emotional Intelligence Questionnaire (TEIQue, the short form (TEIQue-SF) and peer or 360-degree ratings (TEIQue 360), UK. TEIQue has strong reliability. TEIQue-SF is used in studies of the relationship between EI and achievement (Bitar *et al.*, 2023). It is a frequently utilised instrument across numerous nations and has numerous language translations (Daderman & Kajonius, 2022). Schutte Self-Report Emotional Intelligence Test (SSEIT) or Schutte Self-Report Inventory (SSRI), based on Salovey and Mayer's original model and is often used to identify differences in the EI of men and women (Dishari & Al Afnan, 2023).

Mixed models (primarily the Bar-On and Goleman models) combine ability concepts and personality traits. These models focus on intrapersonal qualities, interpersonal skills, stress management, adaptability, and general mood. The advantage of using a mixed assessment is that they can measure multiple qualities of emotional intelligence with one instrument. These dimensions are heterogeneous and one often measures them by self-report and other assessors. These measurements are becoming increasingly more widely used. The most popular validated mixed model measures instruments are Emotional Competence Inventory 2.0 (ECI 2.0), USA; The Emotional Intelligence Questionnaire (EIQ, EQ-i 2.0), USA; USM Emotional Quotient Inventory (USMEQ-i), Malaysia; The Indigenous Scale of Emotional Intelligence, Pakistan; the Mobile Emotional Intelligence Test (MEIT), Spain, Personal-Interpersonal Competence Assessment (PICA), Emotional and Social Competency Inventory (ESCI).

Most of the tests are developed or translated and adapted into English. Often, they contain statements on a four-point to five-point Likert scale. A notable trend in improving testing objectivity is using the 360 Degree Questionnaire. For example, a manager's self-assessment can be corroborated by assessing two other supervisors, peers or subordinates (Sweis *et al.*, 2022). Only some measurements involve repeated testing over a more extended period. An example would be using the Trait Emotional Intelligence Questionnaire (TEIQue) for four years (Zadorozhny *et al.*, 2024).

Recent research emphasises the need to consider the digital world's impact on EI and the importance of using digital tools to assess EI (Audrin & Audrin, 2023). The fresh perspective in EI research is the EI-ACCME test, designed to assess meta-emotional intelligence. This test focuses on the cognitive aspects of emotional abilities and metacognitive and meta-emotional processes that impact our emotional lives. The IE-ACCME scales describe Meta-Emotional Beliefs, Emotional Self-Concept, The Emotional Abilities Test, and Self-Rating of Performance (D'Amico & Geraci, 2023). Scholars continue to create complex EI tests, mainly in medicine and nursing. Researchers developed the EMI-T for social care and healthcare student selection purposes (Pienimaa *et al.*, 2023)

Despite the growing number of available tools, the literature review revealed a lack of EI assessment instruments tailored to the business environment, which remains a promising area for EI application. A combination of EI tests is used to assess EI in the management and business sectors. The

impact of EI on transformational leadership (Hajncl & Vučenović, 2020), the impact of EI on the effectiveness of communications (Dong *et al.*, 2022), features of the influence of emotional intelligence on Prosocial Behavior (Čikeš & Humer, 2023), study stereotypes that limit women's opportunities in entrepreneurship (Tabassum & Nayak, 2021) or a questionnaire including several EI questions is prepared (Ran *et al.*, 2021). Scholars investigated the impact of EI on transformational leadership through EI using several tests, including the Vocabulary Emotion Test (ability test, VET-3) and the Emotional Skills and Competence Questionnaire (self-report measure, ESCQ-45) (Hajncla & Vučenović, 2020). Scholars synthesised a questionnaire using a five-point Likert scale to study the influence of EI of men and women on Corporate Financial Decision-Making in Pakistan (Ran *et al.*, 2021). Moreover, various tests served to study stereotypes limiting women's entrepreneurship opportunities (Zhang *et al.*, 2023).

However, we found a few tests designed for managers. One of these tests was the QEPro test, specifically designed for French managers. QEPro is an ability-based measure of EI with theory-based scoring based on a modified version of Mayer and Salovey's (1997) four-branch EI model. QEPro is dedicated to business executives and managers in a French cultural environment (Haag & Jilinskaya-Pandey, 2023). The constructs are measured in three areas: ability, personality, and trait & affective measures. QEPro correlates in meaningful and theoretically congruent ways with general intelligence, Trait EI measures, the Big Five factors of personality, and the Affect measures. According to Haag and Jilinskaya-Pandey's hypothesis, two meta-competencies, Identifying Emotions and Strategic Management of Emotions, depend on cultural context.

The second test is Emotionally Intelligent Leadership for Students (EILS). EILS is a self-report assessment designed to measure EI leadership within a student context. It aims to act as a learning instrument for students in high school, college/university, or graduate school. It encompasses three main domains: consciousness of context, self-awareness, and awareness of others. The EILS inventory includes 19 statements, each evaluated on a five-point Likert scale, with scores ranging from 8 to 40 for each of the three domains/constructs. We conducted reliability testing, and each scale demonstrated a robust reliability level (Shankman *et al.*, 2015).

The self-report measure Wong and Law Emotional Intelligence Scale (WLEIS), developed by Wong and Law (2002), is promising. The WLEIS is based on the model of Mayer and Salovey (Salovey & Mayer, 1990) and consists of 16 items, which are evenly distributed across four dimensions: self-emotion appraisal, others' emotion appraisal, use of emotion, and regulation of emotion (Wong & Law, 2002). Self-emotion appraisal relates to individuals' awareness of and reflections on their emotions. Others' emotion appraisal pertains to recognising and understanding the emotions of others. Emotion encompasses observing, assessing, and regulating emotions to alter one's emotional state. Regulation of emotion allows individuals to enhance their performance by harnessing self-driven emotions.

Initially, WLEIS was suggested for leadership and management studies. However, it has been successfully applied to South Korean nurses (Park & Yu, 2021), Chinese students (Kong, 2017), Moroccan students (Ghoudani *et al.*, 2018), UK university students (Sochos *et al.*, 2021), and Spanish medical students (Carvalho *et al.*, 2016).

Moreover, scholars studied the WLEIS on a sample of managers in Chile and found that a structural model of four related factors has the best fit but had low reliability in three of the four factors (Acosta-Prado & Zárate, 2019). The results of the testing of 489 Colombian managers indicated that the WLEIS presents favourable fit indices. Convergent and discriminant data supporting WLEIS scores' validity indicates its reliability (Acosta-Prado *et al.*, 2022).

In response to the growing interest in EI within the realms of business, management, and entrepreneurship, we have developed and validated a test tailored to the nuances of the business environment. Based on the latest iteration of D. Goleman's mixed model (Wolff, 2005), our test encompasses four key components: self-awareness, self-management, social awareness, and relationship management. These components reflect crucial competencies for entrepreneurs and managers (Mikuš *et al.*, 2023). These prior empirical results allowed us to assume the following research hypotheses:

H1: Based on the existing EI models, it is possible to develop a reliable EI questionnaire that considers the skills essential for success in the business environment. The questionnaire

could provide quantitative characteristics of the profile and a graphical interpretation of the EI profiles of business environment participants.

H2: A comparative analysis with the results of well-known EI questionnaires will confirm the questionnaire's construct validity.

RESEARCH METHODOLOGY

We applied the four-component instrumental model of emotional intelligence (4EI Model), which includes self-awareness (SA), self-management (SM), social awareness (SocA), and relationship management (RM) as its core components. The 4EI Model is specifically designed for entrepreneurial and business contexts, incorporating 19 distinct competencies (Mikuš *et al.*, 2022).

The 'Emotional Intelligence in Business' questionnaire represents results using a four-quadrantEI diagram, which illustrates the respondent's emotional intelligence profile (EI profile). We validated the EIB questionnaire using Classical Test Theory methods. We analysed the data in MS Excel, SPSS, FACTOR, and R-Studio using techniques such as exploratory and confirmatory factor analyses, Cronbach's alpha, and non-parametric tests (Mann-Whitney U, Kruskal-Wallis).

We conducted the testing between 2020 and 2021 via the online platform of the National University of Civil Defence of Ukraine (https://testing-system-nure.herokuapp.com/auth). Participation in the testing was voluntary, with a total of 158 respondents surveyed. The sample consisted of individuals aged 18–42 from various fields, including 46 non-students and 109 university students – specifically in psychology (12), philosophy (33), mathematics (10), and law (54) – from V.N. Karazin Kharkiv National University and Ukrainian engineering pedagogy academy. Three respondents did not specify their field of study. The sample included students across different academic years: 35 in the 1st year, 28 in the 2nd, 26 in the 3rd, 16 in the 4th, and 7 in the 5th year. In terms of gender, there were 120 women and 38 men.

The research methodology for developing emotional intelligence in business tests included two stages.

Stage 1. Development of the EIB questionnaire

We created a preliminary version of the test, containing 80 statements, on the online platform. It is scored using a five-point Likert scale.

There were 20 statements for each component of the 4EI Model (SA, SM, SocA, and RM). We determined the methodology of test construction. We formulated the questionnaire statements in a way that they were consistent with the theory and at the same time related to the business context – professional activity and entrepreneurial activity. We created a test of 80 questions in Visual Studio and conducted a student survey on the test platform https://testing-system-nure.herokuapp.com/auth. We processed the data using MS Excel, SPSS, STATISTICA, FACTOR, and R-Studio. Correlation analysis with the total test score and assessment of the distribution of responses to the items allowed us to retain the top 10 items on the scale in terms of their psychometric properties. However, only 1 out of 80 initial items did not meet standard psychometric requirements: 'I know which professional tasks cause me fear.' We may assume that it was loaded with some other factor, such as anxiety, rather than self-awareness as a component of EI. As a result of the first survey stage, 40 of the 80 most essential statements remained. This allowed us to make the questionnaire shorter and more precise, which is a preferred outcome in questionary construction.

Stage 2. The final version of the EIB questionnaire

We created the second test version on the online platform https://testing-system-nure.herokuapp.com/auth, which contained 40 statements with scoring on a five-point Likert scale. We received feedback. We checked the construct validity of the results by comparing them with the responses of respondents using methods that are also based on a mixed model of EI, namely, the questionnaire of N. Hall (test contains 30 statements and 5 EI components) (Hall, 2007) and Lyusin (test contains 40 statements and 6 EI components) (Lyusin, 2006).

The overall test score and the score of the RM scale followed a normal distribution: K-S d=0.05414, p>0.20; Lilliefors p>0.20 and K-S d=0.06442, p>0.20; Lilliefors p<0.10, respectively. The other two scales deviate from the normal distribution. The discriminability of all scales and the test as a whole was very high: Ferguson's δ coefficient = 1.0, which means that the test was informative and evenly distinguished between people by differences in the level of EI and its components.

The Exploratory Factor Analysis using the principal components method, polychoric correlation coefficients, Direct Oblimin rotation, and a hierarchical factor solution (Schmid-Leiman solution) with one main factor and four subfactors showed that all selected tasks correlated with the respective factors at the levels of 0.30-0.83. The parallel analysis used to select the significant factors confirmed that the recommended number of factors for this set of items is 4. The factors correlated with each other at the level of relationship management-social awareness 0.43; relationship management-self-awareness 0.32; relationship management-self-control 0.27; social awareness-self-awareness 0.32; social awareness-self-control 0.26; self-awareness-self-control 0.22. The sub-factors correlated with the general factor of EI at the level of relationship management 0.66; social understanding 0.65; self-awareness 0.49; and self-control 0.42. For EI in business, the most critical components were relationship management and social understanding (Lutsenko *et al.*, 2021).

Confirmatory factor analysis showed that the goodness-of-fit of the selected four-factor test model is not high enough: RMSEA 0.074 (preferably less than 0.080; good if less than 0.050), CFI 0.774 and TLI 0.758 (preferably 0.90 or more). The insufficiently large and representative sample can explain this. However, the internal reliability of the scales of the questionnaire and the questionnaire as a whole was very high: Cronbach's alpha coefficient for the EI in Business questionnaire as a whole was 0.932; for the scales of self-awareness – 0.778, self-control – 0.846, social understanding – 0.868, and relationship management – 0.906. The reliability of the scales assessed in the exploratory factor analysis was notably higher: 0.927, 0.906, 0.866, and 0.865, respectively. This result indicated the test's internal consistency and low measurement error (Lutsenko *et al.*, 2021).

One of the test's criterion validity (*i.e.*, its practical value) indicators is the logical distribution of scores among contrasting groups of subjects – age groups, men and women, representatives of different professions. The obtained results corresponded to the expected EI components' expression levels in the groups. The social awareness component is significantly higher in women than men (Mann-Whitney U Test: U=1682, p=0.014). The self-awareness component showed a proportional increase with the advancement in the year of study among higher education students: Kruskal-Wallis test resulted in H=12.61833, p=0.0272. This trend was further supported by the correlation between the level of self-awareness and the year of study: ρ=0.234, p=0.003. Law students reported higher self-control than philosophy students (U=651, p=0.035). Moreover, we observed higher levels of self-awareness and self-control in the group of non-law students compared to philosophy students (U=657, p=0.027; U=554.5, p=0.015, respectively) (Lutsenko *et al.*, 2021).

RESULTS AND DISCUSSION

The development, validation, and psychometric testing of the 'Emotional Intelligence in Business' questionnaire resulted in a reliable, discriminative, and criterion-referenced instrument for measuring both the overall construct and its components. The test has undergone thorough validation and demonstrated strong reliability.

The test enables entrepreneurs to assess four components of EI (SA, SM, SocA, and RM) and to create a graphical representation of both their own and their team's business EI profile.

The test consists of 40 questions, with ten questions dedicated to each component. For each statement, a respondent must select one answer (never, very rarely, sometimes, often, or always). The developed items are statements that indicate the business scope of EI. An example of a task from the self-awareness scale: 'I am aware of the goals for which I work.' An example from the self-control scale: 'I do my job without making mistakes in a stressful situation.' Example from the social understanding scale: 'I feel what I should not say to a person.' An example from the Relationship Management scale:

'I know the strengths and weaknesses of each team member (employee).' The survey can be conveniently conducted in GoogleForms and via a chatbot created on the Smart Sender online platform.

The respondents could receive individual recommendations on further development of EI in the business after filling out the questionnaire based on their results. The chatbot survey in Smart Sender can automatically deliver personalized EI development recommendations to respondents. Smart Sender is an innovative platform for creating chatbots for various services across Telegram, Viber, Facebook, and more. The platform allows for creating bots without writing any code, making it accessible even for users without a technical background. We tested this methodology, namely, we created chatbots on the Smart Sender platform, to give feedback for improvement in the level of competence in each EI component. The chatbot automatically interacts with users via text messages and sends questions and recommendations to respondents. The chatbot can answer users' questions by providing information, making recommendations, or solving problems. It is also possible to offer the EIB questionnaire in Google Forms or paper form. However, the paper form is less convenient and does not provide individual recommendations.

As a result, respondents receive information about their EI Profile in business (Mikuš *et al.*, 2022). The EI Profile matches the 4EI Model. It consists of quadrants equal to the component's value obtained during the test (from 0 to 10). For example, the EI profile can be described as {7.3SA; 5.3SM; 4.9SocA; 7.1RM}, {HLSA; ALSM; ALSocA; HLRM}. This respondent has an average level of SM and SocA and a high level of SA and RM.

The 4EI Model offers the advantage of visually demonstrating the development degree of each component. By constructing an EI profile, it becomes possible to ascertain the development level of each component, allowing individuals to focus on enhancing the requisite EI skills. Moreover, a comprehensive approach involves monitoring the results both before and after participating in a training course, facilitating a clear assessment of progress and areas needing further development. This article was devoted to assessing the EI of managers, entrepreneurs, and other participants in the business environment. The questionnaire was based on the 4EI Model, which contains 19 essential competencies for managers, entrepreneurs, and business people (Mikuš *et al.*, 2022). The 4EI Model was developed based on D. Goleman's updated model. This model excludes the component of motivation, as it is included in other components of the 4EI Model. The competencies of the model for the business environment were chosen based on the generalisation of theoretical material about EI.

Our approach focused on building emotional competencies (*e.g.*, increased awareness and generation of new ideas, ability to collaborate, negotiation and relationship-building skills, and leadership) that will enable managers and entrepreneurs to improve team management and generate positive financial results. However, our research can only be confirmed by the real success of project teams based on the principles of collaboration of students trained according to the 4EI Model.

Our study integrates the latest advancements in EI research in psychology and management. It is based on the popular 4-component approach to EI in psychology. The content of the components reflects the competencies essential for success in management and the business environment.

The EIB questionnaire aligns with the 4EI Model based on Daniel Goleman's latest EI framework. Unlike D. Goleman's Model, which contains 16 general EI competencies, the 4EI Model contains 19 competencies essential for management and business success. In contrast to D. Goleman's questionnaire, which consists of 10 situational questions, the EIB questionnaire consists of 40 business-adapted questions – 10 for each EI component.

Thus, in contrast to the currently existing EI questionnaires, the EIB questionnaire considers the business environment's peculiarities. At the same time, unlike existing questionnaires in the business environment, the EIB questionnaire enables a broader reach of respondents. It is suitable for a wide range of managers and entrepreneurs, not limited to one culture like the QEPro test, specifically designed for French managers (Haag & Jilinskaya-Pandey, 2023), not limited to students like the test Emotionally Intelligent Leadership for Students (EILS) (Shankman *et al.*, 2015).

Moreover, the EIB questionnaire takes less time and is more user-friendly. It contains fewer questions and EI components than many popular questionnaires. We compared the construct validity of

the EIB questionnaire with two well-known EI questionnaires developed by N. Hall (30 statements and 5 EI components) (Hall, 2007) and D. Lyusin (40 statements and 6 EI components) (Lyusin, 2006).

The EI questionnaire contains 40 questions reflecting 4 EI components. At the same time, it allows for building a logical and understandable profile of EI in entrepreneurship (quantitatively and graphically). The EIB questionnaire is based on the most widespread approach to the composition of EI.

CONCLUSIONS

We provided a detailed description of the EIB questionnaire, which enables entrepreneurs, managers, and specialists to assess. The EIB questionnaire includes 40 statements rated on a 5-point Likert scale, assessing managers, entrepreneurs, and business people's SA, SM, SocA, and RM levels. The test also allows for tracking the dynamics of EI development in business according to the 4EI Model. The visual result of the assessment can be reflected in respondents' individual and group EI profiles. The development, validation, and psychometric testing procedures resulted in a reliable, discriminative, and criterion-referenced 'Emotional Intelligence in Business' questionnaire that measures the overall level of the construct and its components. The test is available in English, Slovak, and Ukrainian. We thus developed a practical and easy-to-use tool for measuring the EI of entrepreneurs.

The presented methodology completes the list of EI questionnaires (Butler *et al.*, 2022; Bru-Luna *et al.*, 2021; Sweis *et al.*, 2022). At the same time, our study fills the gap in the ability to assess EI in business and entrepreneurial environments and complements the work on evaluating managers' EI (Shankman *et al.*, 2020; Haag & Jilinskaya-Pandey, 2023). This study is an example of the use of digital technologies in assessing EI, which aligns with current trends in education (Audrin & Audrin, 2023).

The presented methodology for assessing EI has been applied to assess the EI of young people and seniors in Slovakia and Ukraine (Mikuš *et al.*, 2023). The test is simple to administer and can serve across different cohorts and in different countries. Testing with this tool allows users to assess EI and create a base for developing individuals (Mikuš *et al.*, 2023) and group EI profiles (Fedorova *et al.*, 2023). It is also promising in intergenerational team building.

The limitations of the study include a relatively small respondent sample and geographical scope. Thus, in the future, we plan to expand the geographical scope of the research and increase the number of respondents in Slovakia and Ukraine. We aim to gather more evidence on the validity of the EIB questionnaire. The future research agenda includes further validity investigations into other populations and cultures. EIB questionnaires allow us to evaluate the effectiveness of EI development of future managers and entrepreneurs based on the 4EI Model. Furthermore, we plan to concentrate on the possibilities of using artificial intelligence to expand the possibilities of using the EIB questionnaire in entrepreneurship.

REFERENCES

Ackley, D. (2016). Emotional intelligence: A practical review of models, measures, and applications. *Consulting Psychology Journal: Practice and Research, 68*(4), 269-286. https://doi.org/10.1037/cpb0000070

Acosta-Prado, J.C., Zárate-Torres, R.A., & Tafur-Mendoza, A.A. (2022). Psychometric properties of the Wong and Law emotional intelligence scale in a Colombian manager sample. *Journal of Intelligence, 10*(2). https://doi.org/10.3390/jintelligence10020029

Acosta-Prado, J.C., & Zárate, R.A. (2019). Validation of the Wong and Law emotional intelligence scale for Chilean managers. *Suma Psicológica, 26*, 110-118. https://doi.org/10.14349/sumapsi.2019.v26.n2.7

Allen, S.J., Shankman, M.L., & Miguel, R.F. (2012). Emotionally intelligent leadership: An integrative, process-oriented theory of student leadership. *The Journal of Leadership Education, 11*, 177-203. https://doi.org/10.12806/V11/I1/TF1

Audrin, C., & Audrin, B. (2023). More than just emotional intelligence online: Introducing "digital emotional intelligence.". *Frontiers in Psychology, 14*, 1154-1155. https://doi.org/10.3389/fpsyg.2023.1154355

Bitar, A., Amnelius, L., Kristoffersson, E., *et al.* (2023). Emotional intelligence among medical students in Sweden – a questionnaire study. *BMC Medical Education, 23*, 603. https://doi.org/10.1186/s12909-023-04570-0

Bru-Luna, L.M., Martí-Vilar, M., Merino-Soto, C., & Cervera-Santiago, J.L. (2021). Emotional intelligence measures: A systematic review. *Healthcare, 9*, 1696. https://doi.org/10.3390/healthcare9121696

Butler, L., Park, S.K., Vyas, D., Cole, J.D., Haney, J.S., Marrs, J.C., & Williams, E. (2022). Evidence and strategies for including emotional intelligence in pharmacy education. *American Journal of Pharmaceutical Education, 86*(10), ajpe8674. https://doi.org/10.5688/ajpe8674

Carvalho, V.S., Guerrero, E., Chambel, M.J., & González-Ricob, P. (2016). Psychometric properties of WLEIS as a measure of emotional intelligence in Portuguese and Spanish medical students. *Evaluation and Program Planning, 58*, 152-159. https://doi.org/10.1016/j.evalprogplan.2016.06.006

Çetin, S., & Karakaş, A. (2021). Effects of emotional intelligence on knowledge sharing among employees: A study of HoReCa companies in Turkey. *Upravlenets – The Manager, 12*(3), 44-55. https://doi.org/10.29141/2218-5003-2021-12-3-4

Čikeš, B., & Humer, T. (2023). Ability and trait emotional intelligence: Do they contribute to the explanation of prosocial behavior?. *European Journal of Investigation in Health, Psychology and Education, 13*(6), 964-974. https://doi.org/10.3390/ejihpe13060073

Daderman, A.M., & Kajonius, P.J. (2022). An item response theory analysis of the Trait Emotional Intelligence Questionnaire Short-Form (TEIQue-SF) in the workplace. *Heliyon, 8*. https://doi.org/10.1016/j.heliyon.2022.e08884

D'Amico, A., & Geraci, A. (2023). Beyond emotional intelligence: The new construct of meta-emotional intelligence. *Frontiers in Psychology, 14*, 1096-1096. https://doi.org/10.3389/fpsyg.2023.1096663

Dishari, S., & AlAfnan, M.A. (2023). Gender differences in teaching literature through an emotional intelligence model. *Educational Administration: Theory and Practice, 29*(3). https://doi.org/10.5215/kuey.v29i3.709

Dong, B., Peng, X., & Jiang, N. (2022). Exploring the domain of emotional intelligence in organisations: Bibliometrics, content analyses, framework development, and research agenda. *Frontiers in Psychology*. https://doi.org/10.3389/fpsyg.2022.810507

Fedorova, Y., Pilková, A., Mikuš, J., Munk, M., & Rehák, J. (2023). Emotional intelligence profiles and intergenerational collaboration in business. *Journal of Business Economics and Management, 24*(4), 797-817. https://doi.org/10.3846/jbem.2023.20280

Fiori, M., & Vesely-Maillefer, A.K. (2018). Emotional intelligence as an ability: Theory, challenges, and new directions. In K.V. Keefer, J.D. Parker, & D.H. Saklofske (Eds.), *Emotional intelligence in education: Integrating research with practice* (pp. 23-47). Springer. https://doi.org/10.1007/978-3-319-90633-1_2

Goleman, D. (1995). *Emotional intelligence*. Bantam Books.

Ghoudani, K., Pulido-Martos, M., & Lopez-Zafra, E. (2018). Measuring emotional intelligence in Moroccan Arabic: The Wong and Law emotional intelligence scale. *Revista de Psicologia Social, 33*, 174-194. https://doi.org/10.1080/02134748.2017.1385243

Haag, C., Bellinghausen, L., & Jilinskaya-Pandey, M. (2023). QEPro: An ability measure of emotional intelligence for managers in a French cultural environment. *Current Psychology, 42*, 4080-4082. https://doi.org/10.1007/s12144-021-01715-6

Hajncl, Lj., & Vučenović, D. (2020). Effects of measures of emotional intelligence on the relationship between emotional intelligence and transformational leadership. *Psihologijske Teme, 29*(1), 119-134. https://doi.org/10.31820/pt.29.1.7

Hall, N. (2007). *Positive psychology and emotional intelligence*. Positive Psychology New Daily, NY (Editor S. M.).

Karimi, H., & Ataei, P. (2022). The effect of entrepreneurship ecosystem on the entrepreneurial skills of agriculture students: The mediating role of social intelligence and emotional intelligence. *Current Psychology*. https://doi.org/10.1007/s12144-022-03479-z

Kong, F. (2017). The validity of the Wong and Law emotional intelligence scale in a Chinese sample: Tests of measurement invariance and latent mean differences across gender and age. *Personality and Individual Differences, 116*, 29-31. https://doi.org/10.1016/j.paid.2017.04.025

Lutsenko, O., Fedorova, Y., & Tsokota, V.R. (2021). Emotional intelligence as a general personality self-regulation resource – design of a new test "Emotional Intelligence in Business". *Proceedings on Problems of personal resources in educational and professional activities*, FOP Brovin O.V., Kharkiv, Ukraine, 51-55. http://dspace.univer.kharkov.ua/handle/123456789/16260

Lyusin, D. (2006). A new measure for emotional intelligence: EmIn Questionnaire. *Psikhologicheskaya Diagnostika, 4*, 3-22.

Mikuš, J., Pilková, A., Fedorova, Y., & Btytan, Y. (2022). Model for the emotional intelligence's development in entrepreneurship. *The Poprad Economic and Management Forum 2022*, 402-409. VERBUM. Retrieved from https://www.pemf-conference.com/publishing/ on July 1, 2024.

Mikuš, J., Pilková, A., Holienka, M., & Fedorova, Y. (2023). Emotional intelligence in the development of entrepreneurial competence. In M.E. Auer, W. Pachatz, & T. Rüütmann (Eds.), *Learning in the age of digital and green transition: ICL 2022* (Vol. 634, Lecture Notes in Networks and Systems, pp. 11-19). Springer. https://doi.org/10.1007/978-3-031-26190-9_11

O'Connor, P.J., Hill, A., Kaya, M., & Martin, B. (2019). The measurement of emotional intelligence: A critical review of the literature and recommendations for researchers and practitioners. *Frontiers in Psychology*. https://doi.org/10.3389/fpsyg.2019.01116

Park, H.-J., & Yu, S. (2021). Validity and reliability of the Korean version of the Wong and Law emotional intelligence scale for nurses. *SAGE Open, 11*(2). https://doi.org/10.1177/21582440211023202

Perikova, E., & Byzova, V. (2019). Identifying emotional intelligence and metacognitive awareness among university students. *Proceedings of The International Conference on Research in Psychology*. https://doi.org/10.33422/icrpconf.2019.03.137

Petrides, K. (2010). Trait emotional intelligence theory. *Industrial and Organisational Psychology, 3*, 136-139. https://doi.org/10.1111/j.1754-9434.2010.01213.x

Pienimaa, A., Talman, K., Vierula, J., Laakkonen, E., & Haavisto, E. (2023). Development and psychometric evaluation of the emotional intelligence test (EMI-T) for social care and healthcare student selection. *Journal of Advanced Nursing, 79*(2), 850-863. https://doi.org/10.1111/jan.15557

Ran, Z., Gul, A., Akbar, A., Haider, S.A., Zeeshan, A., & Akbar, M. (2021). Role of gender-based emotional intelligence in corporate financial decision-making. *Psychological Research and Behavioral Management*. https://doi.org/10.2147/PRBM.S335022

Salovey, P., & Mayer, J.D. (1990). Emotional intelligence. *Imagination, Cognition, and Personality, 9*, 185-211. https://doi.org/10.2190/DUGG-P24E-52WK-6CDG

Schlegel, K., & Mortillaro, M. (2019). The Geneva emotional competence test (GECo): An ability measure of workplace emotional intelligence. *Journal of Applied Psychology, 104*(4), 559. https://doi.org/10.1037/apl0000365

Shankman, M.L., Allen, S.J., & Miguel, R. (2015). *Emotionally intelligent leadership for students: Inventory* (2nd ed.). Jossey-Bass.

Sochos, A., Regmi, M.P., & Basnet, D.M. (2021). Investigating the validity of the Wong and Law emotional intelligence scale in a Nepali student sample. *Asian Journal of Social Psychology, 24*, 573-580. https://doi.org/10.1111/ajsp.12446

Sweis, R., Aldaod, S., Alsayyed, N., & Sukkari, L. (2022). Self vs. other raters' assessment of emotional intelligence in private and public hospitals: A comparative study. *Administrative Sciences, 12*, 194. https://doi.org/10.3390/admsci1204019

Tabassum, N., & Nayak, B.S. (2021). Gender Stereotypes and Their Impact on Women's Career Progressions from a Managerial Perspective. *IIM Kozhikode Society & Management Review, 10*(2), 192-208. https://doi.org/10.1177/2277975220975513

Wolff, S. (2005). *Emotional competence inventory: Technical manual*. The Hay Group.

Wong, C.-S., & Law, K.S. (2002). The effects of leader and follower emotional intelligence on performance and attitude: An exploratory study. *Leadership Quarterly, 13*, 243-274. https://doi.org/10.1016/S1048-9843(02)00099-1

Zhang, Q., & Shengyue, H. (2022). *Construction Project Manager's Emotional Intelligence and Team Effectiveness: The Mediating Role of Team Cohesion and the Moderating Effect of Time*. https://doi.org/org/10.3389/fpsyg.2022.845791

Zadorozhny, B., Petrides, K., Jongerling, J., Cuppello, S., & Linden, D. (2024). Assessing the temporal stability of a measure of trait emotional intelligence: Systematic review and empirical analysis. *Personality and Individual Differences, 217*, Article 112467. https://doi.org/10.1016/j.paid.2023.112467

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Use of Artificial Intelligence

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Sustainable business models in small and medium-sized enterprises: State of the art and future research directions

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ABSTRACT

Objective: This research aims to reveal a conceptual structure of current literature related to sustainable business models (SBMs) with reference to small and medium-sized enterprises (SMEs).

Research Design & Methods: We applied methods of bibliometric literature review to identify the most important topics and trends on sustainable business model (SBM) related to SMEs and discuss potential future research directions. Our dataset is built on bibliographic records from two important academic databases: Scopus and the Web of Science. We applied methods of social network analysis using the 'bibliioshiny' package in the R environment.

Findings: Our review shows that the recent literature on SMEs has a more direct linkage with the circular economy and its related constructs such as circular business model and innovation. The thematic evolution of business models in an entrepreneurial context shows an increasing interest in researchers of sustainable business models and circular economy.

Implications & Recommendations: The findings of this research provide valuable guidance and a way forward for future researchers to pursue research on topics related to SBM for SMEs. An extensive literature review conducted using scientific bibliometric methods can serve as a reference to developing a better understanding of how the field of SBM and SME literature has evolved in recent times.

Contribution & Value Added: This article is the first of its kind to use bibliometric data analysis tools and techniques to generate pictorial output that highlights the current situation in SBM and SME literature. The study revealed that most of the literature on the given topic is grounded in the European context, with a relatively small body of research conducted thus far in South-East Asian, African, Chinese, and American contexts.

Article type:	research article
Keywords:	sustainable business models; circular economy; small and medium-sized enterprises; entrepreneurship; bibliometric review
JEL codes:	M160

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INTRODUCTION

This article aims to identify the conceptual structure of literature relating sustainable business models (SBMs) in the context of small and medium enterprises (SMEs) and propose key directions for further research. Businesses increasingly tend to frame the fundamental logic of a company as a business model (BM) (Belyaeva *et al.,* 2020; Osterwalder & Pigneur, 2010; Teece, 2010). The BM defines how a company creates, delivers, and captures value to generate profitable revenue streams to achieve competitive advantage (Dubosson-Torbay *et al*., 2002). The 'value proposition,' which is at the intersection of value creation, capture and delivery mechanism is often discussed among scholars in terms of innovative solutions offered by the businesses. Thus, scholars have studied business model innovation (BMI) quite a lot in relation to how the company has introduced new BM or improvised its existing BM.

Scholars often regard 'sustainability' as a source of innovation in BM literature. One of the early works by Girotra and Netessine (2013) highlighted that sustainability in business is not only achieved through innovation in technologies, products, and services but also through business model innovation (BMI). While technology innovation is usually limited to specific industries, the scope of business model innovation can be applied across a wide range of industries. Therefore, we can consider a sustainable business model (SBM) as an important aspect of BMI.

The initial conceptualization of SBMs has evolved to capture sustainable values and has become the new imperative for business success (Brennan & Tennant, 2018). SBMs account for sustainable value created in a collective effort of a network for relevant stakeholders cooperating through informal and formal arrangements and alliances. This enables them to contextualize the strategy embedded in the business environment (Beattie & Smith, 2013). SBM concepts are now well established to capture the strategic logic of creating superior customer value by contributing to sustainable development goals (SDGs) and meeting stakeholder needs. Integration of sustainability in core strategic processes has helped businesses achieve competitive advantage and contributes to its success (Hampl & Loock, 2013; Hult, 2011; Kolk, 2016).

The existing managerial literature is well-developed in addressing the importance of sustainable development from big, multinational corporations' perspective (Dauvergne & Lister, 2012; Durst *et al*., 2021; Tendera-Właszczuk *et al*., 2024). While large corporations are influential due to the multinational reach of their impact, SMEs play a potentially very important role in creating a critical mass needed to truly implement sustainable business development at scale. Our research aims to shed light on current literature related to SBMs in the SMEs' context. We applied methods of bibliometric literature review (Donthu *et al*., 2021) to identify the most important topics and trends in scientific publications on sustainable business models related to SMEs and to discuss potential directions for future research.

This article is arranged as follows. The next section will discuss the materials and methods used to for bibliometric review of literature. This includes explanation of systematic process used for extraction of data from various database and use of "R" programming software to generate results. The third section will briefly discuss literature review in the given field and present the research questions and research objective. The fourth section will be dedicated for the explanation of the findings obtained from the data analysis. This section will include discussion on topics such as annual production of articles on SBM and SMEs, three field plots, co-occurrence network, thematic evolution and thematic maps. The last section will provide the conclusion and also highlight the limitations of this study.

MATERIALS AND METHODS

We used bibliometric analysis paired with a graphical mapping technique to explore the existing literature on SBM concerning SMEs. It categorises selected types of publications that are outlined in the SBM- and SME-related fields. We did it through the analysis of bibliographic records obtained from the Scopus and Web of Science (WoS) databases. Figure 1 explains the steps we followed to conduct the bibliometric literature review.

As mentioned in the steps in Figure 1, we used both Scopus and Web of Science (WoS) databases to conduct keyword searches. The main keywords we used were 'sustainable business model' and 'small and medium-sized enterprises.' We used the Boolean operator 'AND' to make the initial search. We refined the search by adding more synonymous words to the main keywords as presented in the various steps of Figure 1. By reviewing the abstract of some of the most cited articles in the given domain, we identified new keywords and added them to the search by using the Boolean operator 'OR' to the main keywords. We added new keywords until the point where the search result did not add a significant number of new articles to the list. We also used the asterisk (*) as a wildcard character to represent a sequence of characters in a search query. Most of the abstracts that we reviewed for adding new keywords were from *Journal of Cleaner Production* and *Sustainability*.

The time frame of our search was from 2004, when the initial literature on business models emerged until 2023. We cleared the obtained data set concerning the following criteria: language (English only), and source type (scientific articles only). The final dataset obtained for Scopus was ninety-

six and for WoS – fifty-nine. After combining the findings and removing duplicate files, we obtained a final sample of 113 academic articles for further research.

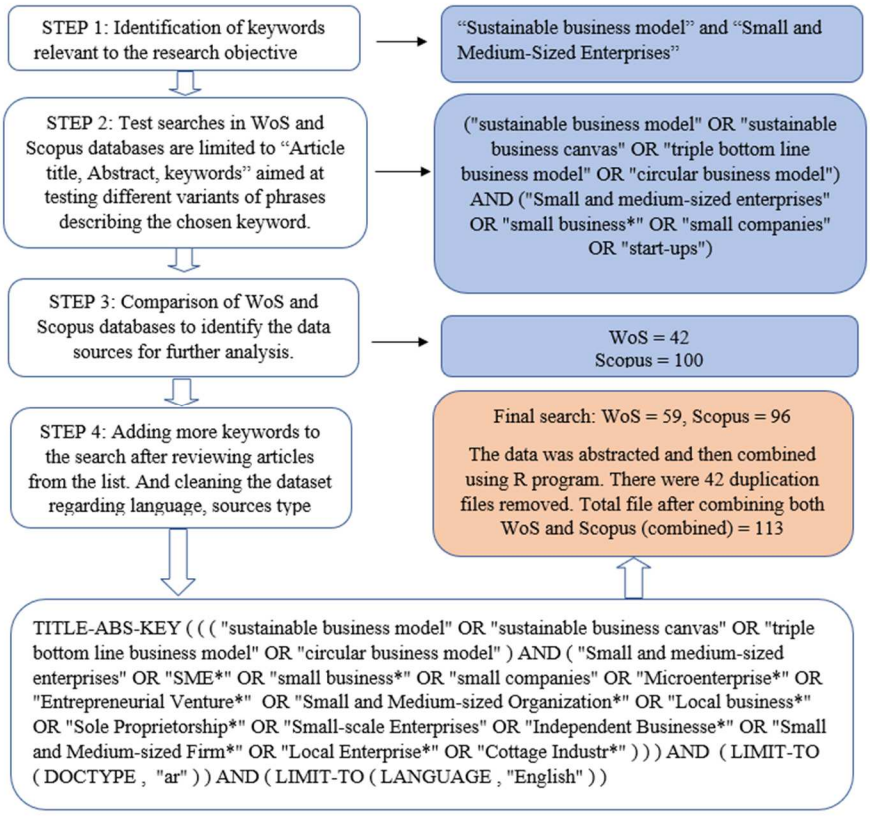

Figure 1. Stages of the research procedure
Source: own elaboration.

To identify and depict the conceptual structure of the field, trends, and key topics, we applied centrality, density, and clustering concepts that are well-established in the field of social network analysis (Wasserman & Faust, 1994). We constructed the network based on the co-occurrence of words extracted from keywords, titles, and abstracts of articles from our sample collection of articles. By using the conceptual structural framework described by Aria and Cuccurullo, (2017), we used the co-word analysis to map and cluster terminologies obtained from 'keywords, titles or abstracts' in a bibliographic collection [NetMatrix <-biblioNetwork(M, analysis = 'co-occurrences,' network = 'keywords,' sep = ';')] (Aria & Cuccurullo, 2017). We referred to the formula used for the co-word network from (Aria & Cuccurullo, 2017): ' $B_{coc}= A'\times A$, where *A* is a *Document × Word matrix*, where *Word* is, alternatively, authors' keywords, keywords plus, or terms extracted from titles or abstracts. Element b_{ij} indicates how many co-occurrences exist between words *i* and *j*. The diagonal element b_{ii} is the number of documents containing the word *I*' (Aria & Cuccurullo, 2017). We used the 'Biblioshiny' software associated with *bibliometrix* R-package to perform multiple correspondence analysis (MAC). This helped us to design a 'conceptual structure' of the field and to present a graphical mapping of bibliometric analysis (Aria & Cuccurullo, 2017). To identify clusters of documents, we used *K*- means clustering and applied MCA to a '*Document x Word matrix A'* in a co-word analysis (Aria & Cuccurullo, 2017). These 'words' were plotted on a two-dimensional map '[CS <- conceptual Structure (M, field='ID,' minDegree=5, k.max=5, stemming=FALSE), labelsize=5]' (Aria & Cuccurullo, 2017).

We used the 'authors keyword' as a field and 'Louvain' as a clustering algorithm while producing various outputs using the Biblioshiny package. To understand thematic evolution and the creation of thematic map, we used different time windows (2004-2015, 2016-2018, 2019-2021, and 2022-2023). We did it to balance the number of articles that were growing slowly in the beginning, and rapidly in the later years.

LITERATURE REVIEW AND THEORY DEVELOPMENT

Previously Reviewed Articles on SBM Concepts

As the concept of SBMs has gained a lot of attention, many review articles on the given topic have been published lately (Bocken *et al*., 2014b; Fobbe & Hilletofth, 2021; Geissdoerfer *et al*., 2018; Khan *et al*., 2021; Kluza *et al*., 2021; Moro *et al*., 2022; Schaltegger *et al*., 2016). It is worth exploring how these articles have summarized their review findings. One of the early reviews conducted by Boons and Lüdeke-Freund (2013) highlighted that business models tend to disregard the accurate ways by which the firm associate 'value' elements presented in the definition of business model. Hence, they suggest 00to consider 'sustainable innovation' to possibly integrate these 'value' elements (Boons and Lüdeke-Freund, 2013). In their review article, Bocken *et al*. (2014a) proposed eight sustainable business model archetypes – 'maximize materials and energy efficiency; create value from 'waste'; substitute with renewables and natural process; deliver functionality, rather than ownership; adopt a stewardship role; encourage sufficiency; re-purpose the business for society/environment; develop scale-up solutions' (Bocken *et al*., 2014a). These archetypes help to explain solutions that help in building the business model for sustainability. Schaltegger *et al*. (2016) reviewed several articles related to business models and sustainability to highlight the concept's evolution. The article explained that on the organizational level, the vision of sustainable development has led to the concept of sustainability management, corporate sustainability, sustainability innovation and sustainable entrepreneurship, and social business (Schaltegger *et al*., 2016). Evans *et al*. (2017) reviewed several bodies of literature to examine whether and how business models can innovate to achieve sustainability goals. Based on the literature on business model innovation and sustainability innovation, the article identified five propositions that characterized SBMs (Evans *et al*., 2017). The article by Geissdoerfer *et al*. (2018) was based on a structured literature review of 25 articles published in SBM innovation literature. This review article focused on improving the understanding of how organizations move to new, sustainable business models using the concept of business model innovation. Fobbe and Hilletofth (2021) systematically selected and thematically analysed forty-seven articles related to SBM elements. Their article states that stakeholder interaction is recognized as an essential element of SBMs and plays a significant role for sustainable value proposition, creation, and capture. The article by Khan *et al*. (2021) was based on eighty-one articles reviewed using the literature mapping review technique. The findings suggested that the majority of sustainability research focused on conceptual analysis. The article highlights that scholars often cite the 'Internet of Things' with an emphasis on achieving triple bottom-line benefits related to SBMs. Kluza *et al*. (2021) analysed research results published in over seventy-two articles using meta-analysis. The findings of the given review presented that cultivating social capital and emphasizing innovation affects SBM in a positive way for businesses operating in different countries all around the world (Kluza *et al*., 2021). Recent article by Moro *et al*. (2022) reviews forty-eight publications related to product-service systems (PSS) and business models. PSS is a sustainable way to offer value to customers (Bocken *et al*., 2014b; Boons & Lüdeke-Freund, 2013). PSS combines the three sustainability dimensions (economic, environmental, and social) in a holistic approach to meet customer needs (Vasantha *et al*., 2012), and focuses on value generation. Using content analysis, Moro *et al*. (2022) describe a mechanism for generating value from the PSS business model.

A Review of the Literature on SBMs and SMEs

While most of the SBM literature is based on multinational corporations (Dauvergne & Lister, 2012; Durst *et al*., 2021; Tendera-Właszczuk *et al*., 2024), there has been an increasing number of articles published more recently to explore the SBM of SMEs. However, there are only a few review articles that focus on exploring the relationship between SBM and SMEs. One among such articles is a systematic literature review by Johnson and Schaltegger (2016b). They investigated sustainability management tools that SMEs use for various applications. Based on the meta-analysis and thematic analysis of 112 publications, they recognised in the literature 26 sustainability management tools that had direct linkage to SMEs. The findings suggest that most SMEs did not implement these tools. The article

explained the barriers to implementation and the key areas of improvement in its implementation. Given the complexities of small businesses, the article also suggested that the area of future research should focus on 'SMEs' to enrich the existing literature on sustainability management tools (Johnson & Schaltegger, 2016b). The review article by Miller *et al*. (2021) explores how the intrinsic heterogeneity attributes of SMEs influence the development of business model design, processes and driver of its value. The article presents the fact that SMEs represent a broader category of businesses that includes micro-businesses, small growing businesses, and medium-sized enterprises etc. with their own exclusive features and meaningful attributes (Miller *et al*., 2021). The differentiating features of SMEs over large firms are their liabilities of smallness, and their size and resource constraints that limit their core competencies and capabilities (Lohrke & Landström, 2016).

The other recent article by Durst *et al*. (2021) provides a systematic literature review (SLR) of SBMs in SMEs to establish existing knowledge and suggest directions for future research. The SLR was based on 85 articles and the findings of the article help us understand that most of the research was done in the European context (52 articles), followed by the US, South America and Asia. Although some insights related to what was the area of research focus on these regions, there was no deeper understanding of the interlinkage between different themes and different countries. The article also highlights that 20 different theories served to study the topic under investigation. Among them, based on resource-based view (RBV) (6 articles), institutional theory (4 articles) and stakeholder theories (3 articles) were most frequently used. With regards to the methods, case study (31 articles) and mono methods (31 articles) were most widely used. The article also identifies five different themes based on how the articles explored SBMs from different perspectives. These themes were antecedents (24 articles), activations (21 articles), relational (15 articles), theoretical (14 articles), and effects (11 articles).

The previously reviewed articles provided a basic understanding of the existing literature on SBMs and SMEs. However, it has not presented a deeper understanding of how different thematic areas within SBMs are related to SMEs from various geographical regions. The existing literature also fails to examine how the literature on SBMs and SMEs has evolved in recent times, what are the interlinkage between different themes, and what is the future research direction. Therefore, our research presents an extension to existing literature particularly Durst *et al*. (2021) by presenting a more in-depth understanding of these topics. The bibliometric methodological approach used in this article differs from earlier systematic reviews, and it enables us to present and interpret unique pictorial outputs.

The Article's Objective and the Research Questions

This article presents an in-depth review of the literature relating SBMs to the entrepreneurial activity of SMEs. To enable the above, we formulated three research questions that guide our research:

- **RQ1:** In the context of SBMs and SME literature, what trends can we observe in annual scientific publications and how are they related to different countries and topics of sustainability?
- **RQ2:** What are different thematic areas that have emerged in the literature and how are they related to SBMs and SMEs?
- **RQ3:** How has the field of study evolved in recent times and what are the future research directions related to SBMs and SMEs?

DISCUSSION

Annual Production of Articles on SBM and SMEs

Over the last ten years, the publications of articles related to SBM, and SMEs have been in an increasing trend particularly after the year 2015 as indicated in Figure 2. This can also relate to the introduction of the UN SDG in 2015. The first scientific article was published in 2004. Until 2018, there were less than 10 articles published each year. Moreover, Figure 2 shows that, most of the articles related to SBM and SMEs were published in recent past (since 2017)s. The growth in the number of publication has been exponential in recent times compared to earlier years.

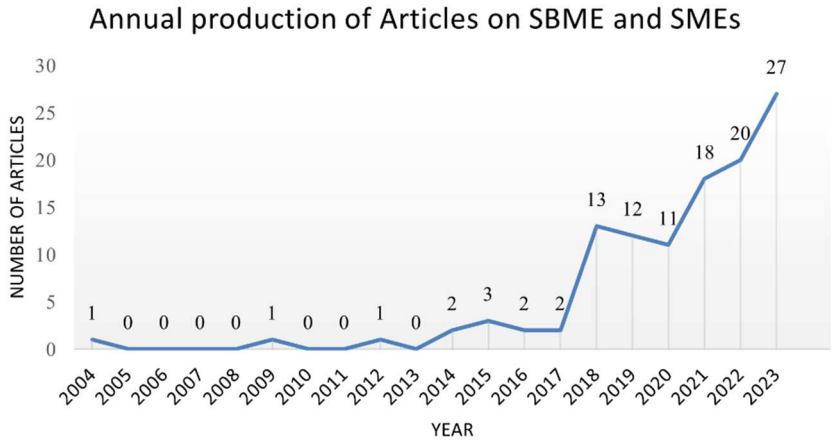

Figure 2. Evolution of publication on SBM and SMEs literature, 2004-2023 (*n* =113)
Source: own elaboration based on Scopus and WoS database.

Figure 3 below related to a three-field plot provides us with information on how different journals have been publishing articles on diverse topics related to research themes in various countries. We can observe that journals *Sustainability*, *Cleaner Production*, and *Business Strategy and the Environment* are the three key journals. 'Circular economy,' 'sustainable business model,' 'SMEs' and 'sustainability' were the four major research topics. Five important countries where these articles were published were Italy, the United Kingdom, China, the USA, and Poland. Figure 3 also shows the interlinkage between journals, keywords used and the origin of the authors' country.

While *Sustainability* has been using all five keywords in the articles it published, it is worth noting that the *Journal of Cleaner Production* has been using 'SBM,' 'circular economy' and 'SMEs' as the keywords in most of its publications. Similarly, the keyword 'SBM' was most frequently among authors from all five different countries. However, it appeared most frequently in the articles published in the *Sustainability* and *Journal of Cleaner Production*, with very few in the *British Food Journal*. The keyword 'circular economy' was most popular among authors from Italy, the UK and Poland whereas, the keyword 'SMEs' – among authors from Italy and the United Kingdom. The sources of both the keywords were mainly *Sustainability* and *Journal of Cleaner Production*.

Co-occurrence Network

The co-word analysis serves in a 'co-occurrence network' to determine the conceptual structure of a framework (Aria & Cuccurullo, 2017). To identify connections between keywords we used the 'keyword co-occurrence analysis' (Aria & Cuccurullo, 2017). This helped us identify 'thematic areas' assembled into 'thematic clusters' to showcase the most important 'theoretical or foundational topics' of the given research field (Fakhar Manesh *et al*., 2021).

To analyse the 'co-occurrence network,' we used '50' as the number of nodes and the minimum number of edges equals '2' in Biblioshiny software to obtain the result as shown in Figure 4. We observed twenty-eight nodes organized in four different clusters. The red cluster has twelve nodes, blue has six nodes, purple has three and green has seven nodes. The size of the bubble represents the 'frequency of words' – the bigger the size, the higher the frequency of words being used. Similarly, the line connecting each bubble represents linkage/connection among keywords with each other.

The red cluster has 'SMEs' as the biggest bubble. The given bubble has a direct linkage with all the other bubbles in the same cluster as well as some of the bigger bubbles in the other clusters. We can observe that there is a strong interlinkage among SMEs, SBM, and the circular economy. Strong linkage between SMEs, sustainability and circular economy (within the red cluster) can indicate the fact that most of the research on SMEs and sustainability is based on circular economy. The other bubbles in the red cluster are also related to the concept of circularity. Circular business model, circular design, and circular business innovation in the red cluster indicate that research in the given cluster is related

to the core theme of 'circular economy.' This indicates that the red cluster is more linked to SMEs' engagement in sustainability through circular economy by using the concept of circular business model. Therefore, we can associate the given cluster with an 'SMEs and circular economy' theme.

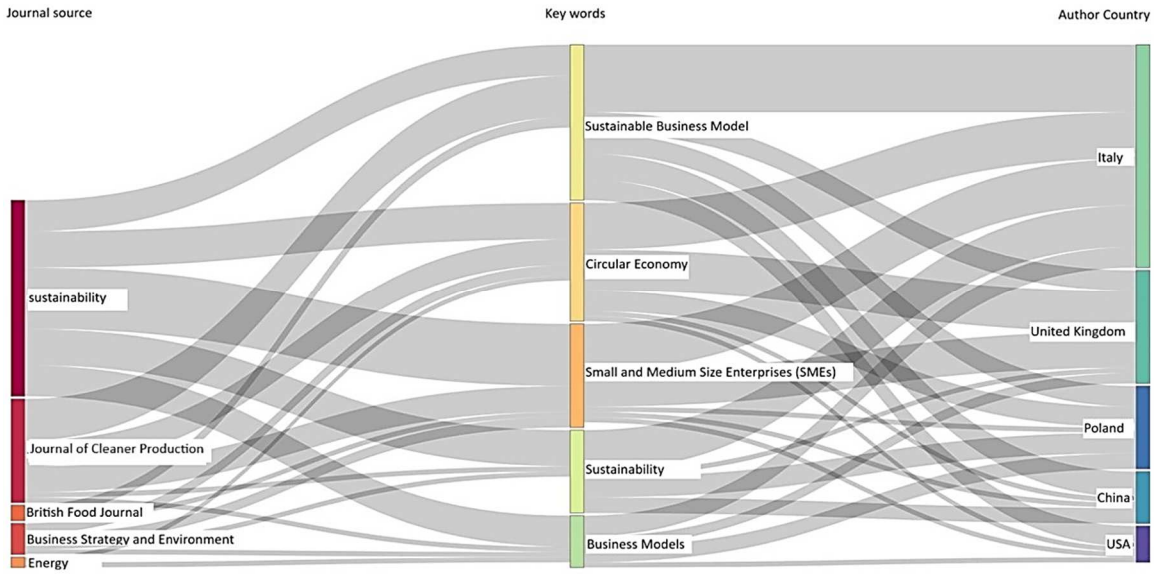

Figure 3. Three field plots
Source: own elaboration using Biblioshiny software of R programming.

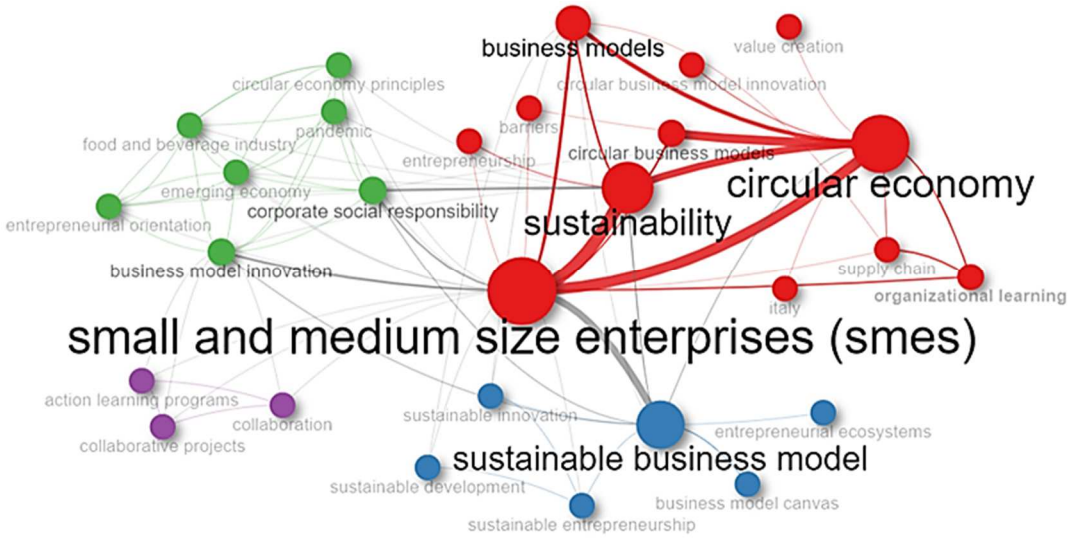

Figure 4. Co-occurrence Network
Source: own elaboration using Biblioshiny software of R programming.

The blue cluster has a sustainable business model (SBM) as the biggest bubble. The other bubbles in the given cluster are sustainable innovation, sustainable development, sustainable entrepreneurship, and business model canvas. There is a strong interlinkage between the SBM of the blue cluster with SMEs in the red cluster. Moreover, SBM is linked with the circular economy (red bubble) and corporate social responsibility (green bubble). These interlinkages help us understand how different keywords belonging to different clusters are related to each other.

The cluster of green bubbles represents more of the keywords related to different thematic areas. The bubble size is relatively the same and keywords such as 'corporate social responsibility,' 'business model innovation,' 'entrepreneurial orientation,' and 'circular economic principles' seem to have closer linkage with other clusters. It is worth noting how business model innovation is interlinked with

sustainable innovation which further has a strong linkage with SBM. This re-emphasizes the importance of sustainable innovation as an integral part of the BMI of businesses.

Similarly, the purple cluster has a few bubbles related to collaborative projects and action learning. We can observe that this cluster is more linked with the BMI of the green and red clusters and SMEs of the red cluster. This observation helps us understand how SMEs use collaborative approaches in achieving BMI.

Thematic Evolution Sankey Diagram

Figure 5 represents the alluvial diagram used for visualizing the 'thematic evolution' of the research field for the period 2004-2023. We divided the field into four time periods (2004-2015, 2016-2018, 2019-2021, and 2022-2023). The reason for choosing the given time frame was because there has been an increasing number of research published in the given domain since 2015 as presented in Figure 2. Moreover, the introduction of UN-SDG in the year 2015 can help us better understand how thematic evolution in research has emerged since then.

Articles published before 2015 were based on themes of business mode and entrepreneurship. In the 2016-2018 period, new thematic areas such as 'sustainable business model' and 'business model innovation' emerged. Similarly, topics related to 'circular economy,' 'sustainability,' 'sustainable business model,' 'SMEs,' and 'corporate social responsibility' were core themes in the period of 2019-2021. In recent years (2022-2023), we can observe that the research themes related to 'SMEs' have a direct linkage with research domains such as 'circular economy' and 'sustainability.' Similarly, the 'sustainability business model' has been linked with concepts related to 'business model.'

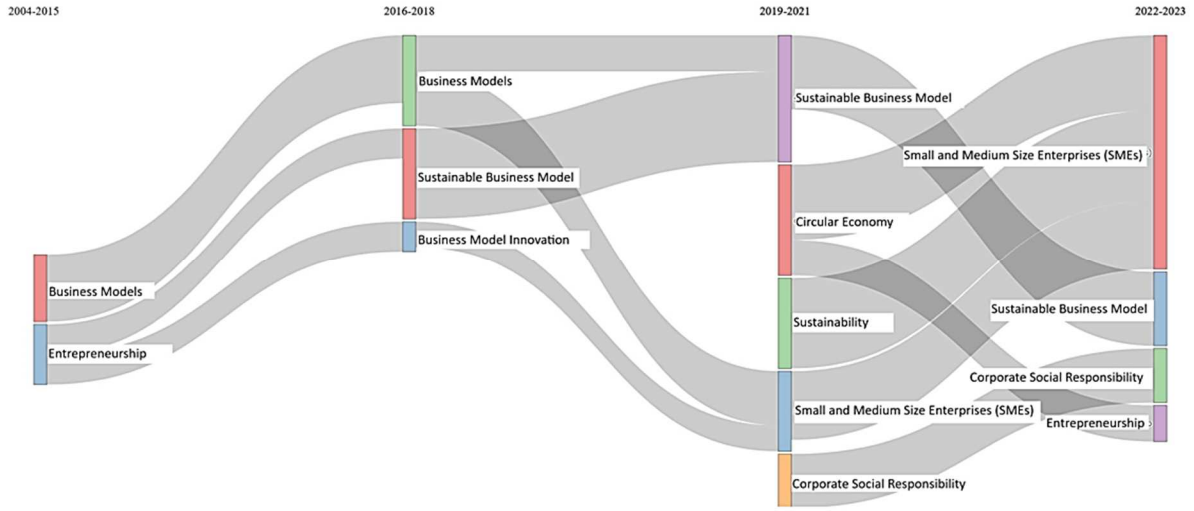

Figure 5. Thematic evolution
Source: own elaboration using Biblioshiny software of R programming.

Thematic Map

'Thematic map' helps us recognize the concentration of research in diverse groupings (Mobin, 2021). The dotted lines presented in Figure 6 divide the map into four quadrants based on 'density and centrality.' The 'centrality' of a theme is referred to as 'the extent of the relation among distinct topics,' and the 'density' implies its progress (Nasr *et al*., 2021). Figure 6 presents the concentration of our themes based on our dataset. As explained by Rejeb *et al*. (2022) the number of publications in which the 'keyword' appeared, determined the 'bubbles sizes.'

The themes with 'high density' and 'high centrality,' are often called '*motor themes*.' This is represented by the first quadrant. These are well-developed themes with strong internal and external ties. In recent years (2022-2023) as presented in Figure 6, topics related to 'sustainable leadership,' 'fashion industry' and 'resilience.' The second quadrant with high density and low centrality is often regarded

as '*highly-developed-and-isolated themes'* and is also called '*niche theme.'* This theme has well-developed internal ties and marginally significant external ties. For 2022-2023, the key thematic areas were related to 'corporate social responsibility,' 'business model innovation,' and 'circular economy principles. The third quadrant is represented by low density and centrality values and is called '*emerging-or-declining themes*.' This quadrant has weak internal and external ties. It mainly represents either emerging or disappearing themes. The fourth quadrant with low density and high centrality is often called '*basic-and-transversal themes.'* It has 'well-developed' external ties and insignificant internal ties and these themes are important for the research field but are not well developed. Based on our results 'circular economy,' 'SMEs' and 'sustainability' are the most important thematic areas in this quadrant.

Discussion

We attempted to further enhance the body of knowledge in the existing literature on SBM in relation to SMEs. We conducted a review of previously reviewed articles related to SBM first, and then SBM concerning SMEs next. The findings of 8 previously reviewed articles of SBM helped us develop our understanding of how the business model concept has evolved in recent years to integrate components of sustainability.

The review articles by Boons and Lüdeke-Freund (2013), Evans *et al*. (2017), Geissdoerfer *et al*. (2018) Kluza *et al*. (2021) highlight how organizations move to new, sustainable business models using the concept of business model innovation. The relationship of innovation to SBM presented in the past reviews is in line with the findings we presented in the co-occurrence network (Figure 4) where keywords such as 'business model innovation,' 'sustainable innovation,' 'circular business model innovation' have appeared as a distinct node. Moreover, the thematic evolution (Figure 5) presents the presence of 'business model innovation' as a key construct that evolved between 2016-2018. In addition to establishing the relationship and validating the past findings, our article presented the pictorial output to showcase the interlinkage among different nodes, to help us understand the integrated relationship that exists among different variables. This provides much better insights than the linear relationships explained in the existing literature. Similarly, the evolution of the new themes presented in the thematic map (Figure 6) and thematic evolution (Figure 5) in recent years particularly after the introduction of SDGs can be related to the findings presented by Schaltegger *et al*. (2016) that explains the relationship between sustainable development and key concepts such as sustainability management, corporate responsibility, sustainability innovation, sustainable entrepreneurship, and social businesses.

With regards to review based on SBM and SMEs, we considered two previously reviewed articles by Johnson and Schaltegger, (2016b) and Durst *et al*. (2021) for the review. The research findings of these articles helped us not only develop a specific understanding of the topic but also define gaps in the literature and frame our research objectives. A review by Johnson and Schaltegger (2016b) highlights the barriers to implementing sustainability management tools among SMEs because of the peculiarities and complexities of their business operation. Therefore, emphasizing the need for strong SME-based research in the context of SBM. This helped in justifying the need for our research as it provided us with an in-depth understanding of the various aspects of a given topic. Similarly, a systematic literature review by Durst *et al*. (2021) helped us shape our current research objective by identifying gaps in existing literature. To address the gap, we proposed various thematic clusters, the evolution of various themes, and the mapping of various research concepts in the given article. Therefore, this strengthens our justification for the relevance of conducting this research using the bibliometric literature review technique. We also investigated the SBM, and SMEs related research articles over the last 20 years (2004-2023) using bibliometric analysis. We used 113 articles (mostly research articles) from sixty-four diverse sources for our data analysis and came up with the findings to answer our research questions.

Corresponding to the first research question, we observed the increasing trend (Figure 3) in the research outputs concerning SBM and SME literature over time, and the expansion of geographical and cultural contexts of the research in the field of entrepreneurship. Among journals we see two venues, *Sustainability* and *Journal of Clean Production* foster a lot of discussion and development on the given research domain. In terms of countries from which authors originated, Italy, the UK, the Netherlands, and Poland were on the frontline of researching the given domain. Among Asian countries, only China

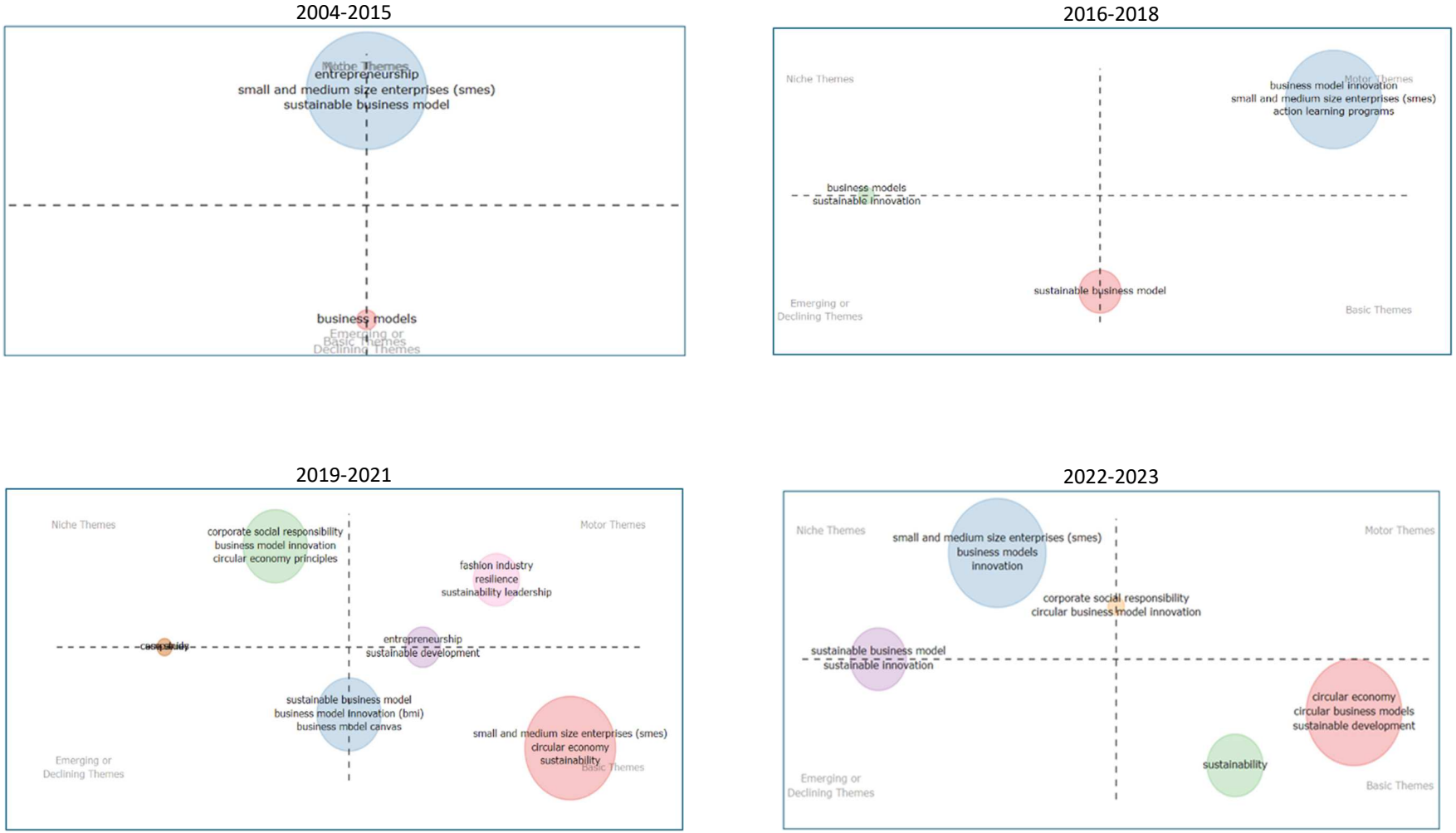

Figure 6. Thematic evolution

Source: own elaboration using Biblioshiny software of R programming.

seems to appear on the list, with Southeast Asia, Korea and Japan largely missing. Also, the American context is limited to the US and underrepresented concerning the size of economies, populations, and sustainability challenges ahead. Based on these observations we expect increased interest in the topic of SBMs in the Americas and Asia. These findings correspond to the findings of (Durst *et al*., 2021) which presented similar results. However, in addition, our research findings established a link between journals, keywords used and the origin country of the authors (Figure 3). By analysing the bibliometric data available for all the reviewed articles establishment of this relationship was possible. The pictorial representation helps us provide a good understanding of the interlinkage among all three variables. Relating Figure 2 and Figure 3, we can also conclude that the majority of the research on the given field took place in the last five years (2018-2023) and most of it in the European context.

Concerning our second research question, we found that 'circular economy' is the key topic when it comes to the literature of SBM concerning SMEs. The findings of the co-occurrence network analysis (Figure 4) presented us with the fact that the topic of circular economy and other concepts related to circularity, for example, circular business model, and circular business model innovation were found in the same cluster. These clusters were strongly connected. This indicates that the current SME literature frequently discusses the theme of circularity. The thematic evolution (Figure 5) also presents a strong linkage between the 'circular economy' and SMEs in recent years. The basic themes in the thematic map (Figure 6) have evolved. In the early days of 2004-2015, business models were on the border between emerging themes and basic themes. Later, sustainable business models replaced them in the same position. Basic themes only emerge in 2019 around topics of circular economy, circular business models, sustainable development, and separate literature discussing sustainability in general. These streams of research further converge into one area of literature relating SMEs, circular economy, and sustainability in recent years from 2022 to 2023. Although the linkage between SMEs and SBM seems to be strong, they appeared in different clusters which means the overall theme of the research conducted in each domain was different.

To answer the third research question, we can refer to the thematic map and thematic evolution to understand the future research direction. The topics that seem to be emerging in recent years, shown as motor themes in our thematic analysis for years 2022-2023 (Figure 6) are the fashion industry, resilience, and sustainability leadership. The explanation for the rising interest in the fashion industry could be the recent SCOS Conference in Paris with the leading theme of Haute Couture. Resilience became very important due to rising disturbances in international trade and global supply chains. The third emerging topic of sustainability leadership replaces earlier conceptual lenses of corporate social responsibility, more popular in earlier years of the domain under investigation. The thematic evolution (Figure 5) presents that research on 'SMEs' has a backward linkage to 'circular economy' and 'sustainability.' This indicates that SBM, with regard to SMEs, is an emerging field. 'Sustainable business model' as a research theme has a backward linkage to 'entrepreneurship.' Over the past decade, this indicates the research topic on entrepreneurship has evolved to focus more on SBM and due to the rising importance of sustainability debate we expect more exciting conceptual frameworks and research to come soon.

CONCLUSIONS

The results of the bibliometric analysis have provided an in-depth and clear understanding of the thematic mapping, thematic evolution, thematic cluster, and other valuable information relevant to SBM and SME literature. The pictorial representation of each output helps us better visualise the concepts and makes it easy to summarize the findings more pragmatically. The review of previously reviewed literature on SBM and SBM in relation to SMEs is also an attempt to contribute to the existing literature and justify this research work. The findings of our research suggested that limited research of SBM among SMEs of Asian countries (particularly South Asia), Americas and African countries found in the existing literature suggests the possibility of future research in the given regions. The findings of the co-occurrence network analysis provided us with valuable insights that SBM and SMEs are in two different clusters. This again re-estates the fact that there is a scant of research directly linked to SBM

and SMEs. Research on SMEs is more linked to circular economy, business model, and the concept of sustainability. However, the adoption of SBM as a business strategy for SMEs still bears the challenges. This corresponds to the findings of Johnson and Schaltegger (2016b) who highlight the peculiarities and complexities of their business operation of SMEs in implementing sustainability tools. Our contribution in this article is the use of novel, bibliometric analysis methods that helped us identify the conceptual structure of literature relating sustainable business models in relation to SMEs and to propose key directions for further research. This methodology allowed us to present how different thematic areas within SBMs are related to SMEs and the geographical focus of earlier studies.

The existing review is established on the bibliometric data obtained from Scopus and the Web of Science database. We did not include articles published in grey literature, non-academic research, and research based on other languages. Therefore, the selected articles that we reviewed seem to have geographical biases as most of the articles published in these two databases are from European or American contexts. Further studies may include literature from multiple databases to enlarge the sample size and include different geographies. Small and medium-sized enterprises are defined differently in statistical terms across the globe. For example, SMEs are companies that employ less than 250 employees in Europe, 500 employees in the US and 3000 employees in China (Steinhäuser *et al*., 2020). As our sample is constructed from articles in which actors self-defined firms under investigation as SMEs, the research we are further analysing in our bibliometric review may not be completely coherent. Despite these limitations, we believe that the current study has provided a state-of-the-art literature review with regard to developing our understanding of the SBM related to SMEs.

REFERENCES

Apostu, S.A., & Gigauri, I. (2023). Sustainable development and entrepreneurship in emerging countries: Are sustainable development and entrepreneurship reciprocally reinforcing?. *Journal of Entrepreneurship, Management and Innovation*, *19*(1), 41-77. https://doi.org/10.7341/20231912

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959-975. https://doi.org/10.1016/j.joi.2017.08.007

Beattie, V., & Smith, S.J. (2013). Value creation and business models: Refocusing the intellectual capital debate. *British Accounting Review*, *45*(4), 243-254. https://doi.org/10.1016/j.bar.2013.06.001

Belyaeva, Z., Rudawska, E.D., & Lopatkova, Y. (2020). Sustainable business model in food and beverage industry – a case of Western and Central and Eastern European countries. *British Food Journal*, *122*(5), 1573-1592. https://doi.org/10.1108/BFJ-08-2019-0660

Bocken, N.M.P., Short, S.W., Rana, P., & Evans, S. (2014a). A literature and practice review to develop sustainable business model archetypes. In *Journal of Cleaner Production* (Vol. 65, pp. 42-56). https://doi.org/10.1016/j.jclepro.2013.11.039

Bocken, N.M.P., Short, S. W., Rana, P., & Evans, S. (2014b). A literature and practice review to develop sustainable business model archetypes. In *Journal of Cleaner Production* (Vol. 65, pp. 42-56). https://doi.org/10.1016/j.jclepro.2013.11.039

Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, *45*, 9-19. https://doi.org/10.1016/j.jclepro.2012.07.007

Brennan, G., & Tennant, M. (2018). Sustainable value and trade-offs: Exploring situational logics and power relations in a UK brewery's malt supply network business model. *Business Strategy and the Environment*, *27*(5), 621-630. https://doi.org/10.1002/bse.2067

Cobo, M.J., López-Herrera, A.G., Herrera-Viedma, E., & Herrera, F. (2011). An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets Theory field. *Journal of Informetrics*, *5*(1), 146-166. https://doi.org/10.1016/j.joi.2010.10.002

Dauvergne, P., & Lister, J. (2012). Big brand sustainability: Governance prospects and environmental limits. *Global Environmental Change*, *22*(1), 36-45. https://doi.org/10.1016/j.gloenvcha.2011.10.007

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W.M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285-296. https://doi.org/10.1016/j.jbusres.2021.04.070

Dubosson-Torbay, M., Osterwalder, A., & Pigneur, Y. (2002). *E-Business Model Design, Classification, and Measurements*. https://doi.org/10.1002/tie.1036

Durst, S., Hammoda, B., Nguyen, H.D., & Asl, M.M. (2021). Sustainable business models and small-and medium-sized enterprises-A literature review. *Sustainable Development and Engineering Economics*, *1*(4), 54-79. https://doi.org/10.48554/SDEE.2021.1.4

Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E.A., & Barlow, C.Y. (2017). Business Model Innovation for Sustainability: Towards a Unified Perspective for Creation of Sustainable Business Models. *Business Strategy and the Environment*, *26*(5), 597-608. https://doi.org/10.1002/bse.1939

Fakhar Manesh, M., Pellegrini, M.M., Marzi, G., & Dabic, M. (2021). Knowledge Management in the Fourth Industrial Revolution: Mapping the Literature and Scoping Future Avenues. *IEEE Transactions on Engineering Management*, *68*(1), 289-300. https://doi.org/10.1109/TEM.2019.2963489

Fobbe, L., & Hilletofth, P. (2021). The role of stakeholder interaction in sustainable business models. A systematic literature review. In *Journal of Cleaner Production, 327,* 129510. Elsevier Ltd. https://doi.org/10.1016/j.jclepro.2021.129510

Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. In *Journal of Cleaner Production*. Elsevier Ltd. https://doi.org/10.1016/j.jclepro.2018.06.240

Girotra, K., & Netessine, S. (2013). *Business Model Innovation for Sustainability*. https://doi.org/10.1287/msom.2013.0451

Gladwin, T.N., Kennelly, J.J., & Krause, T.-S. (1995). Shifting Paradigms for Sustainable Development: Implications for Management Theory and Research. In *Source: The Academy of Management Review*. https://www.jstor.org/stable/258959?seq=1&cid=pdf-

Hampl, N., & Loock, M. (2013). Sustainable Development in Retailing: What is the Impact on Store Choice?. *Business Strategy and the Environment*, *22*(3), 202-216. https://doi.org/10.1002/bse.1748

Hult, G.T.M. (2011). Market-focused sustainability: Market orientation plus! In *Journal of the Academy of Marketing Science 39*(1),1-6. Springer Science and Business Media, LLC. https://doi.org/10.1007/s11747-010-0223-4

Johnson, M.P., & Schaltegger, S. (2016a). Two Decades of Sustainability Management Tools for SMEs: How Far Have We Come?. *Journal of Small Business Management*, *54*(2), 481-505. https://doi.org/10.1111/jsbm.12154

Johnson, M.P., & Schaltegger, S. (2016b). Two Decades of Sustainability Management Tools for SMEs: How Far Have We Come?. *Journal of Small Business Management*, *54*(2), 481-505. https://doi.org/10.1111/jsbm.12154

Joyce, A., & Paquin, R.L. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, *135*, 1474-1486. https://doi.org/10.1016/j.jclepro.2016.06.067

Khan, I.S., Ahmad, M.O., & Majava, J. (2021). Industry 4.0 and sustainable development: A systematic mapping of triple bottom line, Circular Economy and Sustainable Business Models perspectives. In *Journal of Cleaner Production*, *297*, 126655 . Elsevier Ltd. https://doi.org/10.1016/j.jclepro.2021.126655

Kluza, K., Ziolo, M., & Spoz, A. (2021). Innovation and environmental, social, and governance factors influencing sustainable business models – Meta-analysis. In *Journal of Cleaner Production*, *303*, 127015. Elsevier Ltd. https://doi.org/10.1016/j.jclepro.2021.127015

Kolk, A. (2016). The social responsibility of international business: From ethics and the environment to CSR and sustainable development. *Journal of World Business*, *51*(1), 23-34. https://doi.org/10.1016/j.jwb.2015.08.010

Lohrke, F.T., & Landström, H. (2016). Young, Small, and Imprintable: Assessing Progress and Exploring Future Directions in New Venture and Small Business Research. *Group and Organization Management*, *41*(6), 703-716. https://doi.org/10.1177/1059601116672390

Lüdeke-Freund, F. (2009). Business Model Concepts in Corporate Sustainability Contexts: From Rhetoric to a Generic Template for "Business Models for Sustainability." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1544847

Miller, K., McAdam, M., Spieth, P., & Brady, M. (2020). Business models big and small: Review of conceptualisations and constructs and future directions for SME business model research. In *Journal of Business Research, 131*, 619-626. Elsevier Inc. https://doi.org/10.1016/j.jbusres.2020.12.036

Moro, S.R., Cauchick-Miguel, P.A., & Mendes, G.H. de S. (2021). Literature analysis on product-service systems business model: A promising research field. In *Brazilian Journal of Operations and Production Management, 19* (1), 1-18. Associacao Brasileira de Engenharia de Producao. https://doi.org/10.14488/BJOPM.2021.043

Nasr, A., Bagheri, N., Maleki, A., & Nazemi, A. (2021). The knowledge map of energy security. *Energy Reports*, *7*, 3570-3589. https://doi.org/10.1016/j.egyr.2021.06.001

Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: a Handbook for visionaries, Game Chagres, and Challengers.* John Wiley & Sons.

Osterwalder Alexander. (2004). *The Business Model Ontology a proposition in a design science approach*. Université de Lausanne .

Rejeb, A., Rejeb, K., Abdollahi, A., & Treiblmaier, H. (2022). The big picture on Instagram research: Insights from a bibliometric analysis. *Telematics and Informatics, 73,* 101876. Elsevier Ltd. https://doi.org/10.1016/j.tele.2022.101876

Schaltegger, S., Hansen, E.G., & Lüdeke-Freund, F. (2015). Business Models for Sustainability: Origins, Present Research, and Future Avenues.*Organization and Environment, 29*(1), 3-10. SAGE Publications Inc. https://doi.org/10.1177/1086026615599806

Stubbs, W., & Cocklin, C. (2008). Conceptualizing a "sustainability business model." *Organization and Environment*, *21*(2), 103-127. https://doi.org/10.1177/1086026608318042

Teece, D.J. (2010). Business models, business strategy and innovation. *Long Range Planning*, *43*(2-3), 172-194. https://doi.org/10.1016/j.lrp.2009.07.003

Tendera-Właszczuk, H., Frączkiewicz-Wronka, A., Słupik, S., & Łukasik, D. (2024). A Silesian perspective on small and medium-sized enterprises facing the challenges of the green economy. *International Entrepreneurship Review*, *10*(4), 129-142. https://doi.org/10.15678/IER.2024.1004.09

Vasantha, G.V.A., Roy, R., Lelah, A., & Brissaud, D. (2012). A review of product-service systems design methodologies. In *Journal of Engineering Design, 23*(9), 635-659. https://doi.org/10.1080/09544828.2011.639712

Wasserman, S., & Faust, K. (1994). *Social Network analysis: Methods and Applications*. https://doi.org/10.1017/CBO9780511815478

Zott, C., Amit, R., & Massa, L. (2011). The business model: Recent developments and future research. In *Journal of Management, 37*(4), 1019-1042. https://doi.org/10.1177/0149206311406265

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Use of Artificial Intelligence

The authors confirm that the text is free from AI/GAI.

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Impact of legislative direction on inflation

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ABSTRACT

Objective: The article aims to verify the research hypothesis that the impact of the number of government regulations on inflation levels in economies is insignificant.

Research Design & Methods: The conducted analysis was quantitative and concerned the impact of the number of acts on the level of inflation in different countries. We used a case study method and panel data modelling to study the phenomenon. We analysed the number of acts and the level of inflation in 18 countries of the world. We divided the research sample into three periods: 1960-1968, 1986-2006, and 2010-2019. We used a random effects (RE) model for statistical data analysis. It enabled us to examine the relationship between the number of legal acts and inflation, considering the time factor and inter-country variability.

Findings: The empirical results of the study indicated that an increase in the number of pieces of legislation in the analysed countries provoked a reduction in the level of inflation, especially in cases where inflation exceeded 6%. The study showed that the intensification of legislative activity can have a positive effect on stabilising inflation. Moreover, in many cases, after periods of intensified legislative activity, we observed a decline in inflation in subsequent years.

Implications & Recommendations: Legislative activity can play an important role in controlling inflation. Policy makers should pay attention to the number and complexity of legal regulations, as intensifying legislative activity can effectively stabilise inflation, especially in situations where inflation exceeds certain thresholds, such as 6%. The results suggest that properly managed legal policies can promote long-term economic stability.

Contribution & Value Added: The economic literature rarely discusses the impact of legislative activity on inflation in different countries. The article combines panel data analysis with a case study method, offering unique insights into the relationship between the number of pieces of legislation and inflationary stability. Furthermore, the study shows that legislation can be an effective tool for controlling inflation, something that has previously been insufficiently documented in macroeconomic studies.

Article type: research article

Keywords: Inflation; macroeconomics; legislative direction; economic growth; legislative inflation

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INTRODUCTION

The effects of high inflation levels are relatively extensive. Therefore, researchers constantly seek new determinants which could reduce it to an ideal and specific level for the economy. They rarely mention legislation among the causes that could influence inflation. However, the consequences of political, ideological, or legal actions are often reflected in the state of the economy. Simultaneously, striving to create complete and perfect law could lead to 'legislative inflation,' which, like inflation in economics, causes a number of negative social effects.

The period from the 2000s to the 2020s is the time when modern law was created that was partially ideological (*e.g.*, as a tool promoting tolerance or patriotism). This increased the juridification of social

spheres and led to the appearance of symbolic laws (Šulmane, 2011). Therefore, examining the actual impact of legislation on inflation is complicated. In the 1990s, Barro (1996) noticed that there could be a legal variable correlated with economic growth and inflation. As an example, he pointed to better enforcement of property rights, which can stimulate investment and, consequently, economic growth. Moreover, Barro emphasised the possible impact of rules-based systems on the level of inflation. He and others also noted that the rate of inflation could inversely reflect the rule of law (Barro, 1996; Shevchuk *et al.*, 2020). Other studies reflect this, *e.g.*, by James (James, 2007), who indicated that major legal changes could affect the economy, or that a specific reform affects the level of unemployment or inflation.

The above considerations emphasise that one of the goals of legislators should be to aim for an optimal amount and complexity of regulations. They also assume that lawmaking can affect economic growth and inflation rates in various ways in different countries. Therefore, the main objective of the article is to verify the research hypothesis that the impact of the number of government regulations on inflation levels in economies is insignificant.

LITERATURE REVIEW

The literature analysis on macroeconomics suggests that excessively high inflation adversely affects a country's economic processes. Many researchers have already attempted to confirm the above thesis (Neville *et al.*, 2021; Summers *et al.*, 2018; Cieslak & Plfueger, 2023; Harris *et al.*, 2001; Ahmed & Mortaza, 2005; Ayyoub *et al.*, 2011; Mallik & Chowdhury, 2010; Karki *et al.*, 2004). Andrés and Hernando (1997) found that inflation is not positively correlated with per capita income in the long run. Chen (2022) confirmed the relationship between the inflation rate and economic growth. In his studies, he indicates that high inflation has a positive impact on economic growth only in the short term. However, in the longer term, a high level of inflation causes economic problems for business owners and increases social problems. Moreover, Gregorio (1992) observed that between 1951 and 1985, there was a relationship between inflation and economic growth in Latin American countries (Gregorio, 1992).

On the other hand, Bruno (1995) emphasises that inflation could not lead to a decline in economic growth, but to higher inflation. He indicates that the problematic level of inflation starts from 40% and above (Bruno, 1995). Based on other studies, we may conclude that this threshold could be individualised. For example, when analysing inflation in Malaysia in the years 1970-2005, Datta and Mukhopadhyay (2011) found that the threshold value for which economic growth slows exceeded 3.89%. However, Faria and Calneiro (2019) showed that in Brazil, in years with high inflation, the level of production did not change significantly over a long period of time. Ndoricimpa (2017) reached similar conclusions. He studied inflation in African countries and showed that low levels of inflation do not affect economic growth in low-income countries. Simultaneously, Ndorcimpa pointed out that for middle-income countries (as in Africa), inflation increases economic growth until it reaches a certain threshold, followed by a decline (Ndoricimpa, 2017).

Many studies confirm that high levels of inflation negatively impact the economy. In this respect, Fischer stated that the harmful impact of inflation on production results from its macroeconomic instability (Fischer, 1993). Highly volatile inflation could disrupt the ability of businesses to plan and invest, resulting in companies not engaging in long-term contracts (Neville *et al.*, 2021). Simultaneously, high inflation could have a negative impact on social processes and a positive impact on the state of the natural environment (Setyadharma *et al.*, 2021). At the same time, the literature on the subject contains numerous examples of hyperactive or blocked legislatures, leading to a deterioration of the quality of law and the economic situation (Bar-Siman-Tov, 2015). However, the legal complexity and uncertainty are not equivalent. From a legal point of view, an extensive statute with many references, terms, and regulatory subjects could be difficult to understand for a citizen not interested in the law. However, such a law should be clear to people who use legal language. A similar situation applies to the legal system that regulates technology. Its complexity could constitute a significant obstacle for research centres and high-tech companies. Complex and extensive legislation can inhibit the development of new technologies and lead to the transfer of research activities abroad, which can result in limited economic growth in the country (Kirby, 2009). At the

same time, excessive simplification of laws carries risks. As Blank and Osofsky (2017) emphasise, striving for simple solutions in tax law can complicate matters for taxpayers, who may be misled by insufficient specification of certain points in the legislation (Blank & Osofsky, 2017).

Despite doubts about the impact of lawmaking on the economy, there are indications that an appropriate government response through the creation of new legislation positively affects economic growth. As previously indicated, it is correlated with a relatively low and specific level of inflation. An example is the findings of studies conducted by Ash *et al.* (2020). They found that the economies of U.S. states with more developed and complex legal systems tend to have more efficient, more productive economies. The authors of the study attempted to answer whether the correlations they obtained regarding the specificity of laws and GDP reflect causal relationships (Ash *et al.*, 2022). If the economy is at a more advanced level of development, it is natural to introduce more regulations. Therefore, the law of an economy with more industries is characterised by more extensive and detailed regulations.

RESEARCH METHODOLOGY

In the first stage of the research, data on inflation were obtained in all countries of the world. We downloaded this database from the World Bank Open Data. It provided data on changes in consumer price indices for many countries from 1960 to 2023. We filtered the obtained records to exclude data on dependent territories. Noteworthy, not all countries had complete data, but we chose the World Bank Open Data database because of its comprehensiveness. We excluded data from years with major economic crises from the analysis, as they caused significant inflation fluctuations in most countries of the world. We observed the greatest economic and inflation fluctuations from 1969 to 1985, a period during which relatively destructive economic crises were recorded over 16 years. The first was the recession of 1969-1970 (Fabricant, 1972). Another significant event affecting inflation was the energy crisis of the 1970s-1980s (Becker & Seligman, 1981; Zunes, 2009). It impacted oil supply and prices worldwide, with effects observed until the mid-1980s (Arihan, 2021). Furthermore, we excluded from the study data from the 2007-2009 financial crisis and the COVID-19 pandemic from 2020 to 2023. These events significantly impacted the state of economies worldwide.

Filtering the data allowed us to obtain a set where potentially other factors caused inflation fluctuations. We obtained three study periods: I – 1960-1968, II – 1986-2006, and III – 2010-2019. Based on the analysis of inflation targets in individual countries, we assumed an inflation rate above 6% to be undesirable for the economy (CBONDS, 2021; Jahan, 2012). We excluded from the analysis countries with lower inflation levels in the studied periods.

In the next research stage, we obtained data on the number of official journals, the number of pages of enacted laws, the number of laws, the total number of government acts, and legal changes depending on the availability of data in individual countries. Based on a review of official journals available online, we collected data for 18 countries from all continents. The vast majority of the world's countries had malfunctioning electronic official journals, which caused many problems in the correct data retrieval process. The platforms displayed errors when showing large groups of search results. Usually, official journals were outdated, and the presentation of records in them deviated from common data visualisation standards on the Internet in the 21st century. Moreover, in 15 countries, we found significant deficiencies in the digitisation of older documents. This is a significant problem from a citizen's perspective, as it limits access to legislation. In practice, there may be very old laws still in force, but they are inaccessible. In some official online journals, inactive legal acts were not distinctly marked. The operation of many government online platforms from various countries was slow, viewing one page of results could take up to a minute in some cases. At the same time, in official online journals, there was sometimes no division into individual legal acts. All the above-mentioned problems affected both developed, developing, and underdeveloped countries.

The research assumed additional exclusions. For a significant part of the study period, we eliminated data from countries with high inflation. Finally, we created a list of countries without major long-term inflation problems, as well as of those in which obtaining information on historical or current legislation was impossible (Table 1).

Table 1. Exclusions of countries from the study due to data access problems, high inflation, or lack of high inflation problems

Lack of data in legal act databases or lack of inflation data or a non-functioning online official journal.	Bahamas, Bangladesh, Barbados, China, Comoros, Cote d'Ivoire, Cuba, Argentina, Bermuda, Armenia, Belize, Bhutan, Botswana, Burkina Faso, Central African Republic, Chad, Cyprus, Denmark, Egypt, Arab Rep., Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Fiji, Gambia, Grenada, Guinea-Bissau, Guyana, Korea, Dem. People's Rep., Liechtenstein, Marshall Islands, Somalia, Tajikistan, Turkmenistan, Yemen, Iraq, Ireland, Japan, Korea, Kuwait, Lesotho, Liberia, Madagascar, Malawi, Mauritania, Monaco, Myanmar, Namibia, Nauru, New Zealand, Nigeria, Niger, Oman, Pakistan, Peru, Samoa, Senegal, Serbia, Seychelles, Sierra Leone, Spain, Sudan, Timor-Leste, Trinidad and Tobago, Zimbabwe, Ecuador, Jordan, South Sudan, Libia, Tonga, St. Lucia, St. Vincent and the Grenadines, St. Kitts and Nevis
High inflation persisted throughout most years of the study	Angola, Belarus, Burundi, Ghana, Haiti, Turkiye, Venezuela, Indonesia, Iran, Jamaica, Paraguay, Sao Tome and Principe, Solomon Islands, Sri Lanka, Suriname, Tanzania, Uruguay, Uzbekistan, Zambia, Kazakhstan, Syrian Arab Republic, Ukraine, Brazil, Dominican Republic, Nepal
No problems with high inflation*	Antigua and Barbuda, Bahrain, Bosnia and Herzegovina, Brunei Darussalam, San Marino, United Arab Emirates, Kiribati, Micronesia, Palau
No problems with high inflation	Austria, Belgium, Congo, Dem. Rep., France, Germany, Luxembourg, Malta, Montenegro, Netherlands, Panama, Singapore, Switzerland, United States, Malaysia, Saudi Arabia, Canada
The online journal of laws did not function properly, and it was impossible to find accurate data on government legislation	Algeria, Afghanistan, Benin, Chile, Colombia, Congo, Rep., Estonia, Guatemala, India, Israel, Italy, Lao PDR, Mali, Morocco, Mozambique, Nicaragua, Sweden, Togo, Tunisia, Vietnam, Gabon, Georgia, Mexico, Vanuatu
Unreliable data in the journal of laws (not all legal acts are added)	Bulgaria, Cabo Verde, Cambodia, Cameroon, Costa Rica, Djibouti, Dominica, Greece, Guinea, Honduras, Lebanon, Maldives, Mongolia, Philippines, Uganda,
A high level of inflation in the middle of the second period of the study resulting from the political transformation (no problems with inflation in later years)	Czechia, Croatia, Hungary, Lithuania, North Macedonia, Poland, Romania, Russian Federation, Slovak Republic, Slovenia
Limited access to a journal of laws	Iceland, South Africa

Notes: * Inflation data for some years were unavailable.
Source: own study in 2023.

Table 2 summarises the data obtained on inflation and types of legal acts for 18 countries, with particular emphasis on comments regarding the data reliability and completeness.

The first stage involved laying out the time frames and establishing the research methodology and concept. The analysis focused on the economies of countries worldwide that were characterised by high inflation rates and had open, functioning, and clear access to databases of government legal acts. To verify the research hypothesis stated in the Introduction, we used methods such as literature analysis and case studies for selected economies. The formal criteria included the availability of inflation data and the number of government legal acts for the selected countries during the selection process (see 'The database'). The substantive criterion of the research subject was primarily based on assessing the inflationary situation and the availability and quality of legal act databases in individual countries.

We selected the countries for the analysis based on the availability of data on both inflation and the number of legal acts. This allowed for a reliable quantitative data analysis. The included countries came from different regions of the world and represent economies with diverse institutional structures and development levels. This selection enables the identification of various relationships between the legislative process and inflation dynamics. Importantly, the aim of the study was not to fully represent all global economies but to analyse the phenomenon based on countries that met specific data quality criteria.

Table 2. Summary of inflation data and legislation for selected countries

Country	1st study period		2nd study period		3rd study period		Obtained data on legislation
	Data for	Inflation situation	Data for	Inflation situation	Data for	Inflation situation	
	1960-1968	yes/no	1986-2006	yes/no	2010-2019	yes/no	
Albania	L- | I-	-	L+* | I+	yes	L+ | I+	no	Law journals (number)
Australia	L- | I+	no	L+ | I+	yes	L+ | I+	no	Law journals (pages)
Azerbaijan	L- | I-	-	L+* | I+*	yes	L+ | I+	yes	No. of statutes
Bolivia	L- | I+	yes	L+* | I+	yes	L+ | I+	yes	Government legal acts
Salvador	L- | I+	-	L+ | I+	yes	L+ | I+	no	Law journals (number)
Finland	L+ | I+	yes	L+ | I+	yes	L+ | I+	no	Government legal acts
Kenia	L- | I+	yes	L- | I+	yes	L+ | I+	yes	No. of statutes
Kyrgyzstan	L- | I-	-	L- | I+	yes	L+ | I+	yes	No. of statutes
Latvia	L- | I-	-	L+* | I+*	yes	L+ | I+	no	Government legal acts
Mauritius	L- | I+*	yes	L- | I+	yes	L+ | I+	yes	Government legal acts
Moldova	L- | I-	-	L- | I+*	yes	L+ | I+	yes	Law journals (number)
Norway	L- | I+	no	L+ | I+	yes	L+ | I+	no	Government legal acts
Papua New Guinea	L- | I-	-	L+* | I+	yes	L+* | I+	yes	Law journals (number)
Portugal	L+ | I+	yes	L+ | I+	yes	L+ | I+	no	Law journals (number)
Quatar	L+ | I-	-	L+ | I+	yes	L+ | I+	no	Government legal acts
Rwanda	L- | I-*	-	L+ | I-	yes	L+ | I+	yes	Law journals (number)
Thailand	L+ | I+	yes	L+ | I+	yes	L+ | I+	yes	Government legal acts
United Kingdom	L+ | I+	no	L+ | I+	yes	L+ | I+	no	No. of statutes

Note: L+ legislative data were available; L- legislative data were unavailable; I+ inflation data were available; I- inflation data was unavailable; yes/no – assessment of the inflation situation in a given period (were there any overestimated inflation levels – above 6%); – no data; *data incomplete.
Source: own study in 2023.

According to Fidel (1984), a case study is appropriate for studying phenomena when considering a wide variety of factors and relationships (Fidel, 1984). This is characteristic of inflation, which many endogenous and exogenous factors can influence. Simultaneously, economic laws demonstrating the significant impact of lawmaking on inflation processes have not yet been developed, and, more importantly, lawmaking can be directly observed.

In the first stage of the research, we used an 'instrumental case study' (Stake, 1994) to analyse individual countries along with their inflationary and legislative situations. We based the summary of research results on a 'collective case study' (Stake, 1994) within the framework of comparing the phenomenon between countries.

The second stage of the research involved creating an econometric model describing the relationships between the number of legal acts and inflation. Their description in a model form can lead

to multiple interpretations, resulting in difficulties in choosing the most accurate representation of the relationship. This study is based on an econometric analysis, which combines the characteristics of time series data and cross-sectional data. The most comprehensive reflection of the relationships between the level of inflation and the intensity of legislative activity for the subject data set seems to be a panel model with random effects (RE). The RE model assumes the random distribution of individual effects in cross-sectional observations. The effects for individual entities (countries) are included in the regression model using a directional coefficient that represents a general constant parameter. The basis of the RE model is the assumption that the variability between entities is random and uncorrelated with the predictor (Greene, 2002).

The research procedure using the panel model consisted of the following stages:

1. Model specification (formulation of the research problem, determination of the explained and explanatory variables, selection of the analytical form of the model – panel model due to available statistical data – both time series data and cross-sectional data).
2. Estimation of the structural parameters of the model.
3. Substantive assessment of the model estimates.
4. Substantive assessment of the model estimates.
   - Assessment of the degree of model fit to the empirical data.
   - Assessment of the standard errors of the model parameter estimates.
   - Testing the significance of the explanatory variables.
   - Testing the properties of the random component.
5. Drawing conclusions based on the constructed econometric model.

RESULTS AND DISCUSSION

Based on the data obtained, we analysed the legislative and inflationary situation for each of the 18 countries individually. The next stage involved the search for common patterns among the analysed countries. In the data review process, we focused primarily on searching for coexisting values. Based on a review of the literature, we assumed that the introduction of a larger number of legal regulations could positively or negatively impact the inflation rate. Thus, in the tables, we used the green colour to mark years when inflation was above 6% and inflation increases exceeded 2 percentage points, while the increase in legislative forms was positive. On the contrary, we used the red colour to mark years when inflation was above 6% and inflation increases exceeded 2 p.p., but the increase in legislative forms was negative.

We divided the countries into cases based on the type of legislative data obtained. The first group consisted of countries for which we could measure the number of official journals. This group included countries such as Albania, El Salvador, Moldova, Papua New Guinea, Portugal, and Rwanda. Table 4 presents the inflation rates, the number of laws, the increase in single-base inflation, and the relative increase in laws in years in selected countries during periods that guarantee data availability.

Albania faced high inflation rates in the 1990s. The inflation database obtained was incomplete and contained records from 1992 onward. Therefore, it was impossible to analyse the first period (1960-1968) and part of the second period (1986-2006). The database of government legal acts in Albania included records from 2000, and the situation of elevated inflation in this period appeared only once (in 2002, inflation was approximately 7.8%). The third study period (2010 to 2019) was characterised by low inflation rates in Albania. In 2002, compared to 2001, the inflation rate increased by approximately 4.7 p.p., and the number of official journals increased by approximately 53 p.p. We noted that compared to 2002, in 2003, the inflation rate decreased by approximately 7.3 p.p.

We analysed the data for El Salvador for the second part of the study period. The years 1986-1996 were characterised by relatively high inflation rates (over 6%), and this situation normalised only in 1997. In the remaining study periods (first and third), we did not record high inflation in the studied country. We observed that in 1990, compared to 1989, the inflation rate increased by approximately 6.4 p.p., and in 1993, compared to 1992, it was higher by approximately 7.3 pp. At the same time, the

Table 3. Inflation dynamics and the number of journals of laws in selected countries

Albania					Papua New Guinea				
Year	Inflation	Law journals (number)	% inflation increase	% increase in the number of setting logs	Year	Inflation	Law journals (number)	% inflation increase	% increase in the number of setting logs
2000	0.05	53	–	–	2003	14.71	169	2.91	-9.14
2001	3.11	68	3.06	28.30	2004	2.16	149	-12.55	-11.83
2002	7.77	104	4.66	52.94	2005	1.78	192	-0.38	28.86
2003	0.48	115	-7.29	10.58	2006	2.37	237	0.59	23.44
2004	2.28	113	1.80	-1.74					
2005	2.37	116	0.09	2.65	2010	6.01	313	–	–
2006	2.37	156	0.00	34.48	2011	4.44	384	-1.57	22.68
Salvador					2012	4.54	495	0.10	28.91
1986	31.94	442	–	–	2013	4.96	568	0.42	14.75
1987	24.86	550	-7.07	24.43	2014	5.22	632	0.26	11.27
1988	19.76	524	-5.10	-4.73	2015	6.00	737	0.77	16.61
1989	17.63	352	-2.13	-32.82	2016	6.67	1012	0.68	37.31
1990	24.00	511	6.37	45.17	2017	5.42	926	-1.25	-8.50
1991	14.40	372	-9.60	-27.20	2018	4.37	852	-1.05	-7.99
1992	11.21	344	-3.19	-7.53	Portugal				
1993	18.51	706	7.29	105.23	1960	3.05	614	–	–
1994	10.59	916	-7.92	29.75	1961	1.55	610	-1.50	-0.65
1995	10.03	707	-0.56	-22.82	1962	2.66	622	1.11	1.97
1996	9.79	243	-0.24	-65.63	1963	2.02	620	-0.64	-0.32
1997	4.49	239	-5.30	-1.65	1964	3.44	617	1.42	-0.48
1998	2.55	235	-1.94	-1.67	1965	3.42	608	-0.02	-1.46
1999	0.51	238	-2.03	1.28	1966	5.04	615	1.61	1.15
Moldova					1967	5.53	621	0.49	0.98
2010	7.48	269	–	–	1968	6.08	633	0.55	1.93
2011	7.69	242	0.20	-10.04					
2012	4.55	280	-3.14	15.70	1986	12.33	1640	–	–
2013	4.60	321	0.05	14.64	1987	9.63	1842	-2.70	12.32
2014	5.09	133	0.49	-58.57	1988	10.10	1899	0.47	3.09
2015	9.68	391	4.59	193.98	1989	12.69	1967	2.58	3.58
2016	6.36	490	-3.32	25.32	1990	13.63	1763	0.94	-10.37
2017	6.57	472	0.21	-3.67	1991	11.85	2105	-1.78	19.40
2018	3.05	526	-3.53	11.44	1992	9.56	2227	-2.29	5.80
2019	4.84	406	1.79	-22.81	1993	6.78	2069	-2.78	-7.09
Papua New Guinea					1994	5.42	2178	-1.36	5.27
1988	5.45	82	–	–	1995	4.22	2205	-1.20	1.24
1989	4.48	74	-0.96	-9.76	1996	3.07	2438	-1.15	10.57
1990	6.95	84	2.47	13.51	1997	2.34	2437	-0.73	-0.04
1991	6.97	105	0.01	25.00	1998	2.57	2327	0.24	-4.51
1992	4.31	110	-2.66	4.76	Rwanda				
1993	4.97	106	0.66	-3.64	2010	-0.25	74	–	–
1994	2.85	107	-2.12	0.94	2011	3.08	77	3.33	4.05
1995	17.28	117	14.43	9.35	2012	10.27	79	7.19	2.60
1996	11.62	111	-5.66	-5.13	2013	5.92	79	-4.35	0.00
1997	3.96	117	-7.66	5.41	2014	2.35	82	-3.57	3.80
1998	13.57	161	9.61	37.61	2015	2.53	86	0.17	4.88
1999	14.93	193	1.36	19.88	2016	7.17	76	4.65	-11.63
2000	15.60	167	0.66	-13.47	2017	8.28	72	1.11	-5.26
2001	9.30	168	-6.30	0.60	2018	-0.31	102	-8.59	41.67
2002	11.80	186	2.50	10.71	2019	3.35	80	3.66	-21.57

Source: own study in 2023.

percentage increase in the number of official journals in 1990 compared to 1989 was approximately 45 p.p., and in 1993, compared to 1992, it was approximately 38 p.p. In both cases, the years following increases in the inflation rate and the number of official journals (1990 and 1993) saw decreases in the inflation rate; in 1991, the inflation increase was -9.6 p.p., and in 1994, compared to 1993, the inflation rate decreased by nearly 8 p.p.

The availability of data on the number of official journals for Moldova was limited. The complete database spanned from 2004 to 2004, allowing for the analysis of only two records in the second study period. Information on inflation levels for Moldova's economy in individual years was available from 1992, which led to a review of data for the third period (2010 to 2019). Studying inflation-legislation changes revealed that in 2015, compared to 2014, the inflation rate increased by nearly 4.6 pp. Simultaneously (2015), the number of official journals increased by approximately 194 p.p. However, in 2016, the inflation rate decreased from approximately 9.7% to just under 6.4%.

Papua New Guinea declared independence only in 1975, so the inflation and legislation databases were partially available for the second and fully available for the third study period. From 1986 to 2019, the economy of Papua New Guinea recorded high inflation rates. Data analysis revealed that in 1995, compared to 1994, the inflation rate increased by approximately 14.4%. However, the number of official journals in 1995 compared to 1994 increased by approximately 9.3%. A similar situation occurred in 1998. It was observed that in 1998, compared to 1997, the inflation rate increased by approximately 9.6 pp, and the increase in the number of official journals was approximately 38% compared to 1997. We also observed positive increases in Papua New Guinea's economy with respect to legislation and inflation in 1990 and 2002. In 1990, inflation rose by nearly 2%, and the increase in official journals was approximately 13.5 p.p. In 1991, inflation remained at almost the same level as in 1990. The inflation rate dropped in 1996, falling from approximately 17.3% to approximately 11.6%. In 1999, compared to 1998, inflation slightly increased (by approximately 1.36 p.p.). However, in 2003, inflation rose from approximately 12% to nearly 15%, and the number of official journals was approximately 9 p.p. lower than in 2002.

The database of official journals for Portugal was complete for all three study periods. The same situation applied to inflation data; they were available for all years analysed. Portugal's economy recorded high inflation levels (above 6%) in both study periods, but the dynamics of these changes in the first period (1960-1968) were relatively low. In 1987, compared to 1986, the inflation rate increased by approximately 2.6 p.p. At the same time, the increase in the number of official journals was relatively low, approximately 3.6 p.p. However, in 1990, Portugal's inflation rate increased from approximately 12.7% to approximately 13.6%.

Rwanda had a limited database of official journals; data on their number were available from 2004 onward. This meant that we could conduct the study only for the third period (2010–2019). Inflation data for the years 2010-2019 were fully available. We observed the inflation rate in Rwanda's economy in 2012 to be approximately 7% higher than in 2011. This increase was accompanied by a slight increase in the number of official journals. After a period of slightly higher legislative activity, the inflation rate in 2013 decreased by approximately 4.3 p.p. Upon examining Rwanda's economy, a 2016 record showed that the inflation rate increased, while the number of official journals was lower than in the previous year. In 2016, Rwanda experienced a significant increase in the inflation rate. Its value reached approximately 7.2%.

The second case involved countries for which we obtained information on the total number of legal acts implemented by governments over the years. This group included countries such as Bolivia, Finland, Latvia, Mauritius, Norway, Qatar, and Thailand. Table 4 presents inflation rates, the number of government legal acts, the increase in single-base inflation, and the relative increase in government legal acts in the years in selected countries during the periods chosen for the study.

Bolivia's economy experienced high inflation rates in the three study periods. However, data on the number of government legal acts for Bolivia were available from 1999. Inflation rates from 1999 to 2006 were below 6%. Therefore, we reviewed inflation-legislation data for the third study period. In 2011, compared to 2010, Bolivia's economy observed a sharp increase in inflation by approximately 7.4 p.p. This increase was accompanied by a significant increase in the number of legal acts, which increased by approximately 34 p.p. compared to 2011. In 2012, compared to 2011, the inflation

Table 4. Inflation dynamics and the number of government legal acts in selected countries

Bolivia					Mauritius				
Year	Inflation	Government legal acts (no.)	% inflation increase	% increase in the number of government legal acts	Year	Inflation	Government legal acts (no.)	% inflation increase	% increase in the number of government legal acts
2010	2.50	385	–	–	2016	0.98	72	-0.31	9.09
2011	9.88	516	7.38	34.03	2017	3.67	47	2.69	-34.72
2012	4.52	457	-5.37	-11.43	2018	3.22	52	-0.45	10.64
2013	5.74	562	1.22	22.98	2019	0.41	56	-2.81	7.69
2014	5.77	525	0.03	-6.58	Norway				
2015	4.06	593	-1.71	12.95	1986	7.18	782	–	–
2016	3.62	575	-0.44	-3.04	1987	8.72	1149	1.54	47
2017	2.82	555	-0.80	-3.48	1988	6.68	1342	-2.04	17
2018	2.27	487	-0.55	-12.25	1989	4.55	1551	-2.13	16
2019	1.84	542	-0.43	11.29	1990	4.13	1278	-0.42	-18
Finland					1991	3.44	1136	-0.69	-11
1960	3.42	558	–	–	1992	2.33	1344	-1.11	18
1961	1.69	621	-1.73	11.29	1993	2.29	1523	-0.04	13
1962	4.38	703	2.69	13.20	1994	1.38	1385	-0.91	-9
1963	5.00	670	0.61	-4.69	Quatar				
1964	10.28	712	5.28	6.27	1999	2.18	114	–	–
1965	4.94	715	-5.34	0.42	2000	1.65	122	-0.53	7.02
1966	3.87	787	-1.07	10.07	2001	1.47	194	-0.18	59.02
1967	5.38	677	1.50	-13.98	2002	0.24	167	-1.23	-13.92
1968	9.19	831	3.81	22.75	2003	2.26	248	2.02	48.50
					2004	6.80	291	4.53	17.34
1986	2.93	1074	–	–	2005	8.81	314	2.02	7.90
1987	4.11	1340	1.18	24.77	2006	11.84	267	3.02	-14.97
1988	5.09	1384	0.97	3.28	Thailand				
1989	6.59	1381	1.51	-0.22	1960	-0.77	243	–	–
1990	6.15	1398	-0.44	1.23	1961	7.39	295	8.15	21.40
1991	4.31	1744	-1.84	24.75	1962	3.70	335	-3.69	13.56
1992	2.92	1715	-1.39	-1.66	1963	0.00	303	-3.70	-9.55
1993	2.19	1709	-0.73	-0.35	1964	-0.79	267	-0.79	-11.88
1994	1.09	1599	-1.10	-6.44	1965	0.17	335	0.96	25.47
1995	0.79	1809	-0.30	13.13	1966	4.04	333	3.87	-0.60
1996	0.63	1377	-0.16	-23.88	1967	4.31	338	0.27	1.50
1997	1.19	1421	0.56	3.20	1968	1.79	413	-2.52	22.19
1998	1.40	1229	0.21	-13.51					
1999	1.16	1366	-0.24	11.15	1986	1.84	643	–	–
Latvia					1987	2.47	544	0.62	-15.40
1998	4.64	2844	-	-	1988	3.86	598	1.40	9.93
1999	2.36	2976	-2.28	4.64	1989	5.36	600	1.49	0.33
2000	2.65	2978	0.29	0.07	1990	5.86	562	0.51	-6.33
2001	2.49	3258	-0.17	9.40	1991	5.71	885	-0.15	57.47
2002	1.94	3688	-0.55	13.20	1992	4.14	1414	-1.57	59.77
2003	2.94	4349	1.00	17.92	1993	3.31	1879	-0.83	32.89
2004	6.19	4908	3.25	12.85	1994	5.05	2468	1.74	31.35
2005	6.75	4758	0.56	-3.06	1995	5.82	1683	0.77	-31.81
2006	6.54	4505	-0.21	-5.32	1996	5.81	3181	-0.01	89.01
Mauritius					1997	5.63	2510	-0.18	-21.09
2010	2.93	31	–	–	1998	7.99	2947	2.37	17.41
2011	6.52	75	3.59	141.94	1999	0.28	2991	-7.71	1.49

2012	3.85	62	-2.67	-17.33	2000	1.59	2048	1.31	-31.53
2013	3.54	40	-0.31	-35.48	2001	1.63	2075	0.03	1.32
2014	3.22	15	-0.33	-62.50	2002	0.70	2229	-0.93	7.42
2015	1.29	66	-1.93	340.00	2003	1.80	2297	1.11	3.05

Source: own study in 2023.

rate in Bolivia decreased by nearly 5.4 p.p.

In the Finnish economy, higher inflation rates (above 6%) were present in two study periods (I and II). At the same time, data on the number of government legal acts in the country were available in all study periods. Finland's economy experienced significant inflation fluctuations in the years 1960-1968. We found that in 1968, compared to 1967, the inflation rate increased by nearly 4 pp and the number of government legal acts increased by approximately 23%. Analysing data for Finland, we drew attention to 1964 characterised by a higher inflation rate and a larger number of government legal acts compared to 1963. In 1965, compared to 1964, the inflation rate decreased by approximately 5.3 p.p.

Inflation data for Latvia's economy were available from 1992, and the number of government legal acts from 1998. This allowed for an inflation-legislation analysis for part of the second study period. We observed that in 2004, compared to 2003, Latvia's inflation rate increased by approximately 3 pp. This increase was accompanied by an increase in the number of laws by nearly 13 p.p. After a period of introducing a larger number of government legal acts in Latvia (2004), the inflation rate in 2005 compared to 2004 showed a slight increase- by approximately 0.5 p.p. Latvia's economy had high inflation rates in the 1990s and early 2000s, while in the third study period, no high inflation fluctuations were recorded for the studied country.

For Mauritius, the availability of inflation data goes back to the mid-1960s. The legal act database provided access to government legal acts from 2002, allowing for an analysis of inflation and legislation dynamics for the third study period. In Mauritius's economy, we observed a significant increase in inflation in 2011 compared to 2010 – it rose by approximately 3.6 p.p. The number of government legal acts also increased in this period, increasing by approximately 142 p.p. We observed that after 2011, a year with a large number of legal acts introduced, the inflation rate in 2012 decreased by nearly 2.7 p.p.

Analysing the three defined study periods, we noted that Norway's economy experienced high inflation rates in the years 1986-1988 (second study period). The database of Norwegian legal acts was complete, but we did not observe any sharp increases in inflation (above 2 p.p.) in this country during the study period.

Inflation data for Qatar's economy were available for the second and third study periods. Qatar's government legal acts database was clear and extensive, dating back to the 1960s. We noted that the problem of high inflation in the studied country appeared in the years 2004-2006. In 2004, compared to 2003, Qatar's inflation rate was higher by approximately 4.5 p.p. This increase was accompanied by an increase in the number of government legal acts, which was approximately 17 p.p. After periods of increased legislative activity in Qatar (2004 and 2005), we observed that in 2006, the inflation rate continued to increase, reaching almost 12%. Simultaneously, in 2006, compared to 2005, the number of government legal acts was lower by approximately 15 p.p.

The inflation rate in Thailand's economy exceeded 6% in 1961 and 1998. The availability of inflation data and the number of government legal acts in the country studied was high. We observed that in 1961, compared to 1960, Thailand's inflation rate increased by approximately 8 p.p., and the increase in legal acts was approximately 21 p.p. An inflation increase of approximately 2.4 pp was also observed in 1998 compared to 1997. At the same time (1998), the number of government legal acts increased by approximately 17%. After years characterised by increases in the number of government legal acts and inflation above 2 p.p., we observed declines in the inflation rate. In 1962, the rate dropped from approximately 7.4% to approximately 3.7%. In 1999, compared to 1998, inflation decreased by approximately 7.7 p.p.

The third case involved countries for which we obtained information on the number of laws implemented by governments over the years. This group included countries such as Azerbaijan, Kenya, Kyrgyzstan, and the United Kingdom. Table 5 presents inflation rates, the number of laws, the increase

in single-base inflation, and the relative increase in the number of laws in years in selected countries during the study periods.

Table 5. Inflation dynamics and the number of government legal acts in selected countries

Azerbaijan					Kyrgyzstan				
Year	Inflation	Legal acts (no.)	% inflation increase	% increase in the number of legal acts	Year	Inflation	Legal acts (no.)	% inflation increase	% increase in the number of legal acts
2010	5.73	184	–	–	2011	16.64	1963	8.67	19.26
2011	7.86	220	2.13	19.57	2012	2.77	2591	-13.87	31.99
2012	1.07	232	-6.79	5.45	2013	6.61	1860	3.85	-28.21
2013	2.42	292	1.35	25.86	2014	7.53	1704	0.92	-8.39
2014	1.37	260	-1.04	-10.96	2015	6.50	1740	-1.03	2.11
2015	4.03	300	2.65	15.38	2016	0.39	1526	-6.11	-12.30
2016	12.44	485	8.42	61.67	2017	3.18	1441	2.79	-5.57
2017	12.94	439	0.49	-9.48	2018	1.54	1277	-1.63	-11.38
2018	2.27	444	-10.67	1.14	2019	1.13	1599	-0.41	25.22
2019	2.61	245	0.34	-44.82	United Kingdom				
Kenia					1986	3.43	1268	–	–
2010	3.96	29	–	–	1987	4.15	1446	0.72	14.04
2011	14.02	65	10.06	124.14	1988	4.16	1533	0.01	6.02
2012	9.38	97	-4.64	49.23	1989	5.76	1514	1.60	-1.24
2013	5.72	41	-3.66	-57.73	1990	8.06	1630	2.30	7.66
2014	6.88	38	1.16	-7.32	1991	7.46	1740	-0.60	6.75
2015	6.58	62	-0.30	63.16	1992	4.59	1903	-2.87	9.37
2016	6.30	38	-0.29	-38.71	1993	2.56	1833	-2.03	-3.68
2017	8.01	45	1.71	18.42	1994	2.22	1849	-0.34	0.87
2018	4.69	21	-3.32	-53.33	1995	2.70	2047	0.48	10.71
2019	5.24	63	0.55	200.00	1996	2.85	1818	0.15	-11.19
2010	3.96	29	–	–	1997	2.20	1804	-0.65	-0.77
Kyrgyzstan									
2010	7.97	1646	–	–					

Source: own study in 2023.

Regarding the database of Azerbaijan legal acts, it was limited. Legislative data reached back to 2003, and inflation data to 1992. This allowed for analysis during the third study period (2010-2019). In 2011, compared to 2010, the inflation rate increased by just over 2 p.p. This increase was accompanied by a nearly 20 percentage point increase in the number of laws. In 2012, the inflation rate dropped from just under 8% to approximately 1%. Inflation in Azerbaijan rose sharply in 2016 from around 4% to approximately 12.4%. At the same time, the number of laws in 2016 compared to 2015 increased by almost 62%. However, in 2017, data records only a slight increase in the inflation rate of approximately 0.5 p.p.

Inflation data for Kenya's economy were available for the entire study period, and data on the number of laws extended back to 2010. Therefore, we conducted an inflation-legislation analysis for the third period (2010-2019). Kenya's economy during this time was characterised by relatively high inflation rates. In 2011, compared to 2010, one could observe inflation increase sharply from just under 4% to approximately 14%. This increase was accompanied by a rise in the number of laws. Their quantity increased in 2011 compared to 2010 by approximately 124 p.p. In 2012, inflation was close to 9.3%, but this was lower than in 2011 (approximately 14%).

Kyrgyzstan's economy had high inflation rates in the second and third study periods. Despite the availability of inflation data, we could conduct the analysis only for the years 2010-2019. This was due to the incompleteness of the database of legal acts; the number of laws was available from 2010. In 2011, there was a significant positive increase in Kyrgyzstan's inflation rate. Its value increased from just under 8% in 2010 to nearly 17% in 2011. At the same time, in 2011, compared to 2010, the number of laws increased by just over 19 p.p. In 2012, compared to 2011, Kyrgyzstan was characterised by a

decrease in inflation, which dropped by approximately 14 p.p. However, in 2013, compared to 2012, the inflation rate increased by nearly 4 pp and the number of laws decreased by just over 28 p.p.

During the three study periods, the United Kingdom experienced a situation of increased inflation above 6% (in 1990 and 1991) only once. Inflation and legislation data for the UK were available for all study years. In 1990, compared to 1989, the inflation rate in the studied country increased by approximately 2.3 pp. Simultaneously, in 1990, compared to 1989, the number of laws increased by nearly 7.7 pp. The inflation rate in 1991 decreased; its value dropped from approximately 8% to nearly 7.5%.

The analysis of the fourth case included only one country, Australia. In this country, during the three study periods in the years 1986-2006, we detected instances of increased inflation levels. Table 6 presents the inflation rates, the number of law pages, the increase in single base inflation, and the relative increase in the number of law pages in Australia during the third study period.

Table 6. Inflation dynamics and the number of pages in government laws in Australia

Australia				
Year	**Inflation**	**Legal acts (no. of pages)**	**% inflation increase**	**% increase in the number of pages in government laws**
1986	9.05	5969	–	–
1987	8.53	1942	-0.52	-67.47%
1988	7.22	3454	-1.32	77.86%
1989	7.53	2958	0.32	-14.36%
1990	7.33	3454	-0.20	16.77%
1991	3.18	3453	-4.16	-0.03%
1992	1.01	3624	-2.16	4.95%
1993	1.75	3617	0.74	-0.19%
1994	1.97	3660	0.22	1.19%
1995	4.63	4712	2.66	28.74%
1996	2.62	3817	-2.01	-18.99%
1997	0.22	3730	-2.39	-2.28%
1998	0.86	4027	0.64	7.96%

Source: own study in 2023.

The legislative database in Australia was up-to-date, easily accessible, and clear, covering data for all study periods. The years 1986-1998 were characterised by low increases in the inflation rate, with no increase causing inflation to rise above 6%. However, we observed that in 1995, compared to 1994, inflation increased by nearly 2.7 p.p. This increase was accompanied by a rise in the number of law pages by approximately 29 p.p. In 1996, compared to 1995, the inflation rate decreased from approximately 4.6% to approximately 2.6%.

The case study analysis for the first group showed that in the year following a year characterised by an inflation increase of more than 2 p.p. and an inflation level of 6% along with an increase in the number of official journals, the inflation level decreased in countries such as Albania (2003), El Salvador (1992 and 1994), Moldova (2015), Papua New Guinea (1995), and Rwanda (2012).

Moreover, the study of the first case revealed records in individual countries where the inflation rate increase was greater than 2 p.p. and the inflation was greater than 6%. In these years, the number of official journals increased compared to the previous year, while the inflation rate in the following year increased only slightly (by a maximum of 1.5 p.p). We observed this phenomenon in Papua New Guinea in 1990 and 1998, and in Portugal in 1989. Moreover, there were two cases where inflation increased by more than 2 p.p. and was higher than 6%, while the number of official journals decreased compared to the previous year. These changes included Papua New Guinea in 2003 and Rwanda in 2016. In the years following these changes, we observed positive increases in the inflation rate.

The second case study included countries for which we obtained data on the total number of government legal acts. The data analysis showed that the inflation rate decreased in the years following a year with an inflation increase of at least 2 p.p. and a positive increase in the number of government legal acts. We observed this in countries such as:

Bolivia (2011), Finland (1964), Mauritius (2011), and Thailand (1961 and 1998).

In the second case study, we observed that in Latvia in 2005, the inflation rate increased slightly (by approximately 0.5 p.p). This phenomenon occurred after 2004, when inflation increased by over 2 pp (to more than 6%), and the number of government legal acts showed a positive increase. We observed a similar pattern in Qatar, but the inflation increase in 2005 after 2004 was greater, amounting to approximately 2 p.p. In 2006, Qatar experienced another increase in inflation and a decrease in the number of government legal acts.

The third case study showed that after a year with an inflation increase of more than 2 p.p. (to above 6%) and an increase in the number of laws, the inflation rate decreased in four cases. Inflation decreased in Azerbaijan (2012), Kenya (2012), Kyrgyzstan (2012), and the United Kingdom (1990).

In Azerbaijan's economy in 2016, an inflation increase of more than 2 p.p. was recorded, rising to approximately 12.4%. At the same time, we observed an increase in the number of laws in 2016. However, in 2017, inflation increased slightly (by approximately 0.5 p.p). The exploration of the third case showed that in 2013, the inflation increase in Kyrgyzstan of more than 2 p.p. did not coincide with a positive increase in the number of laws.

The fourth case involved only one country, Australia. Throughout the study period, there were no instances of an inflation increase that caused it to rise above 6%. However, we noted that in Australia in 1995, the inflation rate approached a value of just over 4.6% (an increase from 1994 by approximately 2.7 p.p.). This increase was accompanied by a positive increase in the number of law pages. Subsequently, in 1996, the inflation rate decreased by approximately 2 p.p.

Research Results: The random Effects Panel Model

Information regarding the relationships between inflation levels and legislative activity in individual countries possesses the characteristics of both cross-sectional and time-series data, creating a cross-sectional time-series sample. Combining cross-sectional data and time series data by increasing the number of observations facilitates the determination and assessment of existing relationships between the studied variables (Baltagi & Baltagi, 2008). The increase in the degrees of freedom of the model facilitates the distinction between individual effects and effects caused by external factors.

Due to the nature of the data regarding the relationships between the creation of legal acts by the state and the impact of legislation on inflation levels, a panel model was applied for the analysis of this information. Using panel data allows for the inclusion of temporal effects, as well as controlling for the heterogeneity of individual countries, which is accounted for by the random-effects components of the specified model. We collected the data for 17 countries for the following periods: Bolivia (2010-2019); Finland (1960-1968; 1986-1999); Latvia (1998-2006); Mauritius (2010-2019); Norway (1986-1994); Qatar (1999-2006); Thailand (1960-1968; 1986-2003); Azerbaijan (2010-2019); Kenya (2010-2019); Kyrgyzstan (2010-2019); United Kingdom (1986-1997); Albania (2000-2006); Moldova (2010-2019); Papua New Guinea (1998-2006; 2010-2018); Portugal (1960-1998); Rwanda (2010-2019); El Salvador (1986-1999).

The source information included three variables: type of legislation (legal act, law, official journal), inflation level (%), and number of legal acts (N) (Table 7). To model the processes studied, we transformed the source data into natural units by determining the first differences in the variables and their standardisation for individual countries (not within the entire dataset).

The dependent variable (std_I_inf) in this model was the standardised inflation level. The dependent variable was a stochastic process describing changes in the inflation level over time. Meanwhile, the regressor was the number of legal acts. The type of legal act (ActType) was not statistically significant (model 2), suggesting that the type of legal act does not influence the inflation level. The inflation level can be described using the first lags of the standard deviations of the dependent variable (std_I_inf_1) and based on the standard deviations of the number of legal acts (std_d_N_act) and the first and second lags of this variable (model 1) (Table 8).

Table 7. Variables included in the panel model

Names of variables	Measure
Inflation (I_inf)	%
Number of government legal acts (N_act)	N
Standard deviation I_inf (std_I_inf)*	%
Standard deviation N_act (std_N_act)*	N
First increments of I_inf (d_inf)	%
First N_act increments (d_N_act)	N
Standard deviation d_inf (std_d_inf)*	%
Standard deviation d_N_act (std_d_N_act)*	N
Type of legal act (ActType)	legal act

Notes: *Due to the diversity of the initial indicators, to compare the effects examined, standardisation was performed separately for individual countries.
Source: own study in 2024.

Table 8. Matching characteristics: The random effects model for panel data showing the quantitative impact of legislation on the level of inflation

variable	**Model 1**				**Model 2**			
	Coef. value	*Std.Err.*	*z*	*p value*	*Coef. value*	*Std.Err.*	*z*	*p value*
const	-0.056	0.040	-1.394	0.163	-0.035	0.099	-0.358	0.721
std_d_N_act	0.170	0.067	2.551	0.011**	0.171	0.067	2.556	0.011**
std_d_N_act_1	0.114	0.060	1.911	0.056*	0.114	0.059	1.920	0.055*
std_d_N_act_2	0.214	0.065	3.298	0.001***	0.213	0.065	3.289	0.001***
std_I_inf_1	0.477	0.083	5.730	<0.0001***	0.478	0.084	5.694	<0.0001***
ActType	–	–	–	–	-0.010	0.044	-0.234	0.815
Statistics for model 1					**Statistics for model 2**			
Hausman test	Chi-square(4) = 9.02 with p-value = 0.060				Chi-square(4) = 8.77 with p-value = 0.067			

Note: ***p < 0.01, **p < 0.05, *p < 0.1; We included seventeen cross-sectional data units; Dependent variable: std_I_inf; Robust standard errors (robust HAC).
Source: own study in 2024.

CONCLUSIONS

This study has several important limitations that one should consider when interpreting the results. We based the analysis on available data on inflation and legal acts, meaning that countries with limited digitalisation of legislative databases or incomplete data were excluded. This may lead to certain limitations in the representativeness of the sample.

Explaining high levels of inflation usually relies on fundamental economic laws, analyses of fluctuations in economies, and the examination of external factors. It is undeniable that economic laws function correctly – in this context, without the influence of external factors, some phenomena causing high inflation levels were under the control of decision-makers (Cukierman & Gerlach, 2003; Salma & Khan, 2023). Therefore, legal regulations become the primary instrument for inflation monitoring.

The conducted studies showed that in 16 instances, after a year with an inflation increase of more than 2 p.p. (to a value above 6%) and an increase in legislation, the inflation level decreased. We found that in four instances, after a year characterised by an inflation increase (of more than 2 p.p.) to 6% and an increase in legislation, inflation increased slightly. Only in four cases did the inflation rate increase in the year following an inflation increase (of more than 2 p.p.) to above 6% and an increase in legislation.

Based on this, we can assume that the phenomenon of elevated inflation (above 6%) is generally accompanied by an increase in government legislation aimed at reducing inflation levels. This is reflected in the decreasing inflation rates recorded for the years following those with increased inflation and government legislation. Therefore, we rejected the research hypothesis that the amount of government legal regulations has an insignificant impact on inflation levels in economies.

As Barro (1996) emphasises, legal transformations can occur in response to inflation. He points out that the direction of this interaction is unclear, and differences in legal regulations between countries affect the independence of central banks. Therefore, Barro proposes including the rule-of-law index in studies, which, according to the authors of this article, is justified in examining the inflation-legislative situation in a small number of countries. However, the analyses in this article covered a large group of countries over various periods, making the rule-of-law index unavailable for each record. In addition, the conducted studies showed that in most examined countries, the direction of the interaction of government lawmaking was clear: the increase in government legislation caused a decrease in the inflation rate in subsequent years.

The review of the obtained legislative data can lead to the conclusion that the studied countries experience a phenomenon of hyperlexis, which is simply defined as an attempt to create a utopian legal system that regulates almost every sphere of human life (Schwidetzky, 1996). The analysis of legislative data indeed indicates that more laws have been created over the twentieth and twenty-first centuries. This was not an attempt to create an ideal legal system, but rather a necessity to regulate new spheres of life and rapidly developing economies. This is confirmed by research conducted by Ash, Morelli, and Vannoni (2022), who emphasise that the increase in the number of legal conditional clauses, *i.e.*, the increase in legislative details, is positive for economic growth, and the need for additional regulation increases, especially in situations of higher economic uncertainty (there is a need to implement emergency solutions) (Ash *et al.*, 2022).

High sustained inflation results in high economic uncertainty. This may prompt decision-makers to introduce legal regulations to counteract high inflation. The expansion and increased detail of the legislation are beneficial for economic growth, which negatively correlates with the inflation rate. Therefore, from the perspective of economic theory, this process can lead to a reduction in the inflation level in the economy and is significant for understanding the factors influencing it.

From the perspective of economic practice, the study's findings may be relevant for the financial sector, businesses, and investors who analyse the impact of regulatory changes on economic stability. Identifying a pattern where increased legislation precedes periods of inflationary changes may be useful for forecasting market risk and adjusting investment strategies to a changing legal and economic environment.

This study adds new value to the literature by empirically examining the relationship between legislative activity and inflation dynamics using a panel data model with random effects. Unlike previous studies, which primarily focus on macroeconomic determinants of inflation, we incorporated legal factors, emphasising the role of government legislative activity in economic stabilisation. We based the research on a unique dataset covering multiple countries and periods while systematically excluding cases with unreliable legislative data. The findings indicate that an increase in legislative activity often precedes a decline in inflation, challenging traditional approaches and suggesting a significant role of legal regulations in economic adjustment mechanisms.

The relationship between legislative activity and inflation is complex and may depend on various additional factors, such as monetary policy, macroeconomic conditions, and institutional stability. The results indicate the co-occurrence of certain patterns. Further research in this area may contribute to a better understanding of this relationship. Despite these limitations, the presented analysis provides new insights into the potential role of legal regulations in shaping inflation dynamics and may serve as a starting point for further studies in this field.

REFERENCES

Agenția Informațională de Stat „Moldpres" (2023). Monitorul Oficial. Retrieved from https://monitorul.gov.md/ on June, 12, 2024.

Ahmed, S., & Mortaza, M.G. (2010). Inflation and economic growth in Bangladesh: 1981-2005 (No. id: 3033), 1-15. Retrieved from https://ideas.repec.org/p/ess/wpaper/id3033.html on June, 12, 2024.

Andrés, J., & Hernando, I. (1999). Does inflation harm economic growth? Evidence from the OECD. In *The costs and benefits of price stability* (pp. 315-348). University of Chicago Press, 338-339. http://doi.org/10.3386/w6062

Arihan, C. (2021). Oil Crisis (Oil Price Revolution) of 1973 and the United States' Response to the Crisis: The International Energy Agency. *Journal of Management Policy & Practice*, *22*(1), 24-31. https://doi.org/10.33423/jmpp.v22i1.4176

Ash, E., Morelli, M., Vannoni, M. (2022.) More Laws, More Growth? Evidence from U.S. States. BAFFI CAREFIN Centre Research Paper No. 2022-178, 2-34. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4095044 on June, 1, 2024.

Assembleia da República. (2023). Diário da República. Retrieved from https://diariodarepublica.pt/dr/home on June, 22, 2024.

Australian Government. (2023). Federal Register of Leglislation. Retrieved from https://www.legislation.gov.au/ on June, 1, 2024.

Ayyoub, M., Chaudhry, I.S., & Farooq, F. (2011). Does Inflation Affect Economic Growth? The case of Pakistan. *Pakistan Journal of Social Sciences (PJSS)*, *31*(1), 62. Retrieved from https://pjss.bzu.edu.pk/index.php/pjss/article/view/93 on March, 13, 2025.

Azərbaycan Respublikasının. (2023). Retrieved from Milli Meclis. https://meclis.gov.az/ on June, 26, 2023.

Baltagi, B.H., & Baltagi, B.H. (2008). *Econometric analysis of panel data* (Vol. 4). Chichester: Wiley, 7. Retrieved from https://library.wbi.ac.id/repository/27.pdf on June 23, 2023.

Barro, R.J. (1996). Inflation and growth. *Review-Federal Reserve Bank of Saint Louis*, *78*, 153-169. https://doi.org/10.20955/r.78.153-169

Bar-Siman-Tov, I. (2015). Mending the legislative process–the preliminaries. *The Theory and Practice of Legislation*, *3*(3), 245-256. https://doi.org/10.1080/20508840.2015.1136118

Becker, L.J., & Seligman, C. (1981). Welcome to the energy crisis. *Journal of Social Issues*, *37*(2), 1-7. https://doi.org/10.1111/j.1540-4560.1981.tb02623.x

Blank, J.D., & Osofsky, L. (2016). Simplexity: Plain language and the tax law. *Emory LJ*, *66*, 189-264. Retrieved from https://scholarlycommons.law.emory.edu/elj/vol66/iss2/1/ on March, 11, 2025.

Bruno, M. (1995). Does inflation really lower growth?. *Finance and Development*, *32*, 35-35. https://doi.org/10.5089/9781451952193.022

CBONDS. (2021). CBONDS monthly research: countries with inflation targeting. Cbonds.com – Financial Market Data. Retrieved from https://investfunds.ru/analytics/271529/download/ on June 23, 2023.

Chen, Y.B. (2022). The Review and Analysis of Inflation and its Effects: Will Current High Inflation Lead to an Economic Crisis?. *Journal of Business & Economic Policy*, *9*(2), 1-22. https://doi.org/10.30845/jbep.v9n2p1

Chimobi, O.P. (2010). Inflation and economic growth in Nigeria. *Journal of Sustainable Development*, *3*(2), 161-163. https://doi.org/10.5539/jsd.v3n2p159

Cieslak, A., & Pflueger, C. (2023). Inflation and asset returns (No. w30982). *National Bureau of Economic Research*, 5-10. http://doi.org/10.3386/w30982

Cukierman, A., & Gerlach, S. (2003). The inflation bias revisited: theory and some international evidence. *The Manchester School*, *71*(5), 541-565. https://doi.org/10.1111/1467-9957.00366

Datta, K., & Mukhopadhyay, C.K. (2011). Relationship between inflation and economic growth in Malaysia-An econometric review. In *International Conference on Economics and Finance Research*, *4*(1), 415-419. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/54632631/Relationship_between_Inflation_and_Economic_Growth_in_Malaysia_--libre.pdf?1507226662=&response-content-disposition=inline%3B+filename%3DRelationship_between_Inflation_and_Econo.pdf&Expires=1742200801&Signature=LWQUp9QNDoJ80APGOh4mu2tTXz-e1C52RpkoTmJV-Gr5eKRXYMLrdMDeaD-jCvHv6skROoMO2Riea~BAjtRGsNRGCKTlweUS4NqFsX0UhSgoG-wtad6~RvgKqzzsJoGd1sS8gvZI0zu85Vy3xrAufbd9y93VFfbYTIBvAdkZY6B2-HpDry7GpPo-~d0xjEbs8WHdDSkLsv0gVvp6LVPVMKRSQ0Fo0Q7Sk-ZN~dyYZlXCHAYo-ZXQpdECN26mYRrzk9C5jeRwGT5miecngS8wnOHE58or69UbBqHR~5c-O0wyE65hX9OE0pk7qCT9mDQt8sr7n4cxKj1R6h-PIw5wc2eDQ__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA on June 23, 2023.

De Gregorio, J. (1992). Economic growth in Latin America. *Journal of Development Economics*, *39*(1), 83-84. https://doi.org/10.1016/0304-3878(92)90057-G

Fabricant, S. (1972). The "Recession" of 1969-1970. In *Economic Research: Retrospect and Prospect, Volume 1, The Business Cycle Today*. NBER, p. 91. Retrieved from https://www.nber.org/books-and-chapters/economic-research-retrospect-and-prospect-volume-1-business-cycle-today/recession-1969-1970 on June 23, 2023.

Faria, J.R., & Carneiro, F.G. (2001). Does high inflation affect growth in the long and short run?. *Journal of Applied Economics*, *4*(1), 100-102. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=558745 on June 23, 2023.

Fidel, R. (1984). The case study method: A case study. *Library and Information Science Research*, *6*(3), 273-288.

Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, *32*(3), 509-510. https://doi.org/10.1016/0304-3932(93)90027-D

Government of the United Kingdom. (2023). The National Archives. Retrieved from https://www.legislation.gov.uk/ on June 21, 2023.

Greene, W.H. (2002). *Econometric analysis 5th edition.* New Jersey: Prentice Hall. Retrieved from https://books.google.pl/books/about/Econometric_Analysis.html?id=JJkWAQAAMAAJ&redir_esc=y on June 23, 2023.

Harris, M.N., Gillman, M., & Mátyás, L. (2001). *The negative inflation-growth effect: theory and evidence*. Melbourne Institute of Applied Econmic and social Research, University of Melbourne, 27-28. Retrieved from https://ideas.repec.org/p/iae/iaewps/wp2001n12.html on June 23, 2023.

Imprenta Nacional. (2023). Diario Oficial. Retrieved from https://www.diariooficial.gob.sv/ on June 23, 2023.

Jahan, S. (2012). Inflation targeting: Holding the line. *Finance & Development*, *4*, 72-73. Retrieved from https://www.imf.org/external/pubs/ft/fandd/basics/target.htm on June 23, 2023.

James, S. (2007). *Tax Simplification is not a simple issue: the reasons for difficulty and a possible strategy.* University of Exeter Discussion Papers in Management, *18*(07), 1-18. Retrieved from https://mpra.ub.uni-muenchen.de/19281/1/MPRA_paper_19281.pdf on June 23, 2023.

Jayathileke, P.M., & Rathnayake, R.M. (2013). Testing the Link between Inflation and Economic Growth: Evidence from Asia. *Modern Economy*, *4*(2), 2013, 89-92. http://doi.org/10.4236/me.2013.42011

Justisdepartementet. (2023). Lovdata. Retrieved from https://lovdata.no/ on June 20, 2023.

Karki, S., Bajara, S., & Dumre, A. (2020). A review on impact of inflation on economic growth in Nepal. *Archives of Agriculture and Environmental Science*, *5*(4), 577-581. https://doi.org/10.26832/24566632.2020.0504022

Këshilli i Ministrave i Shqipërisë. (2023). Qendra e Botimeve Zyrtare. Retrieved from https://qbz.gov.al/ on June 22, 2023.

Kirby, M. (2009). The fundamental problem of regulating technology. *Indian Journal of Law and Technology*, *5*, p. 15. https://doi.org/10.22459/PICTI.10.2013.01

Latvijas Republika. (2023). Latvijas Vēstnesis. Retrieved from https://lv.lv/lv on June 21, 2023.

Li, C.-S., & Liu, Z.-J. (2012). Study on the Relationship among Chinese Unemployment Rate, Economic Growth and Inflation. Advances in Applied Economics Finance, 1, 8-18. Retrieved from https://www.scirp.org/reference/referencespapers?referenceid=2857597 on June 23, 2023.

Mallik, G., & Chowdhury, A. (2001). Inflation and economic growth: evidence from four south Asian countries. *Asia-Pacific development journal*, *8*(1), 129-133. Retrieved from https://www.unescap.org/sites/default/files/apdj-8-1-ResearchNote-Mallik-and-Chowdhury.pdf on June 23, 2023.

Mauritius National Assembly. (2023). The Government Gazette of Mauritius. Retrieved from https://gpd.govmu.org/ on June 24, 2023.

Ministerio de la Presidencia. (2023). Gaceta Oficial de Bolivia. Retrieved from http://www.gacetaoficialdebolivia.gob.bo/ on June 20, 2023.

Ministry of Justice of Kyrgyz Republic. (2023). Regulatory legal acts. Retrieved from http://cbd.minjust.gov.kg/ on June 22, 2023.

Ministry of Justice. (2023). Al Meezan. Retrieved from https://almeezan.qa/ on June 27, 2023.

Ministry of Justice. (2023). Official Gazette. Retrieved from https://www.minijust.gov.rw/official-gazette on June 24, 2023.

National Council for Law Reporting. (2023). Laws of Kenya. Retrieved from http://kenyalaw.org/ on June 22, 2023.

Ndoricimpa, A. (2017). Threshold effects of inflation on economic growth: is Africa different?. *International Economic Journal*, *31*(4), 599-620. https://doi.org/10.1080/10168737.2017.1380679

Neville, H., Draaisma, T., Funnell, B., Harvey, C.R., & Van Hemert, O. (2021). The best strategies for inflationary times. *The Journal of Portfolio Management*, *47*(8), 8-37. https://doi.org/10.2139/ssrn.3813202

Pacific Islands Legal Information Institute. (2023). Papua New Guinea Government Gazettes. Retrieved from http://paclii.org/countries/pg.html on June 21, 2023.

Salma, U., & Khan, M.F.H. (2023). The Connection Between Political Stability and Inflation: Insights from Four South Asian Nations. *arXiv preprint arXiv:2310.08415*. https://doi.org/10.48550/arXiv.2310.08415

Schwidetzky, W.D. (1996). Hyperlexis and the Loophole. *Oklahoma Law Review*, *49*, 403-424. Retrieved from https://digitalcommons.law.ou.edu/cgi/viewcontent.cgi?article=1768&context=olr on June 23, 2023.

Setyadharma, A., Oktavilia, S., Wahyuningrum, I.F.S., Nikensari, S.I., & Saputra, A.M. (2021). Does Inflation Reduce Air Pollution? Evidence from Indonesia. In *E3S Web of Conferences*, 317. EDP Sciences, 4-7. https://doi.org/10.1051/e3sconf

Shevchuk, V.O., Blikhar, V., Zabzaliuk, D., & Tataryn, N. (2020). The rule of law and inflation in the middle-income countries. *Financial and Credit Activity Problems of Theory and Practice*, *2*(33), 386-399. https://doi.org/10.18371/fcaptp.v2i33.207083

Stake, R.E. (1994). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 236-247). Sage Publications, Inc. Retrieved from https://psycnet.apa.org/record/1994-98625-013 on June 23, 2023.

Šulmane, D. (2011). Legislative Inflation"-An analysis of the Phenomenon in Contemporary Legal Discourse. *Baltic Journal of Law & Politics*, *4*(2), 78-101. https://doi.org/10.2478/v10076-011-0013-4

Summers, L.H., Wessel, D., & Murray, J.D. (2018). Rethinking the Fed's 2 percent inflation target. Washington, DC: Brookings Institute, 1-8. Retrieved from https://www.brookings.edu/wp-content/uploads/2018/06/ES_20180607_Hutchins-FedInflationTarget.pdf on June 23, 2023.

Suomen oikeusministeriö. (2023). Finlex. Suomen sähköinen säädöskokoelma sekä ajantasaisten säädösten ja alkuperäisten säädösten kokoelmat. Retrieved from https://www.finlex.fi/fi/laki/ on June 23, 2023.

Sweidan, O.D. (2004). Does inflation harm economic growth in Jordan? An econometric analysis for the period 1970-2000. *International Journal of Applied Econometrics and Quantitative Studies*, *1*(2), 49-63. Retrieved from https://www.usc.es/economet/reviews/ijaeqs123.pdf on June 23, 2023.

The Secretariat of the Cabinet. (2023). Ratchakitchanubeksa. Retrieved from https://ratchakitcha.soc.go.th/ on June 23, 2023.

The World Bank, World Development Indicators. (2023). *Inflation, consumer prices (annual %)* [Data file]. Retrieved from https://databank.worldbank.org/reports.aspx?source=2&series=FP.CPI.TOTL.ZG on June 28, 2023.

Zunes, S. (2009). The Iranian Revolution (1977-1979). *Washington, DC: International Center on Nonviolent Conflict (ICNC)*, 2-7. Retrieved from https://www.nonviolent-conflict.org/wp-content/uploads/2016/02/The-Iranian-Revolution-1.pdf on June 23, 2023.

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Greedflation in post-pandemic Europe: Analysing profit share dynamics

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ABSTRACT

Objective: The study aims to examine how the profit share indicator (gross operating surplus as a share of value added in non-financial corporations) responded to macroeconomic shocks by comparing its dynamics during the post-pandemic crisis and the global financial crisis (GFC). By identifying deviations from expected trajectories, the study explores whether we can partially attribute corporate profit behaviour in the post-COVID period to mechanisms associated with greedflation.

Research Design & Methods: We studied the impact by examining the difference between the observed values of the profit share indicator during the crisis period and the values forecast using an autoregressive neural network model in a panel data framework. We utilised quarterly data from 16 countries covering the period from 1999 to 2023.

Findings: In many countries, particularly during the post-pandemic inflationary phase, the profit share indicator exceeded forecast values, often significantly. In contrast, deviations during the GFC were generally weaker or absent. The results reveal heterogeneous patterns of profit dynamics and suggest that in some cases, corporate profits may have contributed to inflationary persistence.

Implications & Recommendations: The findings suggest that inflation control strategies should consider not only supply and demand factors, but also profit-side mechanisms. Regulatory frameworks should monitor sectors where post-crisis profit margins increase disproportionately. Future policy design may benefit from incorporating profit-based indicators into inflation diagnostics, especially in periods of macroeconomic shock.

Contribution & Value Added: This study introduces a novel methodology for identifying potential greedflation effects by applying neural network forecasting to macro-level data. It avoids reliance on firm-level markup data while enabling empirical detection of abnormal profit behaviour. By comparing two major crisis episodes, the article provides a new perspective on the structural role of profits in shaping inflationary outcomes.

Article type: research article

Keywords: greedflation; profit share; inflation; profit margin; GFC; post-pandemic crisis

JEL codes: E31, E32, M20

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INTRODUCTION

In recent years, the global economy has faced a series of unprecedented challenges, exacerbated by the COVID-19 pandemic and the subsequent energy crisis (Ciotti *et al.*, 2020; Firlej *et al.*, 2024; Głodowska *et al.*, 2023; Zakeri *et al.*, 2022). Consequently, key financial institutions, including central banks, were caught off guard by a sudden surge in inflation (Cavallo, 2021), which significantly diverged from previous deflationary trends (Brown & Simonnot, 2020). In 2021 and 2022, especially in the Eurozone, we observed dynamic changes in price levels, attributed to three main channels. The first was the energy shock and disruptions in international transport (Munteanu & David, 2023). The second factor was the pent-up demand resulting from the pandemic (Born *et al.*, 2022), which, combined with the persistence of high operating costs after the lifting of restrictions, led to increased inflation. The third factor was the

unex-pected rise in government spending (Reis, 2020), which significantly boosted consumption and had a heterogeneous impact on the economy depending on each country's fiscal situation.

However, alongside traditional inflationary factors associated with the supply and demand model, economists during the post-pandemic crisis also pointed to 'greedflation.' This concept describes the tendency of businesses to exploit periods of rising prices to generate disproportionately high profits (Vinod, 2022), thereby sustaining elevated inflation levels. According to this theory, amidst global price increases driven by supply and demand fluctuations, companies not only adjust their prices to cover rising raw material and wage costs but also raise them beyond those levels, leading to record revenues and further fuelling inflation.

Consequently, we aimed to explore the extent to which 'greedflation' may influence the profit share in non-financial enterprises and whether, in certain countries, it may surpass levels recorded before the crisis. This focus is particularly salient considering research that traditionally links inflation predominantly to demand- and supply-side factors; identifying novel mechanisms driving inflation offers deeper insight into the distinctive features of contemporary economic crises. The significance of the present analysis lies in integrating the concept of greedflation into conventional explanations of price dynamics, thereby providing a more comprehensive understanding of inflationary processes and facilitating the development of more effective stabilisation tools in the future. Furthermore, pinpointing instances in which profit shares exceed pre-pandemic benchmarks furnishes valuable guidance for policymakers and financial institutions seeking to mitigate excessive burdens on consumers and curb persistently high inflation over the longer term.

In this context, the article addresses two main research questions: (1) To what extent did the profit share indicator in non-financial enterprises deviate from expected levels based on pre-crisis dynamics? (2) Can we interpret these deviations as a manifestation of greedflation, *i.e.*, profit-maximising behaviour under crisis conditions? The novelty of the study stems from the use of an autoregressive neural network model trained on stable periods (excluding crisis shocks) to forecast expected values and detect abnormal profit share patterns. This approach enables a unique macro-level assessment of greedflation, contributing to a deeper empirical understanding of inflationary mechanisms in post-crisis economies.

The article is structured as follows. Literature Review discusses the existing research on inflation dynamics and the concept of greedflation. The following section, Research Methodology, outlines the dataset, country selection, and the autoregressive neural network approach applied to forecast profit share indicators. This is followed by Results and Discussion, which presents empirical findings and cross-country comparisons. Finally, the Conclusions section summarises the main insights, highlights policy implications, and points to directions for future research.

LITERATURE REVIEW

Following the COVID-19 pandemic, inflation in Europe surged due to several global disruptions. Widespread lockdowns and restrictions disrupted production and supply chains (Andre *et al.*, 2023). Factory closures, logistical bottlenecks, and higher sanitary costs further strained supply (Chen *et al.*, 2023; Clarida, 2023; Ozili & Ozen, 2023). Combined with a surge in demand following the lifting of pandemic restrictions, these disruptions contributed to rising inflation (Carstens, 2022; Santacreu & LaBelle, 2022). Another critical factor was the disruption of global supply chains (Carstens, 2022; Chen *et al.*, 2023). Interruptions in the supply of semiconductors, raw materials, and essential components affected various sectors, including automotive (Mohammed & Khan, 2022), electronics (Beibit *et al.*, 2023), agriculture (Tougeron & Hance, 2021), and logistics (Juergensen *et al.*, 2020). These disruptions led to increased production costs (Firlej *et al.*, 2024; Hilmola *et al.*, 2020; Klimecka-Tatar & Ulewicz, 2021; Tougeron & Hance, 2021) and ultimately higher prices for consumers. Labour shortages, caused by employees having to stay home due to illness or pandemic-related restrictions, further exacerbated these problems (Chen *et al.*, 2023). The war in Ukraine, which began in February 2022, was another significant factor affecting inflation (Caldara *et al.*, 2022; Canuto, 2022). This conflict caused sharp increases in energy prices, particularly for gas and oil (Canuto, 2022; Chen *et al.*, 2023; Mierzejewski & Tomala, 2024; Mohammed & Khan, 2022). Sanctions imposed on Russia and Moscow's retaliatory restrictions on gas supplies to Eu-

rope further intensified inflationary pressures (Caldara *et al.*, 2022). Moreover, as one of the largest global producers of grain (Lagodiienko *et al.*, 2019), Ukraine experienced significant production and export challenges, which led to increased food prices worldwide (Semenenko *et al.*, 2023).

In response to the crisis triggered by the COVID-19 pandemic, during the early stages of the resulting economic turmoil, the member countries of the European Union undertook a broad range of measures to stabilise the economy. The European Central Bank (ECB) and national central banks utilised several unconventional monetary policy tools, including asset purchase programmes (Kedward *et al.*, 2024) and the provision of low-cost loans to commercial banks (Claeys, 2020). These actions intended to ensure financial liquidity and support the banking sector under difficult economic conditions. Concurrently, national governments implemented comprehensive fiscal packages that included employment support (Lowe, 2022; Su *et al.*, 2021), businesses assistance (Craven *et al.*, 2020; Oche, 2021), and investments in the healthcare sector (Bello *et al.*, 2024; Garcia-Murillo *et al.*, 2018) to mitigate the pandemic's impact and ensure the provision of essential medical services.

The effectiveness of measures taken to combat inflation has varied. Interest rate increases by the ECB and other central banks had a limited short-term impact on inflation (Cavallo, 2021; Lowe, 2022). Higher borrowing costs slowed economic growth but also created additional difficulties for businesses and consumers already facing significant financial obligations (Gachunga & Kuso, 2018; Scott & Pressman, 2015). Consequently, economists and analysts began investigating other causes of persistent high inflation. One concept that gained prominence during this period was 'greedflation,' *i.e.*, the phenomenon where companies take advantage of economic conditions, such as supply chain disruptions or increased raw material costs, to significantly raise prices of their products and services to maximise profits, regardless of actual production costs. This results in higher corporate profit margins, contributing to inflation (Bilbiie & Känzig, 2023; Nariswari & Nugraha, 2020; Vinod, 2022).

However, the literature on greedflation is far from unanimous. While some empirical findings support the view that rising corporate mark-ups have become a significant driver of post-pandemic inflation (Ari *et al.*, 2023; Bivens, 2022), there are also opposing viewpoints suggesting that other factors such as lingering supply bottlenecks, energy market volatility, and pent-up consumer demand exert a more dominant influence on price dynamics (Colonna *et al.*, 2023). Furthermore, some commentators argue that the concept of greedflation oversimplifies complex macroeconomic processes, noting that past episodes of inflationary spikes often involved multiple interacting drivers rather than solely relying on corporate behaviour (Bilbiie & Känzig, 2023; Capelle & Liu, 2023). Research on greedflation spans various sectors and methods. J. Bivens of the Economic Policy Institute estimates that in 2022, prices rose by 6% annually (vs. 1.8% in 2007-2019), with 53.9% of the increase driven by corporate profit margins. According to the IMF (Ari *et al.*, 2023), since 2022, eurozone inflation has been driven by import prices (40%), profits (45%), and wages (25%), while taxes had a disinflationary effect. The market saw the largest profit gains in sectors such as mining, utilities, and services with direct customer contact, where firms passed on more than the nominal import price increase. However, this does not necessarily indicate increased profitability. Economists from the Bank of Italy (Colonna *et al.*, 2023) show the relationship between profit shares and corporate profitability, which in Italy remained at pre-pandemic levels in 2022. In Germany, profitability in industry and manufacturing remained stable in 2022, while it rose in construction, retail, accommodation, and transport. Firms raised prices in anticipation of recovery and cost increases, suggesting that in more competitive sectors, greedflation may have been less pronounced. Temporary profit growth can result from reduced recession costs and preemptive price hikes, which typically decline as recovery and input prices rise, a cyclical pattern also noted by Fed economists (Glover *et al.*, 2023). To emphasise this, noting that during previous economic recoveries (as in the post-pandemic period), corporate profits became the main driver of inflation in the first year but were subsequently overshadowed by business costs.

This study uses profit share as a percentage of GDP rather than firm-level margins to assess the overall profitability of the non-financial sector. This macro-level approach helps capture broad economic and inflationary trends, including the effects of monetary and fiscal policy, and is widely applied in existing literature (Colonna *et al.*, 2023; Glover *et al.*, 2023; Lavoie, 2023). Macro-level analysis allows for the capture

of the effects of general economic changes, such as monetary and fiscal policy (Nikiforov *et al.*, 2023), on corporate profits, which is difficult to achieve when focusing on individual profit margins.

Secondly, using the profit share as a share of GDP avoids distortions caused by differences in industry structure and firm size, which complicate comparisons based on profit margins. While some studies use disaggregated data (Colonna *et al.*, 2023; Hasenzagl & Pérez, 2023), they also acknowledge this problem. By using the profit share at the macroeconomic level, these differences are minimised, providing a more uniform view of the economic situation. Leading research institutions use this method (Benigno *et al.*, 2021; Hasenzagl & Pérez, 2023; OECD, 2021). However, it does not consider the structural diversity of individual economies, which is a limitation of this approach.

Thirdly, as a share of GDP, profit share is less affected by short-term firm-level fluctuations, offering more stable and reliable results crucial for analysing long-term inflation trends (Hasenzagl & Pérez, 2023).

RESEARCH METHODOLOGY

WE aimed to assess changes in the profit share indicator (gross profit share of non-financial enterprises, unadjusted data) in response to the post-pandemic shock and inflation in selected European countries. The sample included 15 countries (Austria, Belgium, the Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, the Netherlands, Poland, Portugal, Spain, and Sweden), chosen for data continuity and comparability across pre- and post-crisis periods. The selection ensured diversity in economic structures and institutional contexts, enhancing both generalisability and data reliability.

To examine the impact, WE used the difference between the observed values of the profit share indicator during the crisis period and the forecast values obtained using an autoregressive neural network model in a panel data framework. Neural network methods are successfully applied in autoregressive contexts (Aydin & Cavdar, 2015; Chen, 2020; Falat *et al.*, 2015), and neural network models are increasingly used in economic sciences. The procedure for building the forecasting model began with identifying time series data whose dynamics were not disrupted by global economic shocks. Based on the literature, WE identified two crisis periods: 2007-2010 (OECD, 2021) and post-2020 (Bhuiyan *et al.*, 2021; Goldthau & Tagliapietra, 2022; Munteanu & David, 2023; Ozili & Ozen, 2023). Accordingly, WE selected time series data (quarterly data from 1999 to the end of 2006 and from 2011 to the end of 2019) to represent the dynamics of the profit share indicator in each country under globally stable conditions. WE used these data to train the neural networks (100 networks were generated, with the learning epochs limited by the minimisation of the mean error of the test set) and chose the network architecture with the highest level of fit. WE set the number of lags used in the autoregressive neural network model to 12, corresponding to a three-year quarterly lag structure. This choice reflects a typical business cycle horizon and allows the model to capture both seasonal and medium-term fluctuations in the profit share indicator. This approach is widely used in economic forecasting, where neural networks are applied to time series data with predefined lag windows, relying on the model's architecture to adjust for the significance and non-linearity of historical observations (Agustí *et al.*, 2022; Almosova & Andresen, 2019).

To connect the profit share indicator to the concept of greedflation, the core assumption was that if the observed profit share consistently and significantly exceeded the forecast (expected) values under stable conditions, this divergence may reflect corporate behaviour aimed at maximising profit margins beyond what can be attributed purely to increased costs. Thus, a sustained higher-than-expected profit share would serve as a potential indicator of greedflation.

WE took several steps to address potential threats to internal validity. To prevent the problem of overfitting during the training stage, WE divided the data into a training set (70% of the observations), a test set where the minimisation of the mean error difference also occurred (15%), and a validation set (15%). Figure 1 depicts the model architecture, incorporating lagged values of the profit share indicator up to 12 lags (3 years), categorisation by country and a series describing temporal changes (date). Ultimately, the model consisted of nine hidden neurons, excluding the input and output neurons. The model fit values for each subset were: training set fit at 0.99, test set fit at 0.98, and validation set fit at 0.98.

During forecasting, WE projected each period's profit share using lagged values from previous forecasts (*e.g.*, Q1 2020 used to predict Q2 2020). For non-crisis periods, WE retained actual values. The

model assumed that stable-period dynamics would have continued post-2020, allowing for the identification of shock impact as the gap between observed and forecast values. As model accuracy declines with each step ahead, the results indicated the likely direction of change, rather than precise magnitudes.

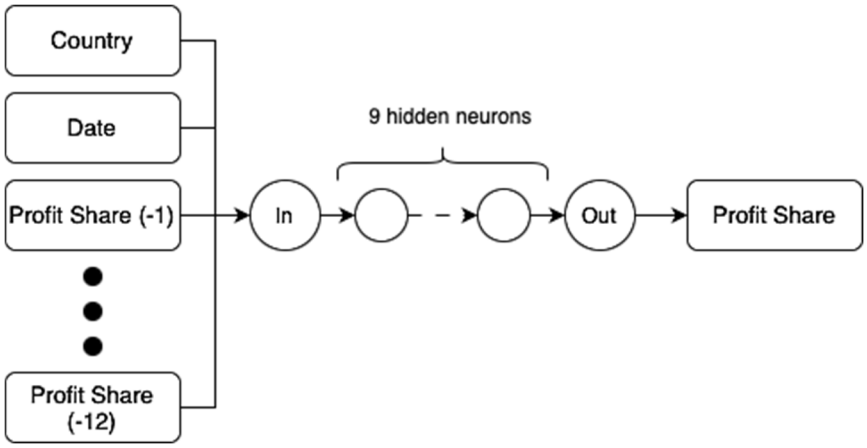

Figure 1. The architecture of the predictive neural network
Source: own elaboration.

RESULTS AND DISCUSSION

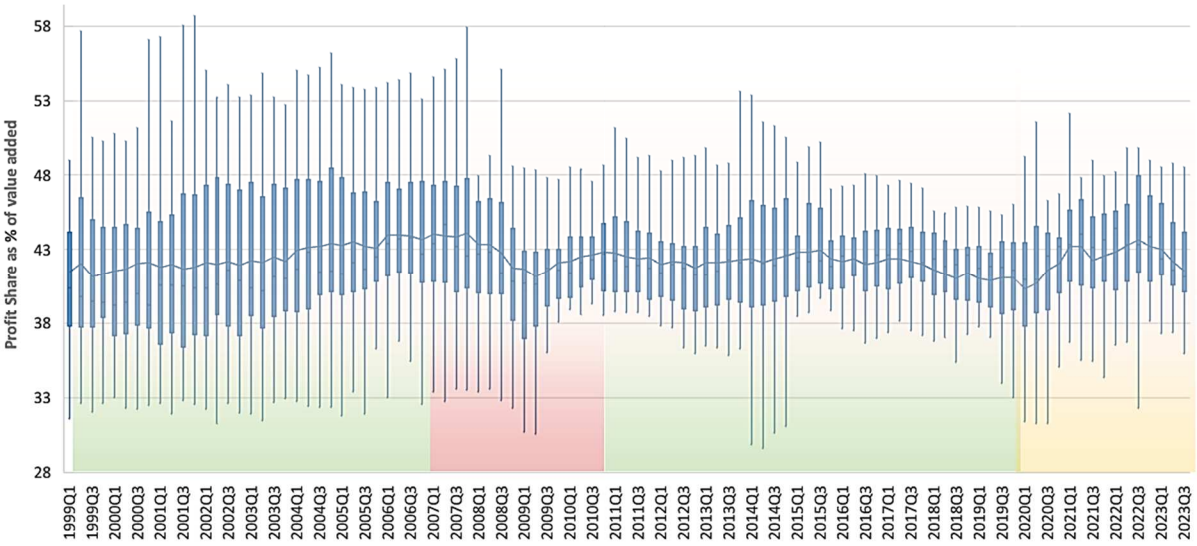

Figure 2. Gross profit share of non-financial corporations as % of value added
Source: own elaboration based on Eurostat, Key indicators – quarterly data, 10.2908/nasq_10_ki, https://ec.europa.eu/eurostat/databrowser/view/NASQ_10_KI__custom_437550/bookmark/table?lang=en&bookmarkId=ea6dc89e-a154-41a1-9ae2-1a2f90aa02fe [09/04/2024].

Throughout the study period, from 1999 to 2023, the profit share indicator for European countries averaged 40.7% of value added. Greece had the highest average profit share during the analysed period, at 55.87% of value added, while France had the lowest, at 32.08%. Before 2007, the indicator values varied significantly between countries. Greece and the Czech Republic had the highest profit share values, ranging from approximately 50% to 61% of value added before the Global Financial Crisis (GFC). On the other hand, France, the Netherlands, Portugal, and Belgium had the lowest values, ranging from about 25% to around 45%. During the 2007-2010 period, the discrepancies between countries decreased, with differences up to 30 percentage points (the lowest observed value being 28% in France and the highest 58% in Greece). In the period after the GFC and before the COVID-19 pandemic, the average profit share was 44.09%. Greece again had the highest average value at 67.1%, while France

had the lowest at 31.34%. Following the COVID-19 pandemic, the average profit share was 42.33%. Greece still had the highest value at 54.34%, and France had the lowest at 31.34%.

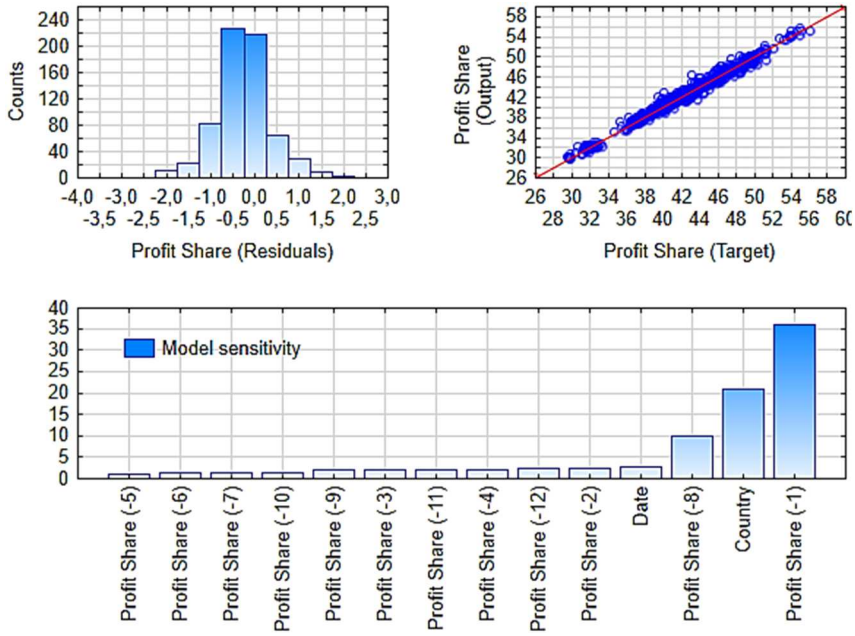

Figure 3. Selected statistics of the predictive model: distribution of model residuals, fit of observed and forecasted values, and model sensitivity to individual variables included in the model

Source: own elaboration based on Eurostat, Key indicators – quarterly data, 10.2908/nasq_10_ki, https://ec.europa.eu/eurostat/databrowser/view/NASQ_10_KI__custom_437550/bookmark/table?lang=en&bookmarkId=ea6dc89e-a154-41a1-9ae2-1a2f90aa02fe [09/04/2024].

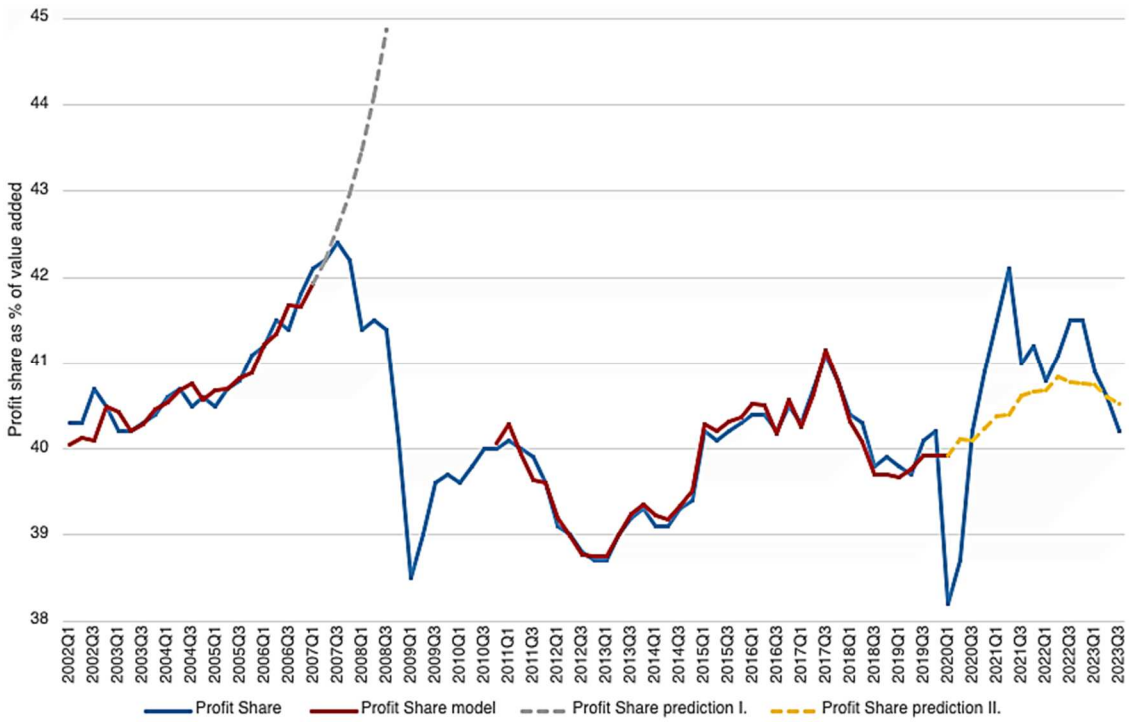

Figure 4. Profit share as % of value added for the Euro area and model fit and forecast for the Post-2020 period

Source: own elaboration based on Eurostat, Key indicators – quarterly data, 10.2908/nasq_10_ki, https://ec.europa.eu/eurostat/databrowser/view/NASQ_10_KI__custom_437550/bookmark/table?lang=en&bookmarkId=ea6dc89e-a154-41a1-9ae2-1a2f90aa02fe [09/04/2024].

As Figures 2-4 show, the predictive model was particularly sensitive to lags, especially around 8 quarters. Before the Global Financial Crisis, the model indicated a sharp increase in the profit share indicator, which then corrected during 2007-2010. This rapid forecast increase resulted from disruptions in the dynamics of the global economy and cyclically described indicators even before the downturn (Claessens *et al.*, 2011). These disruptions affected not only the profit share but also other cyclical indicators such as unemployment (Su *et al.*, 2021), interest rates (An *et al.*, 2020), and GDP (Altig *et al.*, 2020). However, the post-pandemic crisis was an external shock not caused by systemic financial problems. Therefore, the dynamics of the profit share indicator followed widely described cyclical patterns (Kiefer & Rada, 2015; Macallan *et al.*, 2008; Salas *et al.*, 2018) until the crisis occurred. Based on the maintained dynamics of the indicator in the Euro Area, the forecast trend for 2020-2023 shows that the initial shock led to a sharp decline (to nearly 38% in the first quarter of 2020), followed by a peak in 2021 (reaching over 42%). By 2023, the indicator appears to be returning to its predicted values in the Euro Area.

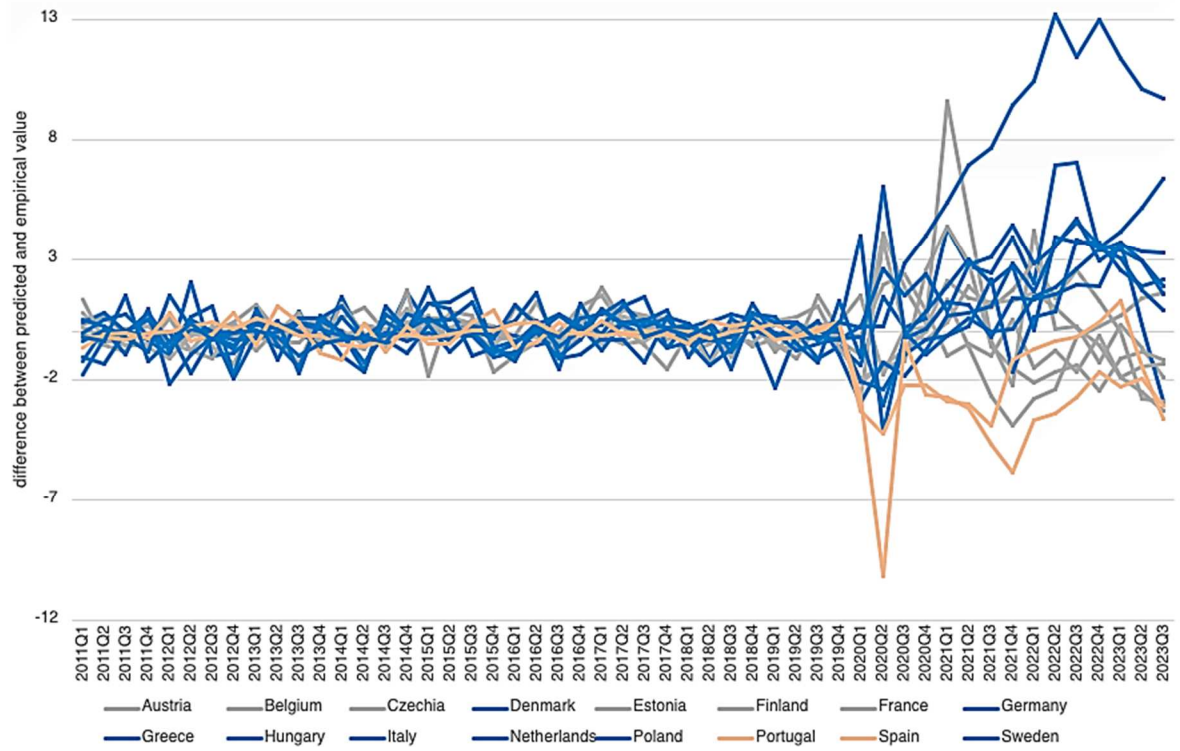

Figure 5. Differences between observed and forecasted values of the profit share indicator across countries

Notes: The Figure captures the aggregated deviations during the crisis period to illustrate divergence from modelled expectations rather than detailed national trends

Source: own elaboration based on Eurostat, Key indicators – quarterly data, 10.2908/nasq_10_ki, https://ec.europa.eu/eurostat/databrowser/view/NASQ_10_KI__custom_437550/bookmark/table?lang=en&bookmarkId=ea6dc89e-a154-41a1-9ae2-1a2f90aa02fe [09/04/2024].

The difference between the observed values of the profit share indicator and the model results (shown in Figure 5) indicated changes in the indicator's dynamics in individual countries after 2020. From 2011 to 2019, the fit error ranged between -2 and 2 percentage points. However, during the crisis period, these differences increased due to changes in historical dynamics in response to the economic shock. This change was not uniform across all countries. Consequently, WE grouped countries based on this difference using Ward's classification. Figure 6 shows these groups in monochrome, and the division into groups is detailed in Figures 7-9. This classification revealed three groups of countries with similar characteristics.

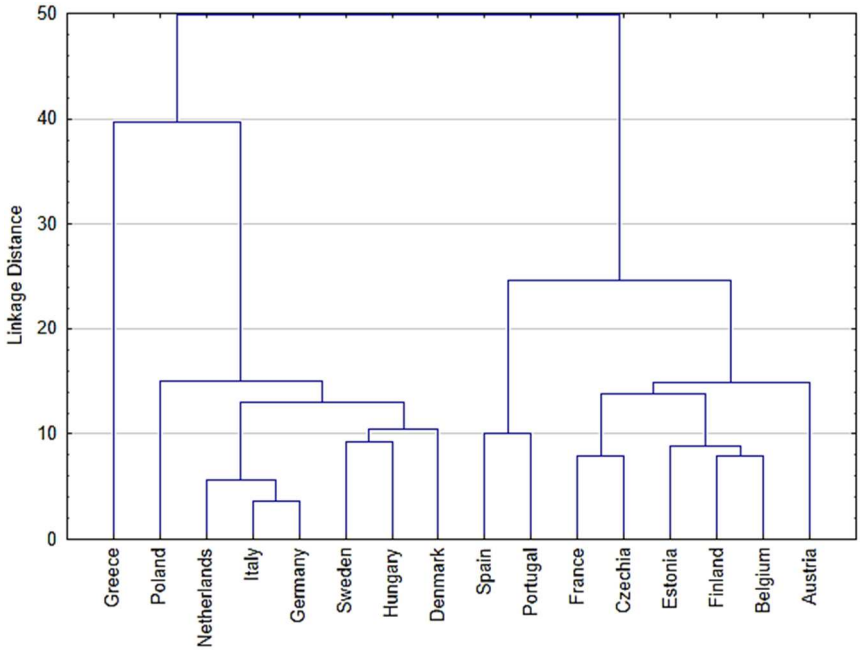

Figure 6. Classification of countries based on similar dynamics in the profit share indicator

Source: own elaboration based on Eurostat, Key indicators – quarterly data, 10.2908/nasq_10_ki, https://ec.europa.eu/eurostat/databrowser/view/NASQ_10_KI__custom_437550/bookmark/table?lang=en&bookmarkId=ea6dc89e-a154-41a1-9ae2-1a2f90aa02fe [09/04/2024].

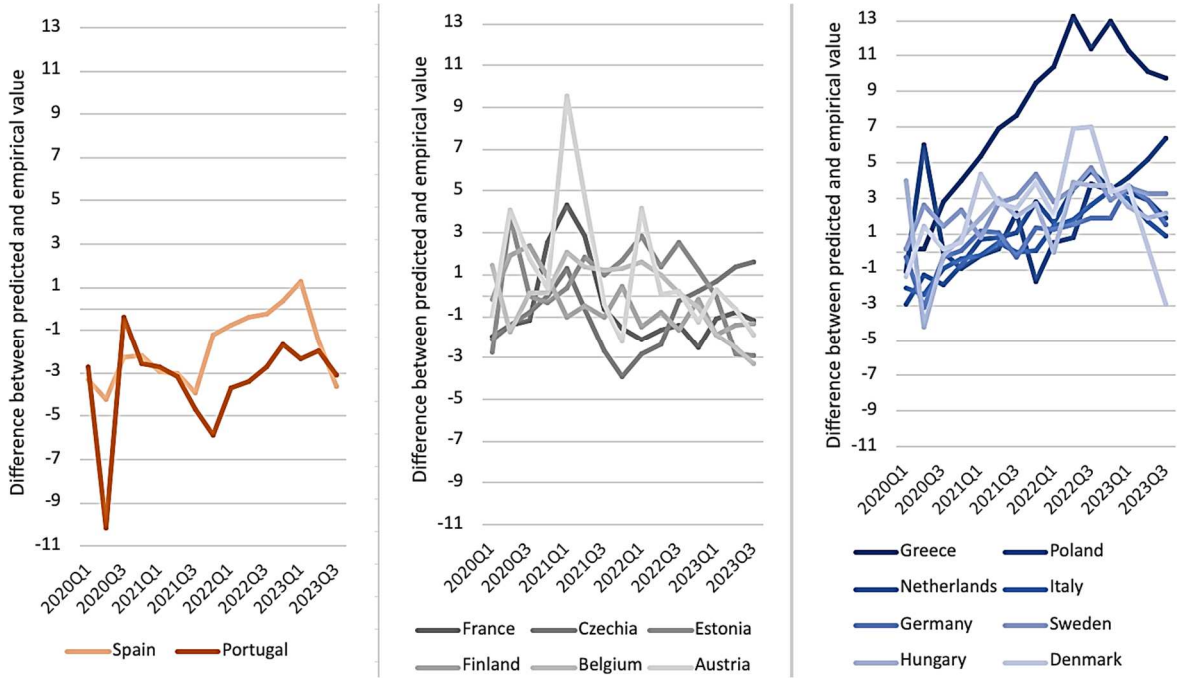

Figure 7-9. Classification of countries into clusters with similar responses in the profit share indicator after 2020, based on hierarchical clustering

Notes: The purpose of this figure is to visualise group-level behavioural patterns rather than individual country-specific trajectories.

Source: own elaboration based on Eurostat, Key indicators – quarterly data, 10.2908/nasq_10_ki, https://ec.europa.eu/eurostat/databrowser/view/NASQ_10_KI__custom_437550/bookmark/table?lang=en&bookmarkId=ea6dc89e-a154-41a1-9ae2-1a2f90aa02fe [09/04/2024].

Figures 7-9 present the three distinguished groups of countries, which highlight the following:

1. Spain and Portugal: These countries experienced a decline in the profit share indicator, particularly in the initial phase of the post-pandemic crisis.
2. France, Czechia, Estonia, Finland, Belgium, and Austria: In these countries, there was a sharp increase in the profit share indicator in the early phase of the crisis, followed by a return to the forecast pre-crisis dynamics.
3. Greece, Poland, the Netherlands, Italy, Germany, Sweden, Hungary, and Denmark: This largest group maintained elevated profit share values for the longest period compared to the forecast-values based on pre-crisis dynamics.

Thus, we may observe that the post-pandemic crisis led to changes in the dynamics of the profit share indicator across individual countries, resulting in an increase for most of them. Importantly, this increase brought the indicator to levels seen in 2000-2007, around 43%. The predictive model indicates that, by the end of 2023, the profit share values were expected to return to or fall below the forecast levels based on pre-crisis dynamics in most countries. This supports the view that the profit surge was a temporary feature of crisis adjustment rather than a structural realignment, although its magnitude raises questions about the underlying pricing behaviour in the recovery phase.

The method employed is based on autoregression, and as such, it carries inherent assumptions. It is recommended that future research expand on this by comparing the current model with alternative models that incorporate different indicators, to demonstrate that the findings regarding greedflation reflect a significant shift in corporate behaviour within selected groups. Within the scope of the profit share indicator used, the phenomenon under discussion appears to be present in certain countries, while the limitations of the chosen method have been outlined in the conclusion.

Various factors such as changes in labour costs (Bils *et al.*, 2018), variations in the quantity of goods produced (Collard-Wexler & De Loecker, 2015), additional advertising expenditures (Hall, 2012), or changes in material costs (Bils & Kahn, 2000) can influence changes in the profit share indicator, due to its cyclical nature. For instance, we may attribute the increase in the profit share observed during the COVID-19 pandemic and the war in Ukraine to the element of unit production costs, specifically the unit costs of materials, which include semi-finished goods and raw materials. If the unit cost of materials rises faster than the unit cost of labour, the ratio of unit price to unit labour cost increases, as does the profit share, while the profit margins imposed by companies remain constant. Another reason cited in analysing the profit share indicator is the increase in production due to the post-pandemic economic recovery, which saw a rise in production volumes. This increase in production volume spread the overall production costs over a larger number of units, thereby reducing unit costs and increasing the profit share of enterprises (Lavoie, 2023).

Although the introduction and literature review discussed the potential for 'greedflation,' the present empirical analysis did not incorporate direct inflation indicators or attempt to measure whether rising profit shares in these countries were correlated with inflated price mark-ups. Profit shares temporarily increased beyond their typical cyclical path in many nations, possibly reflecting both higher unit material costs and short-run pricing opportunities. Moreover, the patterns reported here support earlier studies emphasising the rebound in corporate profits following economic contractions (Colonna *et al.*, 2023; Glover *et al.*, 2023).

Overall, while the results confirm a cyclical return of the profit share indicator to near pre-crisis levels, the lack of direct inflation metrics in our empirical framework means that the question of whether certain companies exploited the crisis to 'overprice' goods remains open. Considering these findings, it is reasonable to interpret the sustained elevation in the profit share indicator in certain countries, particularly between 2021 and 2022, as consistent with macro-level manifestations of greedflation. This interpretation aligns with empirical evidence from Bivens (Bivens, 2022) and the IMF (Ari *et al.*, 2023), who attributed a significant share of post-pandemic inflation to rising corporate profits. Conversely, the more moderate or short-lived deviations observed in countries such as Spain and Portugal suggest that other factors, such as energy costs or labour market dynamics, may have played a more dominant role. These country-level differences underscore the importance of institutional settings, market structures, and sec-

toral concentration in shaping pricing behaviour during economic shocks. Overall, the observed patterns lend partial support to the hypothesis that profit-led inflation occurred in some cases, though a definitive attribution requires further sector-specific or price-based analysis.

CONCLUSIONS

The most frequently cited factors of inflation in the literature are government spending, supply chain disruptions, and government policies. The COVID-19 pandemic and the war in Ukraine created conditions in which companies could exploit the market by raising prices, leading to the phenomenon known as 'greedflation.' Greedflation describes a situation where companies increase the prices of goods and services to maximise profits, regardless of actual production costs.

WE analysed the potential occurrence of greedflation using the profit share indicator, which represents the gross profit share of non-financial enterprises in GDP. This indicator allows for the assessment of the non-financial sector's profitability within the entire economy, mitigating issues related to the diversity of industries and business scales. The study identified differences between the observed values of the profit share indicator during the crisis period and the forecast values, using an autoregressive neural network model. The analysis included data from 15 European countries. The results highlighted two main phenomena affecting the indicator:

1. Global Financial Crisis (GFC): The GFC imposed a correction on the rapidly increasing profit share indicator, reflecting disruptions in the indicator itself as well as other cyclical indicators such as unemployment, interest rates, and GDP.
2. Post-Pandemic Crisis: The dynamics of the Profit Share indicator before the post-pandemic crisis followed cyclical patterns. During the crisis period, there was a change in the observed dynamics, though this change was not consistent across all analysed countries.

The post-pandemic crisis altered the dynamics of the profit share indicator at the individual country level, resulting in an increase for most countries. This increase reached levels observed in the 2000-2007 period. The study identified three groups of countries with similar responses to the post-pandemic crisis:

1. Spain and Portugal: Experienced a decline in the profit share indicator in the initial phase of the crisis.
2. France, Czechia, Estonia, Finland, Belgium, and Austria: Saw a sharp increase in the indicator, followed by a return to pre-crisis values.
3. Greece, Poland, Italy, Germany, Sweden, Hungary, and Denmark: Maintained elevated profit share values for the longest period compared to the forecast values based on pre-crisis dynamics.

The predictive model indicates that by 2024, the profit share indicator will stabilise near or below the values originally forecasted based on pre-crisis trends, indicating that any post-pandemic surge may be temporary rather than a sustained pattern of greedflation. These observations are broadly consistent with prior research on cyclical profit behaviour following economic shocks, but they do not definitively link elevated profit share levels to corporate practices of inflating prices for higher margins.

Our contribution lies in introducing a macro-level, machine-learning-based approach to detect abnormal profit patterns across countries without relying on firm-level data. This offers a replicable method to monitor profit behaviour during crises. Limitations of this method include the absence of direct inflation or price mark-up data and sectoral variation.

Future studies could integrate inflation indicators and firm-level pricing to assess the link between profit growth and consumer prices. Policymakers should consider profit dynamics when diagnosing inflation and act where excessive price-setting persists. In turn, we encourage firms to align prices with costs to retain trust and competitiveness. Though indirect, the findings contribute to the ongoing debate on profit-led inflation in the post-pandemic global economy.

REFERENCES

Agustí, M., Vidal-Quadras Costa, I.V.-Q., & Altmeyer, P. (2022). Deep vector autoregression for macroeconomic data. *IFC Bulletins Chapters*, *59*. Retrieved from https://www.bis.org/ifc/publ/ifcb59_39.pdf on April 11, 2025.

Almosova, A., & Andresen, N. (2019). Nonlinear inflation forecasting with recurrent neural networks. *Journal of Forecasting*, *42*(2), 240-259.

Altig, D., Baker, S., Barrero, J.M., Bloom, N., Bunn, P., Chen, S., Davis, S.J., Leather, J., Meyer, B., Mihaylov, E., Mizen, P., Parker, N., Renault, T., Smietanka, P., & Thwaites, G. (2020). Economic uncertainty before and during the COVID-19 pandemic. *Journal of Public Economics*, *191*, 104274. https://doi.org/10.1016/j.jpubeco.2020.104274

An, S., Kovner, A., & Luck, S. (2020, August 10). *Implications of the COVID-19 Disruption for Corporate Leverage*. Retrieved from https://www.semanticscholar.org/paper/Implications-of-the-COVID-19-Disruption-for-An-Kovner/7e50de1aa6f0babae86ddbdf75a1b8530a5fbac7?utm_source=consensus on May 28, 2024.

Andre, P., Haaland, I., Roth, C., & Wohlfart, J. (2023). Narratives About the Macroeconomy. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4506321

Ari, A., Mulas-Granados, C., Mylonas, V., Ratnovski, L., & Zhao, W. (2023). One Hundred Inflation Shocks: Seven Stylized Facts. *IMF Working Paper*, *2023*. https://doi.org/10.2139/ssrn.4574442

Aydin, A.D., & Cavdar, S.C. (2015). Comparison of Prediction Performances of Artificial Neural Network (ANN) and Vector Autoregressive (VAR) Models by Using the Macroeconomic Variables of Gold Prices, Borsa Istanbul (BIST) 100 Index and US Dollar-Turkish Lira (USD/TRY) Exchange Rates. *Procedia Economics and Finance*, *30*, 3-14. https://doi.org/10.1016/S2212-5671(15)01249-6

Beibit, R., Fatahi Valilai, O., & Wicaksono, H. (2023). Estimating the COVID-19 Impact on the Semiconductor Shortage in the European Automotive Industry using Supervised Machine Learning. *Proceedings of the 2023 10th International Conference on Industrial Engineering and Applications*, 302-308. https://doi.org/10.1145/3587889.3588215

Bello, S., Neill, R., Jegede, A.S., Bamgboye, E.A., Salawu, M.M., Afolabi, R.F., Nzelu, C., Azodo, N., Adoghe, A., Ogunlayi, M., Yaradua, S.U., Wang, W., Liu, A., & Fawole, O.I. (2024). Health systems challenges, mitigation strategies and adaptations to maintain essential health services during the COVID-19 pandemic: Learnings from the six geopolitical regions in Nigeria. *BMC Health Services Research*, *24*, 625. https://doi.org/10.1186/s12913-024-11072-2

Benigno, P., Canofari, P., & Messori, M. (2021). *The ECB's Measures in Support of the COVID-19 Crisis*. Retrieved from https://iris.luiss.it/handle/11385/212563 on May 28, 2024.

Bhuiyan, M.A., Crovella, T., Paiano, A., & Alves, H. (2021). A Review of Research on Tourism Industry, Economic Crisis and Mitigation Process of the Loss: Analysis on Pre, During and Post Pandemic Situation. *Sustainability*, *13*(18), Article 18. https://doi.org/10.3390/su131810314

Bilbiie, F., & Känzig, D. (2023). *DP18385 Greed? Profits, Inflation, and Aggregate Demand*. CEPR. Retrieved from https://cepr.org/publications/dp18385 on May 28, 2024.

Bils, M., & Kahn, J.A. (2000). What Inventory Behavior Tells Us about Business Cycles. *The American Economic Review*, *90*(3), 458-481.

Bils, M., Klenow, P.J., & Malin, B.A. (2018). Resurrecting the Role of the Product Market Wedge in Recessions. *American Economic Review*, *108*(4-5), 1118-1146. https://doi.org/10.1257/aer.20151260

Bivens, J. (2022). Corporate profits have contributed disproportionately to inflation. How should policymakers respond?. *Economic Policy Institute*. Retrieved from https://www.epi.org/blog/corporate-profits-have-contributed-disproportionately-to-inflation-how-should-policymakers-respond/ on May 28, 2024.

Born, B., Enders, Z., Menkhoff, M., Muller, G., & Niemann, K. (2022). Firm Expectations and News: Micro v Macro. *CEPR Discussion Papers*, Article 17768. Retrieved from https://ideas.repec.org//p/cpr/ceprdp/17768.html on May 28, 2024.

Brown, B., & Simonnot, P. (2020). Epilogue: From Pandemic to High Inflation. In B. Brown & P. Simonnot (Eds.), *Europe's Century of Crises Under Dollar Hegemony: A Dialogue on the Global Tyranny of Unsound Money* (pp. 185-201). Springer International Publishing. https://doi.org/10.1007/978-3-030-46653-4_23

Caldara, D., Conlisk, S., Iacoviello, M., & Penn, M. (2022). *The Effect of the War in Ukraine on Global Activity and Inflation*. Retrieved from https://www.federalreserve.gov/econres/notes/feds-notes/the-effect-of-the-war-in-ukraine-on-global-activity-and-inflation-20220527.html on May 28, 2024.

Canuto, O. (2022). *War in Ukraine and Risks of Stagflation*. Retrieved from https://www.policycenter.ma/sites/default/files/2022-03/PB_18-22_Canuto_0.pdf, on May 28, 2024.

Capelle, D., & Liu, Y. (2023). Optimal Taxation of Inflation. *IMF Working Papers*, *2023*(254). https://doi.org/10.5089/9798400261169.001.A001

Carstens, A. (2022). *The return of inflation*. Retrieved from https://www.bis.org/speeches/sp220405.htm on May 28, 2024.

Cavallo, A. (2021). Inflation dynamics during COVID-19. *NBER Reporter*, *3*, 8-11. Retrieved from https://www.nber.org/reporter/2021number3/inflation-dynamics-during-covid-19 on May 28, 2024.

Chen, J.M. (2020). *Economic Forecasting With Autoregressive Methods and Neural Networks* (SSRN Scholarly Paper 3521532). https://doi.org/10.2139/ssrn.3521532

Chen, Y., Jiang, J., Wang, L., & Wang, R. (2023). Impact assessment of energy sanctions in geo-conflict: Russian–Ukrainian war. *Energy Reports*, *9*, 3082-3095. https://doi.org/10.1016/j.egyr.2023.01.124

Ciotti, M., Ciccozzi, M., Terrinoni, A., Jiang, W.-C., Wang, C.-B., & Bernardini, S. (2020). The COVID-19 pandemic. *Critical Reviews in Clinical Laboratory Sciences*, *57*(6), 365-388. https://doi.org/10.1080/10408363.2020.1783198

Claessens, S., Kose, M.A., & Terrones, M.E. (2011). Financial Cycles: What? How? When?. *NBER International Seminar on Macroeconomics*, *7*(1), 303-344. https://doi.org/10.1086/658308

Claeys, G. (2020). *The European Central Bank in the COVID-19 crisis: Whatever it takes, within its mandate* (Research Report 2020/09). Bruegel Policy Contribution. Retrieved from https://www.econstor.eu/handle/10419/237645 on May 28, 2024.

Clarida, P.B.-F., Richard. (2023). *Fiscal Arithmetic and the Global Inflation Outlook*. Pacific Investment Management Company LLC. Retrieved from https://www.pimco.com/en-us/insights/viewpoints/fiscal-arithmetic-and-the-global-inflation-outlook on May 28, 2024.

Collard-Wexler, A., & De Loecker, J. (2015). Reallocation and Technology: Evidence from the US Steel Industry. *The American Economic Review*, *105*(1), 131-171.

Colonna, F., Torrini, R., & Viviano, E. (2023). The Profit Share and Firm Markup: How to Interpret Them?. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4464310

Craven, M., Liu, L., Mysore, M., & Wilson, M. (2020). *COVID-19: Implications for business*. Retrieved from https://www.mckinsey.com/capabilities/risk-and-resilience/our-insights/covid-19-implications-for-business on May 28, 2024.

Falat, L., Stanikova, Z., Durisova, M., Holkova, B., & Potkanova, T. (2015). Application of Neural Network Models in Modelling Economic Time Series with Non-constant Volatility. *Procedia Economics and Finance*, *34*, 600-607. https://doi.org/10.1016/S2212-5671(15)01674-3

Firlej, C., Luty, L., Firlej, K., & Zuzek, D. (2024). Assessment of the financial situation of selected companies of the Polish sugar industry 2016-2022. *Scientific Papers of Silesian University of Technology Organization and Management Series*, *2024*, 121-140. https://doi.org/10.29119/1641-3466.2024.195.7

Gachunga, M.J., & Kuso, Y. (2018). The Impact of External Debt on Economic Growth in Sub-Saharan Africa. *Academic Journal of Economic Studies*. Retrieved from https://www.semanticscholar.org/paper/The-Impact-of-External-Debt-on-Economic-Growth-in-Gachunga-Kuso/dae18a1499bd715e794da72514143af023e7c5af on May 28, 2024.

Garcia-Murillo, M., MacInnes, I., & Bauer, J.M. (2018). Techno-unemployment: A framework for assessing the effects of information and communication technologies on work. *Telematics and Informatics*, *35*(7), 1863-1876. https://doi.org/10.1016/j.tele.2018.05.013

Głodowska, A., Maciejewski, M., & Wach, K. (2023). Navigating the digital landscape: A conceptual framework for understanding digital entrepreneurship and business transformation. *International Entrepreneurship Review*, *9*, 7-20. https://doi.org/10.15678/IER.2023.0904.01

Glover, A., Mustre-del-Río, J., & Nichols, J. (2023). *Corporate Profits Contributed a Lot to Inflation in 2021 but Little in 2022*. Retrieved from https://www.kansascityfed.org/research/economic-bulletin/corporate-profits-contributed-a-lot-to-inflation-in-2021-but-little-in-2022/ on May 5, 2024.

Goldthau, A., & Tagliapietra, S. (2022). Energy crisis: Five questions that must be answered in 2023. *Nature*, *612*(7941), 627-630. https://doi.org/10.1038/d41586-022-04467-w

Hall, R.E. (2012). The Cyclical Response of Advertising Refutes Counter-Cyclical Profit Margins in Favor of Product-Market Frictions. *NBER Working Papers*, Article 18370. Retrieved from https://ideas.repec.org//p/nbr/nberwo/18370.html on May 5, 2024.

Hasenzagl, T., & Pérez, L. (2023). *The Micro–Aggregated Profit Share*. Retrieved from https://luiscanyamel.github.io/website_materials/JMP_LuisPerez.pdf. on May 5, 2024.

Hilmola, O.-P., Lähdeaho, O., Henttu, V., & Hilletofth, P. (2020). Covid-19 Pandemic: Early Implications for North European Manufacturing and Logistics. *Sustainability*, *12*(20), Article 20. https://doi.org/10.3390/su12208315

Juergensen, J., Guimón, J., & Narula, R. (2020). European SMEs amidst the COVID-19 crisis: Assessing impact and policy responses. *Journal of Industrial and Business Economics*, *47*(3), 499-510. https://doi.org/10.1007/s40812-020-00169-4

Kedward, K., Gabor, D., & Ryan-Collins, J. (2024). Carrots with(out) sticks: Credit policy and the limits of green central banking. *Review of International Political Economy*, *0*(0), 1-25. https://doi.org/10.1080/09692290.2024.2351838

Kiefer, D., & Rada, C. (2015). Profit maximising goes global: The race to the bottom. *Cambridge Journal of Economics*, *39*(5), 1333-1350.

Klimecka-Tatar, D., & Ulewicz, R. (2021). Changes in Production Efficiency During the COVID-19 Pandemic. *Multidisciplinary Aspects of Production Engineering*, *4*, 255-265. https://doi.org/10.2478/mape-2021-0023

Lagodiienko, V., Bogdanov, O., & Lagodiienko, V. (2019). Place and role of Ukraine in the world wheat market. *Ukrainian Journal of Applied Economics*, *4*(3), 297-308. https://doi.org/10.36887/2415-8453-2019-3-33

Lavoie, M. (2023). Profit Inflation and Markups Once Again. *Institute of New Economic Thinking*, *15*. Retrieved from https://www.ineteconomics.org/uploads/papers/Marc-Lavoie-Profit-Inflation-and-Markups-Once-Again.pdf on May 5, 2024.

Lowe, P. (2022). *Inflation and Monetary Policy*. Retrieved from https://www.bis.org/review/r220621m.pdf on May 5, 2024.

Macallan, C., Millard, S., & Parker, M.I. (2008). The Cyclicality of Mark-Ups and Profit Margins for the United Kingdom: Some New Evidence. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1280900

Mierzejewski, M., & Tomala, J. (2024). The evolution of profit margins in the energy sector in selected EU countries. *ASEJ Scientific Journal of Bielsko-Biala School of Finance and Law*, *28*, 89-95. https://doi.org/10.19192/wsfip.sj1.2024.12

Mohammed, A., & Khan, S.A. (2022, September 30). *Global Disruption of Semiconductor Supply Chains During COVID-19: An Evaluation of Leading Causal Factors*. ASME 2022 17th International Manufacturing Science and Engineering Conference. https://doi.org/10.1115/MSEC2022-85306

Munteanu, P., & David, G. (2023). The Energy Crisis and Its Real Impact on the Inflation Rate. *Proceedings of the International Conference on Business Excellence*, *17*, 48-61. https://doi.org/10.2478/picbe-2023-0007

Nariswari, T.N., & Nugraha, N.M. (2020). Profit Growth: Impact of Net Profit Margin, Gross Profit Margin and Total Assests Turnover. *International Journal of Finance & Banking Studies (2147-4486)*, *9*(4), Article 4. https://doi.org/10.20525/ijfbs.v9i4.937

Nikiforov, P., Greshko, R., Marych, M., Marusiak, N., Kharabara, V., & Gladchuk, O. (2023). Mutual Influence Of Fiscal And Monetary Policy In The Context Of Ensuring Macro-Financial Stability Of The State. *Management Theory and Studies for Rural Business and Infrastructure Development*, *44*(4), 435-442. https://doi.org/10.15544/mts.2022.43

Oche, E. (2021). Entrepreneurship And Covid-19: Challenges And Opportunities. *Academia Letters*. https://doi.org/10.20935/AL1141

OECD. (2021). *Forecasting developing Asian economies during normal times and large external shocks: Approaches and challenges* (OECD Development Centre Working Papers 345; OECD Development Centre Working Papers, Vol. 345). https://doi.org/10.1787/5a1c4c48-en

Ozili, P.K., & Ozen, E. (2023). Global Energy Crisis. In *The Impact of Climate Change and Sustainability Standards on the Insurance Market* (pp. 439-454). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781394167944.ch29

Reis, R. (2020). The People versus the Markets: A Parsimonious Model of Inflation Expectations. *Discussion Papers*, Article 2033. Retrieved from https://ideas.repec.org//p/cfm/wpaper/2033.html on May 5, 2024.

Salas, V., Juan, L.S., & Vallés, J. (2018). Corporate cost and profit shares in the euro area and the US: The same story?. *Working Papers*, Article 1833. Retrieved from https://ideas.repec.org//p/bde/wpaper/1833.html on May 5, 2024.

Santacreu, A.M., & LaBelle, J. (2022). Supply Chain Disruptions and Inflation During COVID-19. *Economic Synopses*, *2022*(11). https://doi.org/10.20955/es.2022.11

Scott, R.H., & Pressman, S. (2015). Inadequate Household Deleveraging: Income, Debt, and Social Provisioning. *Journal of Economic Issues*, *49*(2), 483-492. https://doi.org/10.1080/00213624.2015.1042794

Semenenko, O., Tolok, P., Onofriichuk, A., Onofriichuk, V., & Chernyshova, I. (2023). Improving Ukrainian grain export supply chains: An inclusive approach. *International Journal of Environmental Studies*, *80*(2), 314-323. https://doi.org/10.1080/00207233.2023.2177426

Su, C.-W., Dai, K., & Andlib, Z. (2021). COVID-19 pandemic and unemployment dynamics in European economies. *Economic Research-Ekonomska Istraživanja*, *35*, 1-13. https://doi.org/10.1080/1331677X.2021.1912627

Tougeron, K., & Hance, T. (2021). Impact of the COVID-19 pandemic on apple orchards in Europe. *Agricultural Systems*, *190*, 103097. https://doi.org/10.1016/j.agsy.2021.103097

Vinod, H.D. (2022). *Greedflation from Causal Paths between Profits and Inflation* (SSRN Scholarly Paper 4134413). https://doi.org/10.2139/ssrn.4134413

Zakeri, B., Paulavets, K., Barreto-Gomez, L., Echeverri, L.G., Pachauri, S., Boza-Kiss, B., Zimm, C., Rogelj, J., Creutzig, F., Ürge-Vorsatz, D., Victor, D., Bazilian, M., Fritz, S., Gielen, D., McCollum, D., Srivastava, L., Hunt, J., & Pouya, S. (2022). Pandemic, War, and Global Energy Transitions. *Energies*. https://doi.org/10.3390/en15176114

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Artificial intelligence negotiation algorithms: Pioneering artificial intelligence negotiation algorithms for business

Anna Odrobina, Wojciech Polan, Jowita Świerczyńska

ABSTRACT

Objective: The article aims to demonstrate AI's role in supporting negotiation preparations, especially in defending the starting position.

Research Design & Methods: In the article, we applied a descriptive analysis, with a prior review of literature sources, comparison, and deduction. We based the development of the artificial intelligence negotiation algorithms (AINA) on a heuristic-synthetic method.

Findings: We propose an algorithm for defending the starting position that not only structures the negotiation process but also provides practical semantic tools to effectively defend the offer and build long-term relationships with customers.

Implications & Recommendations: The AINA algorithm not only offers an effective tool for present negotiators but also provides the foundation for further identification and development of advanced negotiation algorithms. The considerations presented aimed at providing business practitioners with insights into the integration of AI into negotiation strategies and starting a dialogue on the unification of such algorithms in future AI models that will be capable of conducting complex negotiations.

Contribution & Value Added: The presented algorithm for defending the starting negotiation position, which combines the F-A-B technique (Feature-Advantage-Benefit) with the straight line persuasion (SLP) model, represents a novel conceptualisation of defensive logic in negotiations. It focuses on resisting premature concessions while maintaining constructive dialogue. This synthesis constitutes a significant added value and an attempt to address an existing research gap.

Article type:	research article
Keywords:	negotiation process; artificial intelligence; negotiation algorithms; AI-driven business models; AINA
JEL codes:	M21, O33

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INTRODUCTION

Artificial intelligence (AI) is emerging as the most disruptive technology of the twenty-first century, very likely to affect the functioning of individuals, societies, and the global economy, including companies of all sizes: from tech giants developing AI tools for business, through large, small and medium-sized corporations and enterprises to which AI offers opportunities to change their business models using AI, to AI-based start-ups (Weber, 2022). In particular, the emergence of ChatGPT has sparked various discussions about the importance of AI, capable of revolutionising the functioning of many areas (Kanbach *et al.,* 2024; Chuma *et al.,* 2023; Haefner *et al.*, 2023). In the economic sphere, observing the success of companies using AI gives rise to the emergence of new business models based on AI to varying degrees, whereas key questions are those about how to use AI to build and change the architecture of an enterprise with a view to creating, delivering, and capturing

value (Fruhwirth *et al.*, 2020; Jorzik *et al*., 2024). The potential of AI in business processes seems to be huge; one may say that it is still poorly discovered, non-systematised, but continuously tested by enterprises. Nevertheless, the vast majority of companies, as many as 80%, indicate that in the near future AI will enable the maintenance and improvement of competitive advantage (Lee *et al*., 2019), and over 70% of managers indicate that AI will create opportunities for innovative business models with great value creation potential (PwC, 2024; Mariani *et al.,* 2023).

At present, the body of studies on the application of AI in business activities is growing, but no scholars have yet comprehensively addressed the use of negotiation algorithms. In this article, we focused on the issue of using the potential of AI in the negotiation process to defend the starting position, part of the business processes of any company. The article aims to demonstrate AI's role in supporting negotiation preparations, especially in defending the starting position. Therefore, the main research question addressed in this article is: How can artificial intelligence support the creation, structuring, and testing of negotiation algorithms focused on defending the starting position in business negotiations? Rather than attempting to cover all AI-based negotiation tools and platforms, the article focuses on a specific, original algorithm (AINA), designed to delay concessions through structured semantic defence, and examines its functionality in simulated negotiation settings. The structure of the article includes a theoretical part, discussing the current state of application of AI in business activities, identifying the role of negotiation algorithms, with particular emphasis on the negotiation preparation phase, as well as indicating the advantages and disadvantages of automation of the negotiation process, and an empirical part, presenting in detail an innovative negotiation – the algorithm for defending the starting position. It is followed by conclusions from the studies conducted.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Artificial intelligence enables computers and machines to simulate human intelligence and problem-solving abilities. Alone or in combination with other technologies such as sensors, geopositioning, robotics, AI can perform tasks that would otherwise require human intelligence or intervention. As a field of computer science, artificial intelligence comprises machine learning, including deep learning, based on the development of algorithms modelled on decision-making processes in the human brain which, through the use of neural networks, can 'learn' from available data and make increasingly accurate classifications or predictions (John *et al.,* 2023; IBM, 2024).

The emergence of artificial intelligence in modern business is a force changing entire industries and creating new paradigms of the operation and competition of enterprises (Lee, 2019). Global business is dynamically discovering the potential of using AI to build effective competitive advantages and to search for new dimensions of efficiency and new opportunities (Bharadiya, 2023). Consequently, a quickly increasing number of enterprises engage AI in business processes in the hope of building an innovative business model leading to business success (Mishra *et al*., 2021; Weber, 2022).

The rapid penetration of digital technologies has contributed significantly to the growth of the global artificial intelligence market over the past few years. Large investments of technology giants, such as Google, Microsoft, IBM, Amazon, Meta and Apple, in R&D on AI are constantly driving technological progress in various industries. The development of AI is also stimulated by the growing demand for new AI solutions from sectors such as the automotive industry, healthcare, banking and finance, manufacturing, food and beverage service activities, logistics and retail. In 2022, the global AI market was worth USD 454.1 billion; in 2023, it was already USD 538.1 billion, up by 18.5%; this is the compound annual growth rate expected in the market for the next ten years (Figure 1). According to forecasts of Precedence Research (2024), in 2032, the value of the AI market will reach USD 2.6 trillion, an almost five-fold increase over the decade of 2023-2032.

Artificial intelligence affects businesses (Bertoni *et al*., 2022), entire ecosystems (Burström *et al.,* 2021), and industries (Marinakis *et al.,* 2021). People use AI in business to implement automation processes (Qvist-Sørensen, 2020). In this process, the key technology is generative AI (Kanbach *et al.,* 2024), learning to generate statistically probable outputs on the basis of raw data when prompted. Generative models encode a simplified representation of training data and draw on it to create a new

work that is similar to but not identical with the original data (John *et al*., 2023). The development of deep learning has resulted in the extension of the downloaded data to images, speech, music, and other complex data types, which in turn has accelerated the use of AI in business and enabled highly accurate and efficient automation in an ever wider range of business-critical cases (Mishra *et al*., 2021). Generative AI is crucial for business because it allows a kind of automation of creativity, offering a variety of applications in all areas of the value chain (Haefner & Gassmann, 2023). Increasingly better neural networks are projected to improve the quality and diversity of generated content, which also directs AI towards more creative collaboration with people rather than replacing them. As predicted by IBM (2024), in the near future, the computing power of such basic generative models will be made available to companies in a hybrid cloud environment.

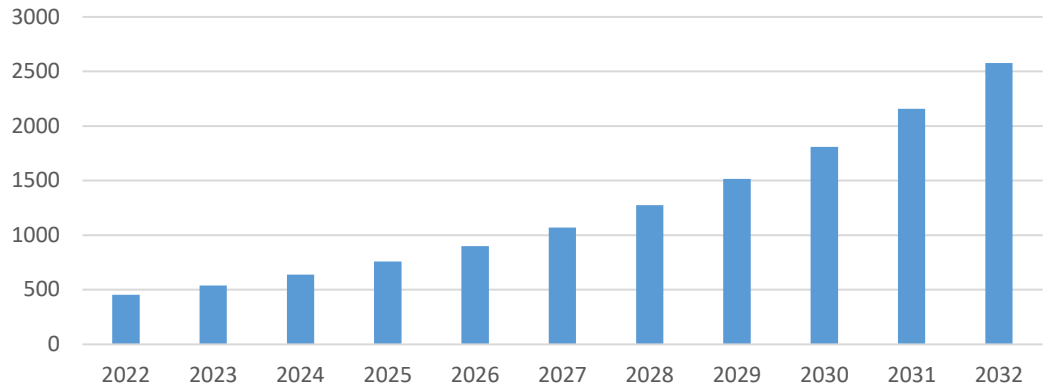

Figure 1. AI market (USD billion)
Source: Precedence Research (2024).

Generative AI aims to transform business models by creating and capturing value in different ways to increase efficiency and reduce costs. Noteworthy, generative AI can serve within existing business models or lead to their adaptation or even radical transformation. The idea is to obtain the effect of innovation from existing business models and create completely new ones (Haefner *et al.,* 2023; Weber, 2022). In the creative industries, AI is accelerating the creation of content for artists and designers. With AI, enterprises create new products and personalised services (Wan *et al.,* 2020). Scholars note that AI allows enterprises to be customer-centric, transforming significantly traditional business strategies (Farayola *et al*., 2023; Nielsen, 2023; Bharadiya, 2023). In e-commerce, AI algorithms personalise product suggestions and even design custom items. Companies can also use AI-generated content for marketing and customer service, saving time, and resources while remaining innovative. Amazon and Meta are best known for integrating AI into advertising their products. This will further accelerate the famous flywheel of platform business models (Haefner *et al.,* 2023; Katsamakas & Pavlov, 2020). Basically, any company can experiment with AI, intending to enhance communication with customers on digital channels, improve customer retention, develop tender offers and manage customer complaints. One area of AI use is the decision-making process based on the analysis of large historical data sets, where AI can optimise the process of making the right and reliable decisions (Battisti *et al.,* 2022; Bharadiya, 2023).

Noteworthy, the use of AI to generate value in an enterprise is a complex, time-consuming, and capital-intensive process which must take place through the systematic implementation of AI tools at every level and every stage of the operation of the business concerned (Fruhwirth *et al*., 2020; Katsamakas *et al*., 2020). The production systems, the interaction of personnel with machines, as well as the interaction of the company with customers, must be completely redesigned, which entails enormous investments but also a huge risk of failure (Rana *et al*., 2022). However, it is essential for successful business process redevelopment and the use of big data for decision-making at the company (John *et al*., 2023; Bharadiya, 2023). Thus, artificial intelligence leads to the emergence of new AI-powered business models (Davenport & Mittal*,* 2022; Widayanti *&* Meria, 2023). To fully exploit the potential of AI in business, it is necessary to gradually implement AI-based solutions, testing their economic utility for a given enterprise and looking for high profitability of the business (Lee 2019). The discourse on AI in business is also taking

place in relation to the need for a kind of balance in the process of integrating AI into the business processes of the enterprise to achieve synergy between the potential of AI and personnel in pursuit of innovative business development, but under the conditions of preserving the ethical practices of AI (Farayola *et al.,* 2023). As noted by Jorzik *et al.* (2024), many studies focus on the technical and organisational challenges associated with the implementation, use, and management of AI. It allows the identification of organisational challenges related to the problem of building an effective business model of the enterprise, thus leading to increased efficiency at the company.

Negotiation is an innate human skill (Martin-Raugh *et al.,* 2019) and an integral part of business life. Most often, the reason for undertaking negotiations in business activity is to establish cooperation with a new counterparty or to continue or improve the effectiveness of cooperation with the current business partner. In general, it is a process of interaction in which at least two parties, who see the need for a common commitment to achieve a goal, but who initially differ in expectations, attempt to overcome their differences by argument and persuasion and to find a mutually satisfactory solution (Fowler, 1996). In relation to business activities, we may define it as a communication process that aims at an agreement between the participants in economic transactions that is satisfactory to each partner when there is a situation of at least partial divergence of interests between the parties (Fisher & Ury*,* 2011). It is also a process of cooperation rather than a struggle for domination (Prościak, 2024). According to Nierenberg (1987) points out, three elements determine the success of negotiations: (1) the possibility of negotiating in a specific case; (2) agreeing to mutual concessions and compromises; and (3) the trust of the parties. Therefore, a negotiation is a process where the counterparties move away from their initially divergent positions and towards a point where they can reach an agreement (Steele *et al.,* 1995). The negotiation process is undoubtedly complex and complicated (Casse, 1992), it has its dynamics and structure (Fighter, 2007). It consists of several phases, which, in turn, consist of successive specific actions. The concept of negotiation as a process is not only about highlighting its holistic character, but also about drawing attention to its dynamic nature and to the sequence and repetition of specific actions.

The literature describes AI as a tool to support negotiators, especially in the preparation stage of the process. However, the prevailing view is that the negotiation process itself, due to the aforementioned complexity and multifaceted nature, is unlikely to be entrusted to AI. According to some researchers, AI does not replace the negotiator, but it is an effective tool supporting repetitive activities. It allows for properly organising, reading, and drawing practical conclusions in all activities undertaken in the preliminary phase, *i.e.*, the preparation of negotiations (Cummins & Jensen, 2024). Noteworthy, AI performs very well in tasks that have clear rules but complex processes (Liu *et al.,* 2020; Mohammad *et al*., 2019). Thanks to the use of AI, the negotiator can quickly deal with the most laborious, 'mechanical' part of the preparatory phase, thus leaving more time to refine issues that require creative thinking, rational analysis, drawing conclusions and making decisions in fields such as selecting the goal, strategy or negotiation techniques. The analysis of data concerning the negotiation partner allows for choosing more personalised and therefore optimally adapted solutions, thus increasing the chances of success in any negotiation (Fasihullah *et al*., 2023). It also allows one to avoid human error in the form of oversight or failure to identify relevant information, *e.g.*, about the negotiation partner. Moreover, AI can forecast the outcome of talks based on the analysis of previous negotiation processes, which can also result in better preparation for a given negotiation process. Thanks to the right algorithms, AI can compile more data than a human in a given time frame, and it does so with greater precision and accuracy (Schulze-Horn *et al.,* 2020). Thus, broad and predictive data analysis performed in a short period allows one to anticipate potential problems and to focus on higher-value tasks, such as capturing meaningful insights and making informed decisions about optimising negotiation strategies and tactics. Obviously, the quality of the information on the basis of which the analysis is carried out is an undeniable factor; for negotiation algorithms to be effective, it is necessary to ensure the high quality of the data provided and lower costs (Cummins & Jensen, 2024; Agua *et al*., 2024). One should also prioritise security issues, especially in terms of protecting sensitive information about negotiation partners (Fasihullah *et al*., 2023).

We, for one, like a growing group of researchers and practitioners (Schulze-Horn *et al.,* 2020; Eidenmüller, 2025), are convinced that AI can effectively serve as a negotiation tool, and therefore, we

are attempting to create such a tool in the form of AINA, an algorithm for defending a starting position. We decided to verify the following hypotheses:

H1: The use of a structured semantic defence algorithm (combining the F-A-B technique and straight line persuasion model) increases the number of objection-handling iterations before a concession is offered, compared to traditional, unstructured negotiation responses.

H2: The AI (i.a., ChatGPT-4o) models, when supported by a structured negotiation algorithm (AINA), can effectively manage preliminary phases of business negotiations, thus streamlining the initial part of the negotiation process.

Based on the above considerations, we conducted an empirical study verifying the above hypothesis in the later stages of the work.

RESEARCH METHODOLOGY

In any negotiation, successfully arguing and defending one's starting position can determine success or failure. In a dynamic and competitive environment, the ability to convince the other party to accept one's arguments, while understanding their needs and objections, is invaluable. In response to those challenges, we developed an algorithm for defending the starting position, combining F-A-B (Feature-Advantage-Benefit) techniques and the straight line persuasion (SLP) model created by Jordan Belfort (2017). This algorithm not only structures the negotiation process, but it also provides practical semantic tools to effectively defend the offer and build long-term relationships with customers.

We developed the AINA algorithm based on a heuristic-synthetic method (Popper, 2014; Rescher, 2019), with the use of a heuristic thought experiment (in the sense defined by Brożek & Jadacki, 2012), in which the authors combined several established negotiation techniques during a real-time negotiation process. The algorithm emerged as a heuristic insight that unified practical tools into a coherent and programmable decision-making path. The algorithmic structure was not derived from existing AI systems but constructed through a process of conceptual synthesis, triggered during simulations. This process aligns with what the philosophy of science recognises as a heuristic thought experiment – a non-formalised but intellectually rigorous method of modelling a potential solution by recombining known elements of practice into a novel, testable structure.

The F-A-B model, also known as the Feature-Advantage-Benefit model, is a technique used in negotiations that helps to effectively argue and defend one's offer using appropriate semantic techniques (Kawszyn & Szaran*,* 2013). Feature (F) is an objective aspect of the product or service (*e.g.*, technical specifications, method of execution). Advantage (A) shows how the feature translates into customer benefits (*e.g.*, improved quality, efficiency). Benefit (B) highlights the final value for the customer (*e.g.*, higher profits, time savings, greater comfort). In the context of negotiations, the F-A-B model helps defend the starting position by presenting the offer in a way that focuses not only on the features but above all on the specific benefits for the customer. Therefore, the negotiator can maintain a strong position, emphasising how the solution offered meets or exceeds the expectations of the other party. The phase in which the customer raises objections is the step before finalising the transaction or closing the negotiation phase. Efforts must then be made to reach an agreement, instead of falling into an argument with the customer or suggesting that they are wrong. To apply the F-A-B technique, one can conduct preparatory actions in the following two areas:

1. arguments – a table of at least three F-A-B arguments should be prepared,
2. argumentative sentences – argumentative sentences based on five defence techniques should be presented (Table 1).

The straight line persuasion (SLP) is a system based on the concept that the selling process should be as quick and direct as possible, guiding the customer from the moment of first contact to the closing of the transaction along a straight line (Belfort, 2017). In other words, the point is to respond so skilfully to the customer's objections to always 'nudge' them back towards that straight line from opening to closing the deal. According to Belfort, the most important precursor to one's success is their acquired ability to root out and dispose of disempowering beliefs rather than their inborn talent. One of his suggestions

was to defend one's offer at least three times against customer objections before one starts making any concessions. This is important because there is a chance that the next time one tries to defend the price, one will get their consent to the terms and conditions offered without making concessions.

Table 1. Price defence techniques (PDT)

Name of the price defence technique	Semantic structure
Aikido	Block 1. Yes, it is correct, you are right, the price is not the lowest, and that is why… Block 2. … closing the sentence and argumentation using the F-A-B method.
Karate	Block 1. Yes, it is correct, you are right. The value of the investment is not the lowest. However, if you consider the fact that… Block 2. … argumentation using the F-A-B method … Block 3. … it may turn out to be worth investing.
Wrestling	Block 1. You can express such an opinion… | You can say that… | You can have such an opinion and at the same time know that Block 2. … argumentation using the F-A-B method.
Capoeira	Block 1. This is not [an objection raised], but … Block 2. … [the factor to which that we draw the customer's attention] will make | cause … Block 3. … [what the customer wants to achieve from buying the product, F-A-B argument]
Krav Maga	Block 1. One sentence that presents to the customer the consequences of non-acceptance of the offer or the effects of their 'cheap thinking' only. It shows the customer where they end up if the choice of products is solely based on the low price.

Source: own study based on Kawszyn and Szaran (2013).

Combining the F-A-B technique with SLP is a very strategic approach in the negotiation process. It can serve as a tool to effectively build arguments and defend one's position and convince the other party to accept the offer, especially in the case of objections, which perfectly fits into the strategy of repeatedly defending one's position before considering making concessions. For example, when the customer expresses their doubt about the product's price (*e.g.*, a battery-powered device), the seller may use the following argument:

- FEATURE: 'Our product uses the state-of-the-art battery technology.'
- ADVANTAGE: 'It means that the device can work twice as long on a single charge compared to competing products.'
- BENEFIT: 'This saves you not only the time you would have to spend on frequent charging, but also the money to buy additional batteries'.

By effectively presenting the benefits that are crucial to the customer, one can increase the offer's perceived value. It may convince the negotiating partner to accept the offer without the need to grant a concession, even after several rounds of defending the seller's position. With each defence, one can re-engage the negotiation partner, asking about additional concerns or needs, which offers the opportunity to further adjust the sales arguments from the F-A-B model to their specific requirements. In practice, using those techniques in combination allows one not only to effectively defend the price but also to build long-term relationships with customers by showing how deeply their needs are understood and how the offer can bring them concrete value.

RESULTS AND DISCUSSION

The combination of the F-A-B technique with the SLP sales model can be structured in the form of a negotiation algorithm. Figure 2 shows a block diagram of the artificial intelligence negotiation algorithms (AINA), considering the defence of the positions using the F-A-B and price defence techniques (PDT). In bold, we present the SLP model or the path the customer follows. It is necessary to try to deflect the customer's objections by defending the offer without making concessions until such non-acceptance occurs three times.

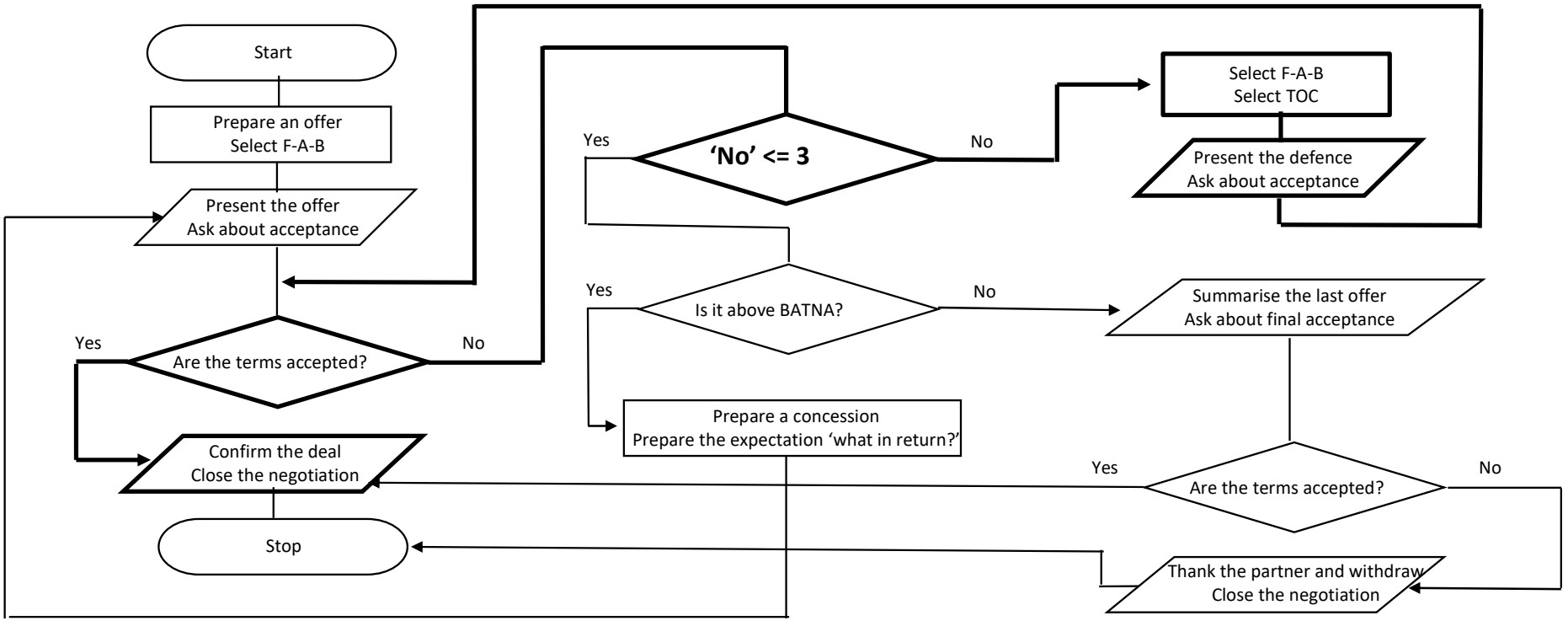

Figure 2. Block diagram of the AINA

Source: own elaboration.

The key condition of the algorithm (Figure 2) is 'no'<= 3. It means that no concession should be offered until after the third objection. It is not arbitrary. According to practitioners such as Belfort (2017), a negotiator should attempt to defend their position at least three times before offering any concession. Semantic price defence techniques also support this principle (Kawszyn & Szaran, 2013), which are structured around waves of objection handling to maximise the perceived value and avoid premature discounting. In the presented algorithm, this threshold has proven to be a psychological 'pivot point.' After three objections, the counterpart is either convinced or begins to expect movement. Therefore, the value '3' reflects a tested and optimised balance between assertiveness and relationship management.

One of the general principles of negotiating to be kept in mind is that concessions should always be offered on condition of the other party's making a concession. Thus defined algorithm allows for the repeated use of the position defence mechanism and iterative proposals of concessions as long as either an agreement is reached on the terms assumed (above BATNA) or one decides to withdraw from the negotiation due to going beyond the area of negotiation. We conducted ten tests of the algorithm presented in this article in the ChatGPT4o model, and we present the test results in an online attachment available at AINA Position Defence Algorithm 29082024 testing (2024).

During the testing phase, we implemented the algorithm in 10 structured negotiation simulations using the ChatGPT-4o model. Each scenario involved presenting an offer, receiving an objection (*e.g.*, 'too expensive'), and applying the algorithm's three-tiered objection-handling logic. Key empirical observations:

1. In 8 out of 10 cases, the simulated buyer accepted the offer after the second or third defence round, without needing to receive a price reduction.
2. In two cases, the model escalated to a concession phase after three unsuccessful objection deflections, which reflects the built-in flexibility of the 'No ≤ 3' rule.
3. ChatGPT-4o maintained semantic consistency and logical reasoning within the SLP framework across iterations, demonstrating the algorithm's compatibility with generative AI language models.

These results confirm that the combination of structured defence and persuasive logic is not only implementable in AI models but also effective in delaying concessions while maintaining customer engagement. The findings suggest that such algorithmic support can improve negotiation performance in simulated and potentially real B2B settings. Given this, we confirm that negotiation algorithms can automate most of the routine activities in all phases of the negotiation process, thus streamlining the entire process, but their potential to generate value is, according to us, particularly useful at the initial stage. For example, their use may be helpful in the following preparatory phase activities:

- Analysis of information about the negotiation partner: Collect and continuously update all relevant data about the partner (e.g., legal form, finances, credibility, structure, prior negotiations). In international cases, also study the culture, customs, and local laws. Negotiations are a process of discovery – new information replaces previous assumptions and drives progress (Voss & Raz, 2016);
- Assessment of the negotiation conditions – awareness of the nature of future cooperation (whether a one-off deal or a permanent relationship), time constraints, negotiation costs, as well as the legal, ideological and procedural requirements has a significant impact on further tactical actions;
- Selection of members of the negotiating team – based not only on competence, negotiating skills, or anticipated roles to be fulfilled in the team, but also on the analysis of personality traits, habits, or interests adequate to the competence, skills, and character of the negotiating team of the partner. Effective negotiators are well-prepared, flexible, assertive and able to build relationships based on trust. They use information, control their emotions, seek common benefits and show patience (Prościak, 2024). It is important here to assess one's own as well as the partner's strengths (the possibility of the partner's influence on decision-making, exerting pressure, assessing the strength of arguments, determination, establishing the respective strengths and weaknesses of the parties);

- Analysis of goals and alternatives: Precisely define and prioritise your own goals (hard and soft) for each negotiation issue, setting maximum (ideal) and minimum (resistance) targets. Identify and assess alternative solutions (BATNA). Understand and rank the partner's goals and compare them with your own to guide negotiation strategy (Roszkowska, 2007);
- Defining the Zone of Possible Negotiation Agreement (ZOPA): By comparing both sides' goals, identify zones of agreement, partial conflicts, and concession possibilities. Evaluate short- and long-term benefits, prepare counterarguments, and anticipate the partner's questions to strengthen your negotiation position (Spangler, 2003);
- The choice of negotiation strategy and tactics – in business, the concepts of conducting talks are not universal, which is why a professionally developed strategy provides for many scenarios, whereas carefully selected tactics (a sequence of negotiation techniques) are key to succeed in negotiations. The most effective strategies and techniques are based on well-established knowledge, experience, analytical thinking skills, a flexible approach to a given topic and good relations with the opponent.

The empirically study has demonstrated that:

1. The current AI model is not yet a system advanced enough to allow artificial intelligence to negotiate in such a way that, based on a simple general algorithm, a person should have a sense of contact with a negotiator communicating at the same (human) level;
2. Even today, the AI system allows negotiators to better prepare for real negotiations, thanks to conducting test negotiations using the algorithm.

The algorithm presented above is particularly useful in the negotiation of complex products or services where it is important to accurately explain the value of the offer and to effectively deflect objections. It allows negotiators to maintain a clear path to closing the deal while building a solid foundation for future interactions. Thus described algorithm described includes key elements of defending the starting position in negotiations. However, like any model, it may require adapting to specific situations and customers. One can also supplement it with additional techniques and tools, such as SWOT analysis, BATNA or non-verbal communication techniques. The proposed algorithm for defending the starting position, based on a combination of two techniques, namely the F-A-B technique and straight line persuasion (SLP) selling model, can serve, *inter alia*, in the following business negotiation settings:

1. The product or service requires a detailed explanation of the features, advantages and benefits.
2. The negotiation partner has many objections and questions about the offer.
3. The aim of the talks is to defend the price and to minimise concessions.
4. It is important for the negotiation partner to feel that their needs are understood and fulfilled.
5. Both parties to the negotiation process have clearly defined goals and needs.

Both buyer and seller can deploy thus created negotiation algorithm. From the seller's perspective, the prerequisites for using the algorithm are as follows:

1. For better preparation, especially in terms of knowledge of the features, advantages, and benefits of the offered product or service.
2. For implementing effective and efficient conversations with the customer, building long-term relationships and listening more actively to the customer's needs.
3. For a convincing presentation of the offer. To specify its unique value to the customer thanks to the use of the language of value.
4. To respond effectively to customer objections. Especially because of the 'upfront' expectation of and preparation for the need to respond to objections. Also thanks to the valuable arguments prepared beforehand.
5. To persuade the customer to close the transaction. Faster closing of a sale or of a negotiation stage in a given area.

On the other hand, the deployment of the proposed algorithm should prepare the buyer to decline the presented proposal in several steps, which will encourage the seller to present all the main advantages and benefits of the offer under discussion. Buyers can use similar techniques to obtain better terms for themselves, namely:

1. Offer analysis: by evaluating the features, advantages, and benefits of the offer presented.
2. Expressing objections: formulating questions and objections to obtain additional information or better terms.
3. Negotiating terms: using arguments based on the F-A-B model to obtain better terms or price.

The discussion on the application of AI in negotiation processes is becoming increasingly intensified, particularly in the context of leveraging AI's potential to establish a solid foundation for these processes. Researchers have been focusing on various AI tools that support negotiations, including natural language processing (NLP) tools, which assist in sentiment assessment and the understanding of communicative aspects; predictive analytics tools, which help forecast negotiation outcomes; sentiment analysis tools, which facilitate the evaluation of the emotional state of negotiation partners; as well as data analytics platforms and negotiation support systems, which aid in the development of negotiation strategies. AI-based negotiation models include approaches grounded in game theory (Lewis *et al.,* 2017) and machine learning (Bagga *et al.,* 2020). Many scholars highlight that the core principles of classical human negotiation theory – such as transparency, assertiveness, relationship-building, and the importance of fairness – remain essential in AI-mediated negotiations (Gratch, 2021; Shin *et al*, 2024; Shin, 2022; Vaccaro *et al.,* 2025). Contemporary discussions tend to emphasize either cooperative approaches to negotiation (*e.g.*, win-win models) or predictive models focusing on pricing or behavioral patterns. However, they often lack the provision of a practical, tactical algorithm that would enable a structured and repeatable defense of the initial negotiation position. To the best of the our knowledge, no previous study has integrated semantic tools used in sales under pressure (SLP) with value-based structural argumentation (Features–Advantages–Benefits; F-A-B) into a coherent decision-making pathway designed to defend an initial stance without the need for immediate concessions.

CONCLUSIONS

This article introduced and tested an original negotiation algorithm (AINA) based on a structured combination of F-A-B techniques and the straight line persuasion model. The empirical component, conducted through a series of structured simulations using the ChatGPT-4o model, showed that the algorithm enables consistent objection handling and supports negotiators in maintaining their initial offer without making immediate concessions.

While the results demonstrate the algorithm's compatibility with AI-supported dialogue and its ability to simulate persuasive negotiation behaviour, claims related to deeper outcomes – such as building long-term relationships or improving customer understanding – remain theoretical assumptions, which require further validation in comparative field studies involving human participants and real negotiation processes. We positively verified both hypotheses. Structured semantic defence using the AINA algorithm (H1) might increase the number of objection-handling iterations before concessions are made. Furthermore, when guided by this algorithm (H2), AI systems like ChatGPT-4o demonstrated the capability to manage early negotiation phases effectively, thereby streamlining the preparatory process and enhancing initial offer resilience.

Research limitations include the AI-simulated nature of the tests, the lack of benchmarking against traditional techniques, and the absence of longitudinal relationship metrics. Despite the promising results of the AINA algorithm in simulated negotiation scenarios, we must acknowledge several limitations. Firstly, we optimised the current version of the algorithm primarily for defending the initial position during the objection-handling phase, and its utility across other negotiation phases (*e.g.*, opening, final concession exchange, post-negotiation anchoring) remains untested. Secondly, the algorithm assumes a relatively linear and rational behaviour pattern, which may not fully capture the emotional, cultural, or strategic complexity of real-world negotiations – especially those involving asymmetric power or cross-cultural dynamics. Thirdly, there is a risk that excessive reliance on structured defence routines may limit the negotiator's flexibility or reduce perceived authenticity. From a technical perspective, further work is needed to ensure the adaptability of the algorithm to evolving dialogue in multi-turn interactions and to calibrate its integration with generative AI systems in ways that preserve human agency. Future research should explore how AINA-type algorithms perform in live, high-stakes

B2B negotiations, including field experiments with human participants, comparative studies against alternative AI support methods, and cross-cultural validation of defence logic across negotiation styles. Further research is necessary to evaluate the algorithm's performance in live negotiations, test its cross-cultural effectiveness, and measure its impact on relationship-building over time.

REFERENCES

Agua, P.B., Correia, A., & Frias, A. (2024). Artificial Intelligence and Automation Impacts for the Future of Negotiation. Proceedings of the International Conference on Opportunities and Challenges in Management, *Economics and Accounting*, *1*(1), 15-22. https://doi.org/10.33422/omeaconf.v1i1.253

AINA Position Defence Algorithm 29082024 testing. (2024). Retrieved from https://wpconsult.blogspot.com/2024/08/aina-position-defence-algorithm.html on August 29, 2024.

Bagga, A., Jain, A., Shapiro, D., & Singh, M.P. (2020). An end-to-end neural framework for argument-based negotiation. *Proceedings of the 19th International Conference on Autonomous Agents and Multi Agent Systems (AAMAS 2020)*, 20-28.

Battisti, S., Agarwal, N., & Brem, A. (2022). Creating new tech entrepreneurs with digital platforms: Meta-organizations for shared value in data-driven retail ecosystems. *Technological Forecasting and Social Change*, *175*(2), article 121392. https://doi.org/10.1016/j.techfore.2021.121392

Belfort, J. (2017). *Way of the Wolf. Straight line selling. Master the art of persuasion, influence, and success.* New York: Simon+Shuster Inc.

Bertoni, F., Bonini, S., Capizzi, V., Colombo, M.G., & Manigart, S. (2022). Digitization in the Market for Entrepreneurial Finance: Innovative Business Models and New Financing Channels. *Entrepreneurship Theory and Practice*, *46*(5), 1120-1135. https://doi.org/10.1177/10422587211038480

Bharadiya, J.P. (2023). Machine Learning and AI in Business Intelligence: Trends and Opportunities. *International Journal of Computer*, *48*(1), 123-134.

Brożek, A., & Jadacki, J. (2012). Eksperymenty myślowe w nauce. *Filozofia Nauki*, *20*(1), 5-32.

Burström, T., Parida, V., Lahti, T., & Wincent, J. (2021). AI-enabled business-model innovation and transformation in industrial ecosystems: A framework, model and outline for further research. *Journal of Business Research*, *127*, 85-95. https://doi.org/10.1016/j.jbusres.2021.01.016

Casse, P. (1992). *The One Hour Negotiator*, Oxford: Butterworth-Heinemann Ltd.

Chuma, E.L., & Gomes de Oliveira, G. (2023). Generative AI for Business Decision-Making: A Case of ChatGPT, *Management Science and Business Decisions*, *3*(1), 5-11. https://doi.org/10.52812/msbd.63

Cummins, T., & Jensen, K. (2024). Friend or foe? Artificial intelligence (AI) and negotiation. *International Journal of Commerce and Contracting. 8*(1-2), 35-43. https://doi.org/10.1177/20555636241256852

Davenport, T.H., & Mittal, N. (2022). How companies can prepare for the coming "AI-first" world. *Strategy & Leadership*, *51*(1), 26-30. https://doi.org/10.1108/SL-11-2022-0107

Eidenmüller, H. (2025). The Advent of the AI Negotiator: Negotiation Dynamics in the Age of Smart Algorithms. *Journal of Business & Technology Law*, *20*(1), 1-28.

Farayola, O.A., Abdul, A.A., Irabor B.O., & Okelele, E.C. (2023). Innovative Business Models Driven By AI Technologies: A Review. *Computer Science & IT Research Journal*, *4*(2), 85-110, November. https://doi.org/10.51594/csitrj.v4i2.608

Fasihullah, A., Awan, B., & Khan, A. (2023). Negotiating in the digital age: Exploring the role of technology in modern negotiations. *Law and Policy Review*, *2*(1), 61-86. https://doi.org/10.32350/lpr.21.05

Fisher, R., & Ury, W. (2011). *Getting to Yes: Negotiating Agreement Without Giving In.* United States: Houghton Mifflin.

Fowler, A. (1996). *Negotiation Skills and Strategies.* London: Chartered Institute of Personnel & Development.

Fruhwirth, M., Ropposch, C., & Pammer-Schindler, V. (2020). Supporting Data-Driven Business Model Innovations. A structured Literature Review on Tools and Methods. *Journal of Business Models*, *8*(1), 7-25.

Gratch, J. (2021). The promise and peril of automated negotiators. *Negotiation Journal, 37*(1), 13-34. https://doi.org/10.1111/nejo.12333

Haefner, N., & Gassmann, O. (2023), Generative AI and AI-Based Business Model Innovation. *Journal of Business Models*, *11*(3), 46-50.

IBM (2024). *What is artificial intelligence (AI).* Retrieved from https://www.ibm.com/topics/artificial-intelligence on July 26, 2024.

John, M.M., Holmström Olsson, H., & Bosch, J. (2023). Towards an AI-driven business development framework: A multi-case study. *Journal of Software: Evolution and Process*, *35*, https://doi.org/10.1002/smr.2432

Jorzik, P., Klein, S.P., Kanbach, D.K., & Kraus, S. (2024). AI-driven business model innovation: A systematic review and research agenda. *Journal of Business Research*, 182/114764, 1-17, https://doi.org/10.1016/j.jbusres.2024.114764

Kanbach, D.K., Heiduk, L., Blueher, G., Schreiter, M., & Lahmann, A. (2024). The GenAI is out of the bottle: generative artificial intelligence from a business model innovation perspective. *Review of Managerial Science*, *18*, 1189-1220, https://doi.org/10.1007/s11846-023-00696-z

Katsamakas, E., & Pavlov, O. (2020). AI and Business Model Innovation: Leverage the AI Feedback Loops. *Journal of Business Models*, *8*(2), 21-30.

Kawszyn, R., & Szaran, A. (2013). *Techniki obrony ceny. Tylko dla MOCnych handlowców*! Warszawa: Al Fianco Partners, Wydanie III.

Lee, J., Suh, T., Roy, D., & Baucus, M. (2019). Emerging Technology and Business Model Innovation: The Case of Artificial Intelligence, *Journal of Open Innovation: Technology, Market, and Complexity*, *5*(3), 44, 1-13, https://doi.org/10.3390/joitmc5030044

Lewis, M., Yarats, D., Dauphin, Y., Parikh, D., & Batra, D. (2017). Deal or no deal? End-to-end learning for negotiation dialogues. *Proceedings of the 2017 Conference on Empirical Methods in Natural Language Processing (EMNLP 2017)*, 2443-2453. https://doi.org/10.18653/v1/D17-1259

Liu, T., & Zheng, Z. (2020). Negotiation assistant bot of pricing prediction based on machine learning*, International Journal of Intelligence Science*, *10*. https://doi.org/10.4236/ijis.2020.102002

Mariani, M.M., Machado, I., & Nambisan, S. (2023). Types of innovation and artificial intelligence: A systematic quantitative literature review and research agenda. *Journal of Business Research*, 155/113364. https://doi.org/10.1016/j.jbusres.2022.113364

Marinakis, V., Koutsellis, T., Nikas, A., & Doukas, H. (2021). AI and Data Democratisation for Intelligent Energy Management. *Energies*, *14*(14)/4341. https://doi.org/10.3390/en14144341

Martin-Raugh, M.P., Kyllonen, P.C., Hao, J., Bacall, A., Becker, D., Kurzum, Ch., Yang, Z., & Barnwell, P. (2019). Negotiation as an Interpersonal Skill: Generalizability of Negotiation Outcomes and Tactics across Contexts at the Individual and Collective Levels. *Computers in Human Behavior*, *104*/C; 9-21. https://doi.org/10.4236/ijis.2020.102002

Mishra, S., & Tripathi, A.R. (2021). AI business model: an integrative business approach. *Journal of Innovation and Entrepreneurship*, *10*(18), 1-21. https://doi.org/10.1186/s13731-021-00157-5

Mohammad, Y., & Nakadai, S. (2019). *Optimal Value of Information Based Elicitation During Negotiation, Economic Paradigm: Learning and Adaptation AAMAS*, AAMAS 2019, May 13-17, 2019, 242-250, Montréal, Canada., Optimal Value of Information Based Elicitation During Negotiation (ifaamas.org).

Nierenberg, G.I. (1987). *Fundamentals of Negotiating.* New York: HarperCollins.

Popper, K. (2014). *Conjectures and refutations: The growth of scientific knowledge*. London: Routledge.

Precedence Research (2024). *Artificial Intelligence (AI) Market Size, Share, and Trends 2024 to 2034.* Retrieved from https://www.precedenceresearch.com/artificial-intelligence-market on August 1, 2024.

Prościak, A. (2024). *Kupiec Alfa. Przewodnik po efektywnych zakupach i negocjacjach*. Warszawa: Wydawnictwo Helion S.A.

PwC. (2024). *Thriving in an age of continuous reinvention: PwC's 27th Annual Global CEO Survey.* Retrieved from https://www.pwc.com/gx/en/ceo-survey/2024/download/27th-ceo-survey.pdf on August 1, 2024.

Qvist-Sørensen, P. (2020). Applying IIoT and AI– Opportunities, Requirements and Challenges for Industrial Machine and Equipment Manufacturers to Expand Their Services. *Central European Business Review*, *9*(2), 46-77. https://doi.org/10.18267/j.cebr.234

Rescher, N. (2018). *What if?: thought experimentation in philosophy*. New York: Routledge.

Roszkowska, E. (2007). *Modelowanie procesów decyzyjnych oraz negocjacji za pomocą kompleksów reguł.* Białystok: Wydawnictwo Uniwersytetu w Białymstoku.

Schulze-Horn, I., Hueren, S., Scheffler, P., & Schiele, H. (2020). Artificial Intelligence in Purchasing: Facilitating Mechanism Design-based Negotiations. *Applied Artificial Intelligence*, *34*(8), 618-642, https://doi.org/10.1080/08839514.2020.1749337

Shin, D. (2022). The perception of humanness in conversational journalism: An algorithmic information-processing perspective. *New Media & Society, 24*(12), 2680-2704. https://doi.org/10.1177/1461444821993801

Shin, D., Koerber, A., & Lim, J. (2024). Impact of misinformation from generative AI on user information processing: How people understand misinformation on generative AI. *New Media & Society,* March. https://doi.org/10.1177/14614448241234040

Spangler, B. (2003). *Zone of Possible Agreement (ZOPA)*. In Burgess, G. & Burgess, H. (Eds.) *Beyond Intractability*. Conflict Research Consortium. University of Colorado, Boulder.

Steele, P., Murphy, J., & Russill, R. (1995). *It's A Deal: A Practical Negotiation Handbook*. New York: McGraw-Hill Publishing Co.

Vaccaro, M., Caosun, M., Ju, H., Aral, S., & Curhan, J.R. (2025). Advancing AI negotiations: New theory and evidence from a large-scale autonomous negotiations competition. *SSRN.* https://doi.org/10.2139/ssrn.5175035

Voss, Ch., & Raz, T. (2016). *Never Split the Difference: Negotiating as If Your Life Depended on It.,* New York: Harper Collins.

Wan, J., Li, X., Dai, H.-N., Kusiak, A., Martinez-Garcia, M., & Li, D. (2021). Artificial-Intelligence-Driven Customized Manufacturing Factory: Key Technologies, Applications, and Challenges. *Proceedings of the IEEE*, *109*(4), 377-398. https://doi.org/10.1109/JPROC.2020.3034808

Weber, M., Beutter, M., Weking, J., Böhm, M., & Krcmar, H. (2022). AI Startup Business Models. Key Characteristics and Directions for Entrepreneurship Research, *Business &Information Systems Engineering*, *64*(1), 91-109. https://doi.org/10.1007/s12599-021-00732-w

Widayanti, R., & Meria, L. (2023). Business Modelling Innovation Using Artificial Intelligence Technology. *International Transactions on Education Technology* (ITEE), *2*(2), 95-104. https://doi.org/10.33050/itee.v1i2.270

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Use of Artificial Intelligence

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Polish accountants' readiness for sustainability reporting

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ABSTRACT

Objective: The article aims to assess the attitudes of Polish accountants towards sustainability reporting (SR) as a new area of accounting and to self-assess their readiness to produce such reports.

Research Design & Methods: We conducted the empirical study using a questionnaire addressed to Polish accountants by the largest professional organisation of accountants in Poland. We tested research hypotheses using quantitative methods, i.e., non-parametric tests and linear regression models.

Findings: The study showed a correlation between the respondents' declared interest in sustainability reporting and their level of acceptance of the inclusion of these reports in their accounting duties. The vast majority of Polish accountants rated their state of preparedness for sustainability reporting as insufficient. The results also indicate a correlation between the declared level of interest in the topic of SR and the perception of sustainability reporting as an opportunity or a threat for the accountant. Respondents who are more interested in the issue are positive and optimistic about the opportunities for the future of the profession arising from sustainability reporting. We found that women in the accounting profession are more interested in the topic of SR.

Implications & Recommendations: The obtained results broaden and deepen the knowledge on the attitude of the accounting community in Poland to the obligation of sustainability reporting. On the one hand, they provide a diagnosis of the perception of the topic of SR by accountants and, on the other hand, clearly indicate the need for educational and promotional activities.

Contribution & Value Added: The study fills a research gap in the area of accountants' perception of sustainability reporting. The findings of the study enable accounting organisations and company boards to better prepare accountants for the new obligations imposed by the EU. The results broaden and deepen the knowledge of the determinants of Sustainability Reporting and the accounting profession in Poland.

Article type:	research article
Keywords:	accounting profession; sustainable accounting; corporate social responsibility; sustainability reporting; competencies of accountants
JEL codes:	M40, M48

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INTRODUCTION

It has been noted for years that financial reporting is insufficient to meet the expectations of an ever-widening audience for information from companies. It ignores what can be regarded as 'intangible value,' understood in a broader sense than the provisions of balance sheet law. Thus, as stated, the existing approach to financial statements places the burden on historical values. At present, however, this approach does not fully fit with stakeholder expectations (Sciulli & Adhariani, 2023). As Kamela-Sowińska (2015) notes, significant changes are taking place in this regard, underpinned by the shift from classical accounting to economic reporting against the backdrop of legitimacy theory within the framework of corporate social responsibility (hereinafter referred to as CSR). The need to combine financial and non-financial information in reports is highlighted by Arora *et al*. (2023), who emphasise the importance of integrated reports, which can include sustainability reporting (hereinafter referred to as SR).

Currently, the sustainability report is part of the management report, the scope of which derives from accounting regulations. For this reason, it is quite often considered that accountants are responsible for its preparation as preparers of financial reports (Szadziewska, 2014; Arora *et al*., 2023). This, however, requires them to learn new areas of knowledge and broaden their skills, including mastering new methods of operating within the framework of sustainability accounting in the broadest sense, in particular, sustainability reporting (Boharu *et al*., 2022). The specific role of accountants and the accounting system in ensuring that a wide range of users have access to quality information in the area of SR is pointed out by Dechow (2023). In contrast, Lewis (2000) and Williams *et al*. (2010) highlight the specific role of accountants in developing and promoting sustainability reporting.

From the point of view of the state of research on the assessment of UR reporting, it is worth noting that the vast majority of research is concerned with the users of the reports, in particular investors (Jonsdottir, 2022). Some of these studies focus on report quality from the perspective of report users (*e.g*., Arvidsson & Dumay, 2022; Barker & Eccles, 2019; Saini *et al*., 2022; Krasodomska & Cho, 2017; Grant Thornton, 2024). There are far fewer studies conducted from the perspective of the reports' preparers. Some of these studies compare preparers' and users' approaches to the scope, quality and usefulness of the information contained in reports (Helfaya *et al*., 2019; Tello *et al*., 2016) and the role of integrating non-financial and financial information within integrated reports (*e.g*., Zyznarska-Dworczak, 2022; Dumay *et al*., 2019; Hoang, 2018; McNally *et al*., 2017; Krasodomska & Cho, 2017). Noteworthy, the research on the perception of preparers is not strictly about the accounting community (Helfaya *et al*., 2019). However, it seems, especially in light of legitimacy theory, that the new SR obligations, encompassing an increasing number of entities, require knowledge not only of the areas of IR but also of linking this information to the financial data presented in the financial statements. Such competence is available to accountants, provided they have adequate training in the subject of CSR.

We were not able to find research relating directly to accountants' readiness for SR. This article fills this research gap with reference to the Polish market. Given that the scope of SR has been defined at the EU level, the conclusions of this article may also be useful in other EU countries. The selection of respondents from the community of Polish accountants was dictated by the developed market for financial and accounting outsourcing services in the domestic market. The largest accounting and auditing corporations, thanks to their branches located in Poland, rely on Polish staff to provide services to the whole world. The purpose of this article is to assess the attitudes of Polish accountants towards reporting SR as a new area of accounting and to self-assess their readiness to prepare such reports. In designing the study, the following research questions were formulated:

RQ1: Does the age and gender of respondents affect perceptions of the subject of CSR?

RQ2: How do accountants assess their preparedness in terms of SR?

RQ3: How do accountants think SR will affect the development of their profession?

RQ4: What are the knowledge, competence and skill needs of accountants in terms of SR?

The article comprises five parts. A general introduction is followed by a critical analysis of the literature, together with an indication of the hypotheses set against it. The sources and research methods used are then presented. A description of the results obtained and how they relate to the hypotheses, as well as a comparison of the results with other studies, is included in the 'Results and discussion' section.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The term sustainability was implemented by H. C. Carlowitz and was spread by environmental advocates as early as the 1960s/70s, and referred to changes in the approach to conservation processes. In a broad sense, sustainable development is the maximisation of the net benefits of economic development while being able to protect it and restore the usefulness and quality of natural resources in the long term (Pearce & Turner, 1990).

In this context, both large corporations and informed groups of society are noting their influence on the formulation and implementation of rules of conduct previously attributed to the role of the state

(Scherer *et al*., 2006). The aspect related to the implementation of CSR reporting practices should thus be considered a social change according to the multi-level theory of social evolution in organisations (Aguilera *et al*., 2007). Nowadays, it is not only financial information that influences the financial performance and value creation of companies, but they are increasingly influenced by the content of SR (Zaporowska & Szczepanski, 2024; Șova & Popa, 2022). There is increasing pressure from investors for companies to present both financials and SR results as part of their reporting practice (Ferri *et al*., 2023).

The growth of the group of entities disclosing SR information and the growing belief that stakeholders benefit from it (Cheng *et al*., 2014; Bucaro *et al*., 2020; Rachel, 2019) has led to increasing calls for its legislative provision. Disclosure of standardised reporting information on UR will positively impact the competitive position of companies (Lozano, 2015)

It is worth emphasising that disclosing detailed information about the CSR is an important element of the dialogue between the organisation and its stakeholders. Disclosing this information requires a structured process for the flow of information about the areas indicated, and can change the perception of the entity and the legitimacy of its actions (Adams & McNicholas, 2007; Scherer *et al.*, 2013; Dumay *et al.*, 2015; Dumay *et al.*, 2019). It should be pointed out that legitimacy theory is one of the system-oriented theories in which the behaviour of economic units is considered from the perspective of its relationship with the environment (system) (Deegan & Unerman, 2006), and the development of an organisation is conditioned by the consent of society, which requires it to comply with accepted norms.

In 2024, mandatory sustainability reporting (for further well-defined groups of entities) was introduced as a result of the CSRD (Corporate Sustainability Reporting Directive) (Directive, 2022). The importance of linking the concept of SRD with accounting itself and education in this area, as well as the compliance of reporting with the assumptions made, has also been pointed out (Simmons *et al*., 2024; Biondi *et al*., 2020). EFRAG's decisions show a dichotomous nature with respect to the ISSB 'International Sustainability Standards Board' by including two bodies in its structure: the 'Financial Reporting Body' of the FRB, the 'Non-Financial Reporting Body' of the NFRB (Tettamanzi *et al.,* 2022). This structure, oriented towards the performance of technical work, is a kind of acknowledgement of the broadened approach to the accounting system and thus also of the responsibilities of accountants. As a result, the term Sustainability Accounting is increasingly being used, with initiatives at the Global Level emerging (Tettamanzi *et al*., 2022). Such a direction is grounded in legitimacy theory.

The transition from traditional accounting to reporting that includes SR, together with the provision of finance and non-financial services, requires specific skills from the accounting profession. To date, non-financial reporting has often been handled by accountants, which suggests that in many entities, enhanced sustainability reporting will also be the responsibility of accountants (Salin *et al*., 2024). The correctness of the SR will be attested by auditors who have a long-standing relationship with accounting departments.

This raises the question of whether accountants in Poland are adequately prepared for sustainability reporting. Previous research conducted in other countries indicates that accountants are insufficiently involved in sustainability reporting and should play an informational, interpersonal and decision-making role in achieving the effectiveness of sustainability reporting (Lusher, 2012; Che Kasim *et al*., 2024; Souza *et al*., 2025). Sometimes companies organise sustainability reporting through new organisational units, bypassing accounting departments. Che Kasim *et al*. (2024) emphasise that there is an increasing expectation of greater involvement of accountants in sustainability reporting. According to Özsözgün (2014), 'there is a lack of defining the relationship between the sustainability concept and accounting and also potential solutions to overcome the problems which create challenges for accounting and accounting professionals.' Furthermore, accountants working directly in companies or also in accounting offices have to accept non-financial reporting not only as a legal obligation, but also as a contemporary market requirement (Trzpioła, 2024). In light of the referenced research, we formulated the following hypothesis:

H1: There is a correlation between accountants' perceptions of their level of interest in CSR and their opinion of SR as an area within the scope of accountants' responsibilities.

The new approach to reporting in accounting presents both challenges and opportunities for the accounting community. A study by Cohn (2021) shows that accountants are challenged by often problematic, ambiguous disclosures and the need to master new methods in reporting. The process of transitioning from traditional accounting to reporting adapted to new trends requires accountants to prepare themselves substantively and managers to prepare themselves organisationally, which requires time and the commitment of adequate resources (Boharu *et al*., 2022). The state of preparation of accountants for SR was also examined by Grujić and Vojinović (2024). Accountants from Bosnia and Herzegovina were surveyed. The survey showed that the majority of accountants accept the new task as part of their duties, but at the same time present the opinion that they are not sufficiently prepared for preparing the SR. A survey conducted by Souza *et al*. (2025) showed difficulties in the practice of sustainability reporting by accountants, who pointed out that one of the main reasons for their lack of adequate preparation to prepare these reports is the diverse and ambiguous legal status and the lack of training. There is an urgent need to change the mentality of the accounting community and adapt it to the new problem areas, as well as to master the new methods used in compiling and reporting information in the area of the SR. This includes the ability to apply the new IR standards. Research conducted in the US university environment on the integration of SR accounting into the accounting curriculum showed interesting results. The survey of 452 accounting faculty found that there was little formal integration of SR issues into the accounting curriculum. Rather, teaching SR was an individual initiative of some faculty members (Simmons *et al*., 2024). It follows that the educational preparation of accountants in the field of SR is not sufficient, as pointed out in previous publications on the knowledge of sustainability issues by accountants and accounting students (Chulián, 2011). A survey conducted in Poland by Kłobukowska and Wachulak (2024) among accountants shows that they need the organisation of periodic training due to legal changes. This research also shows that changes in the area of economic and sustainable development do not significantly influence the abandonment of the accounting profession in Poland (Kłobukowska & Wachulak, 2024). In this context, the following hypothesis was formulated:

H2: There is a correlation between the level of accountants' declared interest in CSR issues and their perception of the degree of preparation for SR.

Auntie *et al*. (2022) point out in their research that sustainability reporting is not only a new job responsibility that many accountants will have to combine with their existing ones, but also that some accountants will have to 'retrain' for it from their previous job within the accounting system. It is also an opportunity to strengthen their role and position within companies, advise partners and help create a sustainable enterprise (Radu & Tabirca, 2019). Research shows that, according to accountants, expanding their knowledge of managing UR factors opens up new opportunities for their professional development, both in terms of their tasks within the company and in terms of its broader environment and business model (Kłobukowska & Wachulak, 2024). Research also points to the new role of accountants as 'gatekeepers' of sustainability information (Egan & Tweedie, 2018; Schaltegger & Zvezdov, 2015). The results of the study by Schaltegger and Zvezdov (2013) also point to the control function of accountants in the creation of sustainable enterprises and the creation of information on this topic. In the previous practice, accounting services, while not directly obliged to prepare such reports, provided data to them and verified that the information contained in the non-financial reports is consistent with the financial data. In light of the research conducted so far, the following hypothesis was assumed:

H3: There is a relationship between accountants' declared level of interest in the topic of CSR and their posi-tive assessment of the impact of SR on the accounting profession in the future.

Research shows that the gender and age of preparers of SR influence their attitudes towards sustainability issues and sustainability reporting. Most studies refer to the participation of women on the board and their attitudes towards the issue of SR and the quality of the reports (Horbach, 2018; Li *et al*., 2017; Bernardi & Threadgill, 2010; Bilimoria, 2000). Women tend to be more sensitised and better versed in this topic, and more positive about reporting on these issues (*e.g*., Bilimoria, 2011; Horbach, 2018). Moreover, younger employees show more interest in, for example, environmental problems

and related reporting than older employees (*e.g.*, Piscitelli & D'Uggento, 2022; Gosztonyi, 2023). In light of the referenced studies, the following hypotheses were adopted:

H4: There is a correlation between the gender of the respondents and the level of declared interest in the CSR issues.

H5: There is a correlation between the age of the respondents and their level of declared interest in CSR issues.

RESEARCH METHODOLOGY

The survey used a questionnaire made in Google Forms, which was distributed by the Stowarzyszenie Księgowych w Polsce (Accountants Association in Poland – AAP) – the largest professional organisation of accountants. The invitation to take part in the survey was posted on AAP's homepage and on the websites of 25 district branches. In addition, the request to participate in the survey was sent in several newsletters. This way of distributing the form makes it possible to conclude with a high degree of certainty that the questionnaires went to the right people and were only filled in by accounting professionals. In the invitation to the survey, we drew attention to the ongoing legislative work aimed at implementing the CSRD into Polish law, which was to be completed in 2024. Despite the extensive information campaign throughout Poland, the topicality of the topic and the long exposure time of the survey (April – December 2024), the number of respondents was only 280. The return rate of the questionnaires obtained was significantly lower than in the case of previous surveys addressed and distributed in the same manner in previous years. It can be assumed that the lower number of respondents reflects the low interest of accountants in the topic of SR.[1] We believe that accountants are primarily interested in current topics relevant to their practice rather than issues, even important ones, that will be relevant to their work in the near future.

The sampling was random. Every person involved in accounting had a chance to take part in the survey. The number of accountants in Poland is estimated to be around 400 000. In the SurveyMonkey survey sample calculator, with a population at this level, with a 90% confidence level and a 5% margin of error, the representative sample was 273 people. A 5% higher degree of certainty would require 384 respondents. Unfortunately, we cannot say with certainty that the sample was representative, which is a limitation of the survey conclusions. However, due to the large diversity of respondents, we may assume that the structure of the sample largely corresponded to the general population data, as confirmed by the analysis of internal AAP data. The respondents varied in age and work experience and represented units with different income levels.

A combination of quantitative methods was used to verify the research hypotheses: non-parametric tests and linear regression models. As not all variables met the assumptions of normality of distribution and homogeneity of variance, non-parametric tests, which are more resistant to violations of these assumptions, were preferred. Basic information about the respondents is provided in Table 1.

We assumed that there was a correlation between the declared interest in the topic of SR and their acceptance of the inclusion of sustainability reporting in their responsibilities. To the question 'Who do you think should be involved in UR reporting (multiple choice)?,' it was possible to choose an answer or to enter your own. The answers to choose from were as follows:[2] specialised departments for sustainability reporting (79.9%), entity management (58.6%), controllers (27.3%), accountants (19.8%), others (8.5%). Only 57 respondents were in favour of assigning sustainability reporting tasks to accountants. Figures 1 and 2 present the distribution of answers to the question on the entity responsible for the sustainability reporting according to the respondent's interest in the SR topic (1 – no interest, 5 – very high interest).

[1] In our earlier studies, for which data was collected through the same channels, a return rate more than ten times higher was achieved.

[2] Respondents were able to select more than one response option, so the sum of responses is greater than 280.

Table 1. Summary data on respondents

Criteria	Specification
Number of respondents	280
Gender	Women (76.4%); Men (21.45%); Disagreement (2.1%)
Age	Up to 20 years (0.4%), 20-30 years (10.7%), 31-40 years (24.3%), 41-50 years (36.8%), 51-60 years (20%), 61-70 years (3.9%), Disagree (3.9%)
Experience in accounting	Up to 5 years (10.7%), 5-10 years (14.6%), 11-20 years (31.1%), 21-30 years (30.4%), 31-40 years (9.6%), More than 40 years (0.7%), Disagree (2.9%)
Position	Accountant (50%), Accounting office owner (19.3%), Finance director (8.9%), Chartered accountant (2.9%), Other (18.9%)
Revenue of the respondents' main source of income	Up to PLN 1 million: (18.6%), Between PLN 1 and 5 million: (13.6%), Between £5m and £20m: (9.3%) Between 20 and 50 million PLN (14.3%), Between 50 and 100 million PLN (14.3%), More than 100 million PLN (19.6%), Not applicable (19.6%)
Industry	Services (44.3%), Food (6.4%), Construction (5.5%), Plastics (3.6%), Real Estate (3.6%), Transportation (2.5%), Raw Materials (2.5%), Other (31.8%)

Source: own study.

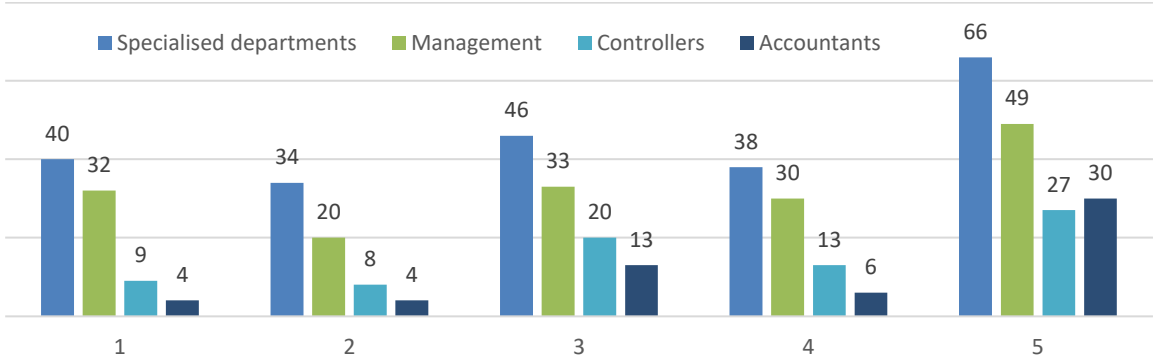

Figure 1. Responsibility for reporting on SR vs. interest in the subject of CSR: All responses (n=280)
Source: own elaboration.

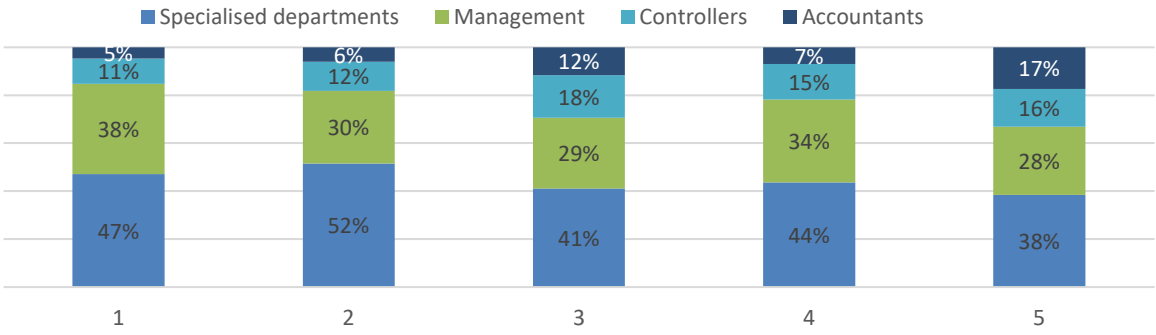

Figure 2. Interest in the topic of CSR: Responses of respondents considering that accountants should be responsible for the SR (n=57)
Source: own elaboration.

Analysing the figures above, we can see that accountants would be willing to entrust the preparation of the SR reports to specialised departments (almost 80% of respondents). This attitude may be due to several factors. One is a reluctance to implement solutions that may not ultimately come

into force.[3] A second reason may be an overload of responsibilities with a simultaneous shortage of accounting staff. Another reason may be the fear of the unfamiliar subject of SR to most accountants.[4] As shown in Figure 2, the number of respondents indicating the answer 'accountant' generally increases with the declared level of interest in the topic of CSR. We verified the relationship between the level of interest in CSR and the willingness of accountants to engage in SR using the Mann-Whitney test. The result obtained ($p = 0.045$) shows that there are significant differences between the groups, confirming that those who are more interested in CSR are more likely to declare their willingness to engage in reporting. This leads to a partially positive verification of hypothesis H1 (There is a correlation between accountants' perceptions of their level of interest in the of CSR and their opinion of SR as an area within the scope of accountants' responsibilities), disturbed by the lower number of indications of respondents who rated their interest in CSR as '4'. The lack of unambiguously positive verification of hypothesis H1 may be due to the small number of respondents who felt that accountants should be responsible for the SR.

The next tested hypothesis H2 (There is a correlation between the level of accountants' declared interest in CSR issues and their perception of the degree of preparation for SR) relates to the self-assessment of preparedness for CSR reporting. Accountants rated their overall knowledge of the CSRD poorly. Only 21.3% of respondents considered this knowledge to be good (14.4%) or very good (6.9%). Figure 3 illustrates the relationship between declared knowledge of the CSRD and interest in the topic of the CSR (on a scale of 1-5).

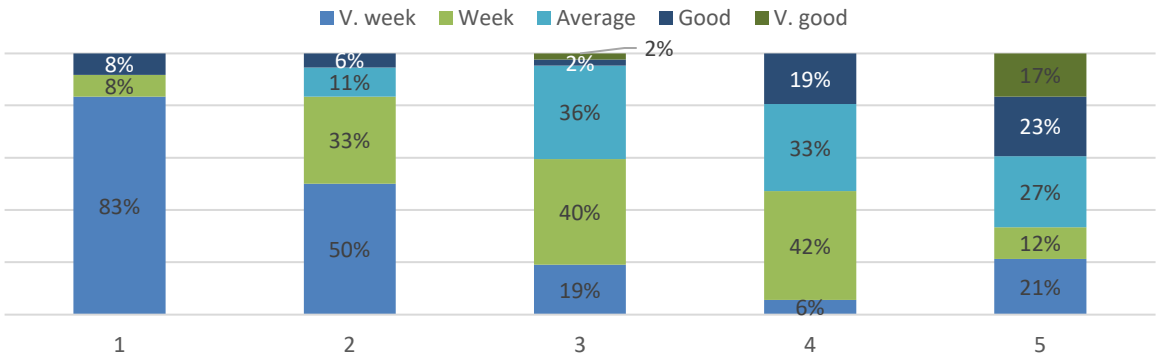

Figure 3. Interest in SR topics (1-5) vs. general knowledge of the CSRD
Source: own elaboration.

For this hypothesis, we analysed the relationship between the overall rating of interest in UR and self-assessment of preparation for reporting. We used Spearman's rank correlation analysis but obtained no significant relationship ($\rho = 0.03$, $p > 0.05$), suggesting no relationship between these variables. In an effort to deepen the conclusions relating to H2, we examined the relationship between knowledge of the CSRD and seniority in accounting. Table 2 shows this relationship.

Those with between 5 and 10 years' seniority were the most critical of their knowledge (60.9% poor or very poor knowledge). One third of accountants with seniority between 31 and 40 years (so in practice the oldest in age) rated their knowledge as good (20%) or very good (13.3%). It does not appear from the data collected that knowledge of the CSRD guidelines depends on seniority in accounting. The results obtained indicate ambiguity in the respondents' assessments. The oldest employees declared the greatest interest in the topic of CSR and, therefore, also in the CSRD. This may be indicative of a lack of awareness of the actual state of knowledge on the topic of the CSRD.

Further detailing the question on general familiarity were declarations regarding familiarity with the basic principles of sustainability reporting,[5] namely, due diligence, double materiality, stakeholder

[3] Directive (EU) 2025/794 of the European Parliament and of the Council of 14 April 2025 amending Directives (EU) 2022/2464 and (EU) 2024/1760.
[4] Only one in five respondents declared a good or very good knowledge of the CSRD.
[5] These principles are explained in ESRS No. 1.

dialogue, and the value chain principle. Figure 4 illustrates the summary of responses (1 + 2), *i.e.*, declared very poor and poor knowledge of the basic principles of SR.

Table 2. Assessment of knowledge of the CSRD by seniority in accounting (in %)

Knowledge of reporting principles	Length of service in accounting (years)							
	<5	5-10	11-20	21-30	31-40	>40	Not specified	Total
1 (very poor)	11.8	30.4	30.9	24.1	13.3	0.0	20.0	24.7
2 (weak)	41.2	30.4	21.8	29.3	20.0	0.0	20.0	27.0
3 (average)	23.5	21.7	32.7	22.4	33.3	0.0	40.0	27.0
4 (good)	17.6	8.7	10.9	17.2	20.0	100.0	0.0	14.4
5 (very good)	5.9	8.7	3.6	6.9	13.3	0.0	20.0	6.9

Source: own study.

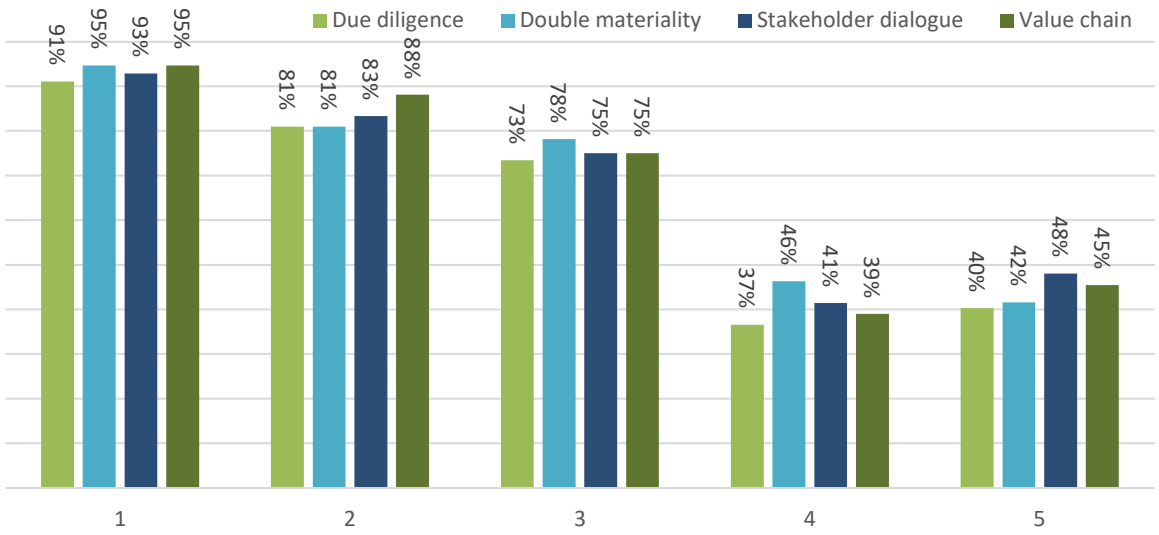

Figure 4. Interest in the topic of IR (1-5) vs. knowledge of the basic principles of SR (sum of responses 1 and 2, very poor or poor knowledge of the principles)
Source: own elaboration.

The correlation coefficients were respectively 0.434 (general familiarity), 0.435 (due diligence), 0.477 (double materiality principle), 0.429 (stakeholder dialogue principle), 0.472 (value chain principle). The correlation at this level indicates a moderate positive linear relationship between the responses analysed. With regard to both the accountants' general knowledge of the CSRD and the key reporting principles, a strong correlation was observed between the assessment of the knowledge of individual issues and the degree of interest in the topic of CSR. As many as 67.5% of respondents rated knowledge of the principles of dual materiality, stakeholder dialogue and the value chain as poor or very poor. Slightly fewer respondents (63.6%) referred similarly to knowledge of due diligence. In summary, the conclusions regarding hypothesis H2 are ambiguous. On the one hand, there is no statistically significant relationship between the analysed variables at the overall level. However, such a relationship, confirmed by correlation coefficients, was present in the relationship 'interest in CSR and knowledge of basic reporting principles.'

Concerning hypothesis H3 (There is a relationship between accountants' declared level of interest in the topic of CSR and their positive assessment of the impact of SR on the accounting profession in the future), it can be concluded that for the respondents the topic of sustainability reporting is a novelty and at the same time a great unknown. Respondents stated that sustainability reporting would be an opportunity for accountants (7.1%), a threat to accountants (22.5%), at the same time an opportunity and a threat to accountants (32.1%), neither an opportunity nor a threat to accountants (38.2%). As mentioned earlier, less than 20% of respondents felt that accountants should be involved in the SR.

To verify this hypothesis, we used the Kruskal-Wallis test to examine the relationship between the level of interest in CSR and the perception of SR as an opportunity for the accounting profession (response: 'opportunity for accountants'). The analysis yielded no statistically significant differences (p = 0.317), suggesting that the level of interest in CSR did not significantly influence the perception of UR as an opportunity. The statistical test referred to only one response. A summary of the responses to all questions in relation to interest in CSR is shown in Figure 5.

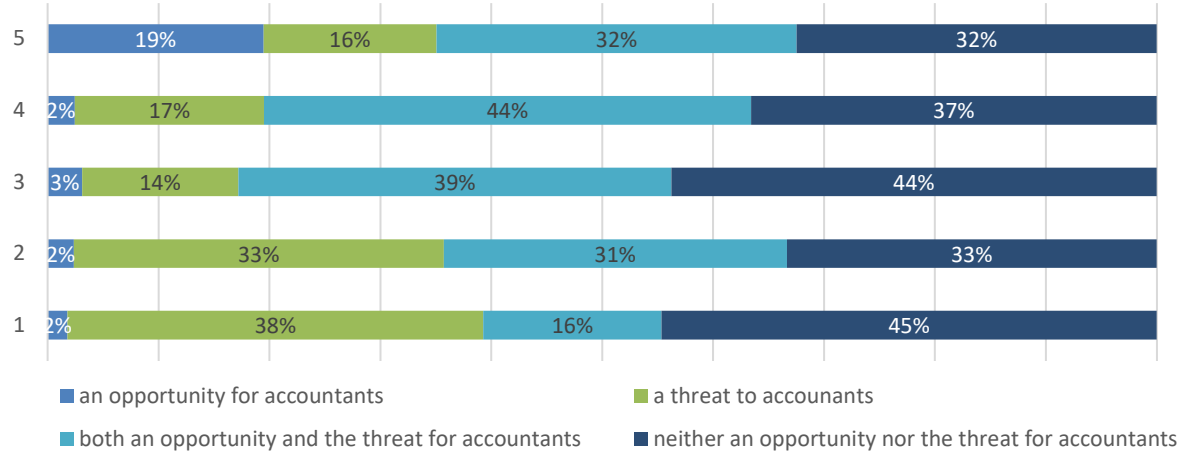

Figure 5. Interest in SR topics (1-5) vs. assessment of opportunities and risks for accountants related to SR
Source: own elaboration.

We also attempted to assess the gender of respondents as a factor influencing their perceptions of UR reporting (Table 3).

Table 3. UR reporting: Opportunity or threat for accountants (by gender in %)

Interest in CSR	Sustainability reporting is for accountants (%):							
	Neither an opportunity nor a threat		Both an opportunity and a threat		Opportunity		Threat	
	W	M	W	M	W	M	W	M
1	25.3	9.5	12.3	0.0	0.0	14.3	35.6	25.0
2	12.0	14.3	16.4	6.3	0.0	14.3	22.2	25.0
3	24.1	38.1	21.9	56.3	7.7	14.3	8.9	25.0
4	12.0	23.8	20.5	18.8	7.7	0.0	15.6	0.0
5	26.5	14.3	28.8	18.8	84.6	57.1	17.8	25.0

Source: own study.

Table 3 shows that almost 85% of women who declare a strong interest in CSR recognise that reporting in this area is an opportunity for accountants. Men are less optimistic in this case. With regard to risks, it can be seen that among women there is a correlation between interest in CSR and the indication of the answer 'risk.' They are, however, distorted with answers '4 and 5'. Despite the lack of a statistically significant correlation, it is worth noting that almost 20% of those declaring a very high interest in the topic consider CSR as an opportunity for accountants. Simultaneously, as many as 37.5% of respondents with very little interest in SR consider sustainability reporting to be a threat to accountants. Only 2% of respondents in this group see sustainability reporting as an opportunity. The lack of a statistically significant relationship between one of the responses and interest in the topic of CSR does not allow for a clear positive verification of hypothesis H3. However, a higher degree of optimism can be observed among respondents, who at the same time declare the highest degree of interest in the topic of CSR.

With regard to hypothesis H4 (There is a correlation between the gender of the respondents and the level of declared interest in the CSR issues), men declare a lower interest in the topic of IR (37%) than women (44%). At the same time, as many as one-third of men were undecided (they marked

the answer '3'). To test for differences between men and women in the level of interest in CSR, the Mann-Whitney test was used. Women scored higher on average (M = 3.23) than men (M = 2.74), and the difference was statistically significant (U = 3696.0, p = 0.0026), supporting the hypothesis of a gender effect. As a result, H4 was positively verified.

In light of hypothesis H5: (There is a correlation between the age of the respondents and their level of declared interest in CSR issues), it is worth emphasising that the highest level of interest in the topic of IR was declared by the oldest accountants (60-70 years). Employees of retirement age may not accurately assess the real risks and opportunities for the profession. They may, for example, be over-optimistic because they are unlikely to be involved in SR. On the one hand, the statement indicated by the largest number of respondents that sustainability reporting is neither an opportunity nor a threat for accountants may indicate their indifferent attitude towards the topic described. However, on the other hand, this attitude is consistent with the answer to questions about the entity that should be responsible for the SR. To verify H5, a Spearman rank correlation test was used to examine the relationship between the age of the respondents and the level of interest in the CSR. The results indicated a very weak and non-significant correlation (r = -0.06, p > 0.05), not confirming hypothesis H5.

RESULTS AND DISCUSSION

Consequently, the area of sustainability reporting as part of Sustainability Accounting will increasingly be attributed to accountants, especially in medium and small companies. It is emphasised that appropriate platforms for SR are becoming increasingly important. However, Rahaman *et al*. (2023) found that the effectiveness of the creation and operation of such platforms is dependent on the level of preparation of accountants in social accounting practice. Helfaya *et al*. (2019) found that preparers of non-financial reports showed a different perspective on their scope and quality than users. They focused more on the practical side of report preparation, whereas users paid more attention to the usefulness of the information contained in the reports. The accountants we surveyed, who fall into the group of preparers, for the most part showed an indifferent attitude towards the SR, typical rather of people who believe that this topic does not concern them. This is confirmed by the partial verification of H1, in which the vast majority of respondents considered that the preparation of SR reports should be handled by specialised departments of business units. Other results were provided by the study of Rahaman *et al*. (2023). One of our findings was that as many as 77.5% of the accountants surveyed agreed with the extent to which social accounting should be practised. Although there is a belief among some accountants about the need to change perceptions of the expectations of the SR area, particularly evident in terms of education level and gender. A study by Grujić and Vojinović (2024) showed that accountants from Bosnia and Herzegovina accept the need for sustainability reporting in their new responsibilities. However, in their opinion, they do not have the appropriate knowledge and tools to perform this task properly. The accountants indicate the need to implement measures to prepare this professional group for sustainability reporting.

In our survey, respondents indicated a fairly low level of familiarity with the CSRD. A survey conducted by Souza *et al*. (2025) among accountants affiliated to the Regional Accounting Council of Goias showed that as many as 80.4% of respondents perceive the lack of regulations as the main obstacle to being adequately prepared for CSR reporting. Slightly fewer (71.7%) of the respondents identified a lack of adequate training on the subject as another important reason for their inadequate preparation. The survey showed that appropriate efforts at government, business, and professional bodies to promote training that could help prepare the accounting community for their new responsibilities are particularly important in this regard. In our survey, the longest-serving employees had the best assessment of their knowledge. This group of respondents also showed the most positive attitude towards SR as an opportunity for the accounting profession in the future. In contrast, research by Gosztonyi (2023) and Shi *et al*. (2019). showed that younger employees (generation Z) are more oriented and sensitive to the issue of SR and related reporting than older employees.

In light of the results obtained, the educational process in the form of studies, training courses in lifelong education in this profession is of particular importance. The pessimistic attitude of the young

respondents may be due to the lack of sufficient integration of this problem in the educational programme at secondary and higher university levels. This is confirmed by research conducted by Fernández Chulián (2011), who advocates the inclusion of sustainability in accounting degree programmes. He emphasises the importance of education in 'constructing' the new accounting model. Such a conclusion is also in line with the results obtained from a survey of accounting faculties in the US, which showed a low degree of formal integration of UR reporting issues into the accounting curriculum (Simmons *et al*., 2024). The deficit and need for training in sustainability accounting is highlighted by Kłobukowska and Wachulak (2024), who surveyed accountants. Thus, the need for specific staff training becomes imperative so that the revised reports reflect the issues addressed with fidelity and integrity.

In our study, women declared more interest in the issue of CSR than men. Research by Bilimoria (2000) indicates that among non-financial reporters, women show greater sensitivity to environmental, social and ethical issues. They are also better versed in IR issues, more sensitive and more positive about sustainability goals than men. Horbach (2018) came to similar conclusions in his research. This is in line with our results, which in principle were the only ones (hypothesis H4) to show a statistically significant relationship. Other studies also indicate that the participation of women in the board of directors has an overall positive impact on the activities and reporting of IR (*e.g.*, Li *et al*., 2017; Bravo & Reguera-Alvarado, 2017). Our results may indicate that accountants in Poland have a slightly different approach to their sustainability reporting obligations than in other countries.

CONCLUSIONS

This section addresses four research questions (RQ1, RQ2, RQ3, RQ4). Our study showed a statistically significant dependence of interest in SR on gender, with no dependence on age, which allows for a partially positive answer to question RQ1. However, this phenomenon manifests differently in Poland than in other countries, as indicated by the conclusions of other studies. Older employees declared a higher level of acceptance and optimism for the future of the profession than younger employees. On the other hand, as in other studies, women declared a greater interest in and level of knowledge about SR than men.

With regard to question RQ2, we should note that the respondents assessed their level of preparation for reporting as quite low, which is linked to the answer to question RQ3. The results showed that the accounting community in Poland is not unanimous in its opinions. Only the group of people who are very interested in CSR assessed the inclusion of their preparation in the scope of accounting duties as an opportunity for the profession. Significantly more people with little interest in these issues assessed them as a threat to the profession. Many accountants now consider that SR is not part of their duties and that they therefore do not need to have expertise in this area. The responses received provide a good introduction to the answer to question RQ4, concerning the knowledge, competence and skills needs of accountants in relation to SR. We believe that it is necessary to introduce and develop a process of education among accountants on SR in various forms. This will be a difficult task given the mindset of accountants and the significant simplifications announced by the EU in this area. There is also a need to popularise the concept of 'sustainability accounting,' which expands the boundaries of the accounting system and raises awareness of the need for a new approach to reporting. It is reasonable to start this process by making accountants aware of the importance of the topic of sustainability, with an indication of the impact on current quality of life, economic stability, social justice, and technological development. We may assume that such an information campaign, aimed directly at accountants, will increase interest in the topic of the SR.

The results of the survey broaden and deepen the knowledge of the attitude of the accounting community in Poland towards the obligation to SR. They also provide a basis for the development of practical solutions for preparing companies for SR. Moreover, they provide important information on the practical side of the accounting profession in Poland. The limitation of the study is the relatively small sample of the survey and the small participation of accountants employed in the largest entities that have been preparing non-financial reports for a long time. The juxtaposition of their opinions with accountants who have not yet recognised their role in this area could be the basis for further in-depth research.

REFERENCES

Adams, C.A., & McNicholas, P. (2007). We are changing the world for the better. Sustainability reporting, accountability and organizational change. *Journal of Accounting, Auditing and Accountability*, *20*(3), 382-402. https://doi 10.1108/09513570710748553

Aguilera, R.V., Rupp, D.E., Williams, C.A., & Ganapathi, J. (2007). Putting the S Back in Corporate Social Responsibility: A Multilevel Theory of Social Change in Organizations. *The Academy of Management Review*, *32*(3), 836-863. https://doi.10.5465/AMR.2007.25275678

Arora, M.P., Lodhia, S., & Stone, G.W. (2023). Accountants' institutional work: a global study of the role of accountants in integrated reporting, *Qualitative Research in Accounting & Management*, *20*(5), 647-674. https://doi.org/10.1108/QRAM-06-2022-0108

Arvidsson, S., & Dumay, J. (2022). Corporate sustainability reporting quantity, quality and performance: Where to now for environmental policy and practice?. *Business Strategy and the Environment*, *31*(3), 1091-1110. https://doi.org/10.1002/bse.2937

Aunt, I.C., Ivan, O.R., & Crisan, E.D. (2022). Non-Financial Reporting of Information Within Companies. Case Study OMV Petrom. Ovidius University Annals. *Economic Sciences Series*, *22*(1). Retrieved from https://ideas.repec.org/a/ovi/oviste/vxxiiy2022i1p815-824.html on February 20, 2025.

Barker, R., & Eccles, R.G. (2019). *Should FASB and IASB be responsible for setting standards for non-financial information?*. Saïd Business School, University of Oxford. https://doi.org/10.2139/ssrn.3272250

Bernardi, R., & Threadgill, V.H. (2010). Women Directors and Corporate Social Responsibility. *Electronic Journal of Business Ethics and Corporate Social Responsibility*, *15*, Retrieved from https://www.researchgate.net/publication/228240247_Women_Directors_and_Corporate_Social_Responsibility on February 20, 2025.

Bilimoria, D. (2000). Building the business case for women corporate directors, In R.J., Burke, M., Mattis (Eds.), Women on Corporate Boards of Directors: *International Challenges and Opportunities* (pp. 25-40), Kluwer Academic Publishers, Dordrecht, The Netherlands.

Biondi, L., Dumay, J., & Monciardini, D. (2020). Using the International Integrated Reporting Framework to comply with EU Directive 2014/95/EU: can we afford another reporting façade?. *Meditari Accountancy Research*, *28*(5), 889-914. https://doi.org/10.1108/MEDAR-01-2020-0695

Boharu (Mircea), R.-M., Șenchea A.D., & Savu A.C. (2022). The Accounting Profession and Addressing Sustainability Issues, "Ovidius" University Annals. *Economic Sciences Series* XXII, *2*, 827-833, Valahia" University of Târgoviste.

Bravo, F., & Reguera-Alvarado, N. (2017). do independent director's characteristics influence financial reporting quality?. *Spanish Journal of Finance and Accounting/Revista Española de Financiación y Contabilidad, 47*(3), 1-19. https://doi.org/10.1080/02102412.2017.1362200

Bucaro, A.C., Jackson K.E., & Lill J.B. (2020). The Influence of Corporate Social Responsibility Measures on Investors' Judgments When Integrated in a Financial Report Versus Presented in a Separate Report. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/1911-3846.12542.pdf on January 2, 2025.

Che Kasim, C.F., Yusoff, H., & Mohd Fahmi, F. (2024). Accountants' roles in sustainability accounting and reporting: The preliminary findings. *Corporate Governance and Organizational Behavior Review*, *8*(2), 50-59. https://doi.org/10.22495/cgobrv8i2p5

Cheng, B., Ioanoou, I., & Serafeim, G. (2024). Corporate social responsibility and access to finance. *Strategic Management Journal, 35*(1), 1-23. https://doi.org/10.1002/smj.2131

Chulian, M.F. (2011). Constructing New Accountants: The Role of Sustainability Education. *Revista de Contabilidad. 14*(1), 241-265. https://doi.org/10.1016/S1138-4891(11)70034-6

Cohen, J., & Simnett, R. (2015). CSR and assurance services: a research agenda. *Audit: A Journal of Practice & Theory, 34*(1). 59-74. https://doi.org/10.2308/ajpt-50876

Cohn, M. (2021). Accountants face challenges with sustainability reporting. *Accounting Today*. Retrieved from https://www.accountingtoday.com/news/accountants-face-challenges-with-esg-reporting on January 17, 2025.

De Villiers, C., Rinaldi, L., & Unerman, J. (2014). Integrated Reporting: Insights, gaps and an agenda for future research. *Accounting, Auditing & Accountability Journal*, *27*(7), 1042-1067. https://doi.org/10.1108/AAAJ-06-2014-1736

Dechow, P. (2023). Understanding the Sustainability Reporting Landscape and Research Opportunities in Accounting. *The Accounting Review*, *98*. 481-493. https://doi.org/10.2308/TAR-2023-0145

Deegan, C., & Unerman, J. (2006). *Financial Accounting Theory*. McGraw-Hill Education, Berkshire.

Di Vaio, A., Syriopoulos, T., Alvino, F., & Palladino, R. (2020). Integrated thinking and reporting towards sustainable business models: A concise bibliometric analysis. *Meditari Accountancy Research*, *29*, 691-719. https://doi.org/10.1108/MEDAR-12-2019-0641

Dumay, J., Frost, G., & Beck, C. (2015). Material legitimacy: Blending organisational and stakeholder concerns through non-financial information disclosures. *Journal of Accounting and Organizational Change*, *11*(1), 2-23. https://doi.org/10.1108/JAOC-06-2013-0057

Dumay, J., La Torre, M., & Farneti, F. (2019). Developing trust through stewardship: Implications for intellectual capital, integrated reporting, and the EU Directive 2014/95/EU. *Journal of Intellectual Capital*, *20*(1), 11-39. https://doi.org/10.1108/JIC-06-2018-0097

Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU with regard to corporate sustainability reporting, 16.12.2022, EN *Official Journal of the European Union*, L 322/15

Egan, M., & Tweedie, D.A. (2018). 'Green' accountant is difficult to find. Can accountants contribute to sustainability management initiatives?. *Accounting, Auditing & Accountability Journal*, *31*(8), 1749-1773.

Fernández Chulián, M. (2011). Constructing New Accountants: the Role of Sustainability Education. *Revista de Contabilidad*, *14*, 241-265. https://doi.org/10.1016/S1138-4891(11)

Ferri, S., Tron, A., Colantoni, F., & Savio, R. (2023). Sustainability Disclosure and IPO Performance: Exploring the Impact of SR Reporting. *Sustainability*, *15*(6). 5144. https://doi.org/10.3390/su15065144

Gosztonyi, M. (2023). Comparative Analysis of X-Y-Z Generation Entrepreneurs in a Semi-Peripheral EU Member Country: Insights from Regularized Regression Techniques. *European Research Studies Journal*, *XXVI*(4), 191-217. https://doi.org/10.35808/ersj/3280

Grant Thornton. (2024). *ESG w polskim biznesie, Czy firmy w Polsce są świadome obowiązków wynikających ze zrównoważonego rozwoju*. Retrieved from https://grantthornton.pl/wp-content/uploads/2024/04/ESG-w-polskim-biznesie-raport-Grant-Thornton.pdf on April 30, 2025.

Grujić, M., & Vojinović, Ž. (2024). Esg reporting in crisis circumstances: readiness and obstacles of accountants in BiH, XXIX International Scientific Conference Strategic Management and Decision Support Systems in Strategic Management SM2024, Subotica (Serbia), 17-18 May 2024. https://doi.org/10.46541/978-86-7233-428-9_411

Helfaya, A., Whittington, M., & Alawattage, C. (2019). Exploring the quality of corporate environmental reporting: Surveying preparers' and users' perceptions. *Accounting, Auditing & Accountability Journal*, *32*(1), 163-193. https://doi.org/10.1108/AAAJ-04-2015-2023

Hoang, T. (2018). 'The Role of the Integrated Reporting in Raising Awareness of Environmental, Social and Corporate Governance (ESG) Performance', Stakeholders, *Developments in Corporate Governance and Responsibility*, *14*, Emerald Publishing Limited, Leeds, (pp. 47-69). https://doi.org/10.1108/S2043-052320180000014003

Horbach, J. (2018). The relevance of personal characteristics and gender diversity for (eco-)innovation activities at the firm-level: Results from a linked employer-employee database in Germany. *Business Strategy and the* Environment, *27*(7), 924-934. https://doi.org/10.1002/bse.2042

Jonsdottir, B., Sigurjonsson, T.O., Johannsdottir, L., & Wendt, S. (2022). Barriers to Using ESG Data for Investment Decisions. *Sustainability*, *14*(9), 5157. https://doi.org/10.3390/su14095157

Kamela-Sowińska, A. (2015). Econo Skutki ekonomiczne realizacji umowy społecznej jako podstawy raportów CSR. *Studia Oeconomica Posnaniensia*, *3*(1), 68-85.

Kłobukowska, J., & Wachulak, E. (2024). Zawód księgowego w Polsce w dobie wyzwań gospodarczych i finansów zrównoważonego rozwoju. *Nauki Ekonomiczne*, *39*, 43-65. https://doi.org/10.19251/ne/2024.39(3)

Krasodomska, J., & Cho, C.H. (2017). Corporate social responsibility disclosure: Perspectives from sell-side and buy-side financial analysts. *Sustainability Accounting, Management and Policy Journal*, *8*(1), 2-19. https://doi.org/10.1108/SAMPJ-02-2016-0006

Lewis, L. (2000). Environmental audits in local government: A useful means to progress in sustainable development. *Accounting Forum*, *24*(3), 296-318. https://doi.org/10.1111/1467-6303.00043

Li, J., Zhao, F., Chen, S., Jiang, W., Liu, T. & Shi, S. (2017). Gender diversity on boards and firms' environmental policy. *Business Strategy and the Environment*, *26*, 306-315. https://doi.org/10.1002/bse.1918

Lozano, R. (2015). A holistic view of sustainability factors in the company. *Corporate Social Responsibility and Environmental Management, 22*(1), 32-44. https://doi.org/10.1002/csr.1325

Lusher, A.L. (2012). What is the Accounting Profession"s Role in Accountability of Economic, Social, and Environmental Issues?. *International Journal of Business and Social Science*, *3*(15), 13-19. https://ijbssnet.com/journal/index/1430

McNally, M.-A., Cerbone, D., & Maroun, W. (2017). Exploring the challenges of preparing an integrated report. *Meditari Accountancy Research*, *25*(4), 481-504. https://doi.org/10.1108/MEDAR-10-2016-0085

Pearce, D., & Turner, R.K. (1990). *Economics of Natural Resources and Environment*. Harvester Wheatsheaf, New York.

Piscitelli, A., & D'Uggento, A.M. (2022). Do young people really engage in sustainable behaviours in their lifestyles?. *Social Indicators Research*, *163*, 1467-1485. https://doi.org/10.1007/s11205-022-02955-0

Özsözgün Ç.A. (2014). "How accounting and accountants may contribute in sustainability?". *Social Responsibility Journal*, *10*(2), 246-267. https://doi.org/10.1108/SRJ-04-2012-0049

Rachel M. (2019). Examination and implications of experimental research on investor perceptions. *Journal of Accounting Literature*, Elsevier, *43*(C). 145-169, https://doi.org/10.1016/j.acclit.2019.11.001

Radu, V., & Tabirca, A.I. (2022). Accounting information systems in the knowledge society. *LUMEN Proceedings*, 8. 258-269 (online), https://doi.org/doi.org/10.18662/lumproc.142

Rahaman, M.M., Chowdhury, A.R., Akter, S., & Rahman, M.Z. (2023). Accountant Perceptions and Attitudes Towards the Social Accounting Practices in Bangladesh. *International Journal of Corporate Finance and Accounting*, *10*(1), 1-19.

Saini, N., Singhania, M., Hasan, M., Yadav, M.P., & Abedin, M.Z. (2022). Non-financial disclosures and sustainable development: A scientometric analysis. *Journal of Cleaner Production*, *381*(1), https://doi.org/10.1016/j.jclepro.2022.135173

Salin, A.S.A.P., Hasan, H.C., Kamarudin, N.N.A.N., & Mad, S. (2024). Formulating A Competency Framework for Accountants on Environment, Social and Governance (ESG) Standards and Finance Digitalization. *Information Management and Business Review, 16*(3(I)), 309-317. https://doi.org/10.22610/imbr.v16i3(I).3857

Salin, A.S.A.P., Hasan, H.C., Kamarudin , N.N.A.N., & Mad, S. (2024). Formulating A Competency Framework for Accountants On Environment, Social and Governance (ESG) Standards and Finance Digitalization. *Information Management and Business Review*, *16*(3(I), 309-317. https://doi.org/10.22610/imbr.v16i3(I).3857

Schaltegger, S., & Zvezdov, D. (2015). Gatekeepers of sustainability information: Exploring the roles of accountants. *Journal of Accounting and Organization Change*, *11*, 333-361.

Schaltegger, S., & Zvezdov, D. (2013). In Control of Sustainability Information: Untangling the Role of Accountants. In L. Songini, A. Pistoni, & C. Herzig (Eds.), Accounting and Control for Sustainability (pp. 265-296). Article 17100582. *Studies in Managerial and Financial Accounting*, *26*. Emerald Publishing Limited, https://doi.org/10.1108/S1479-3512(2013)0000026008

Scherer, A.G., Palazzo, G., & Baumann, D. (2006). Global Policies and Private Entities. Towards a new role for the multinational corporation in global governance. *Business Ethics Quarterly*, *16*, 505-532.

Scherer, A.G., Palazzo, G., & Seidl, D. (2013). Legitimacy management in complex and heterogeneous environments: sustainable development in a globalized world. *Journal of Management Studies*, *50*(2), 259-284. https://doi.org/10.1111/joms.12014

Sciulli, N., & Adhariani, D. (2023). The use of integrated reports to enhance stakeholder engagement. *Journal of Accounting & Organizational Change*, *19*(3), 447-473. https://doi.org/10.1108/JAOC-11-2021-0156

Shi, L., Han, L., Yang, F., & Gao, L. (2019). The Evolution of Sustainable Development Theory: Types, Goals, and Research Prospects. *Sustainability*, *11*, 7158. https://doi.org/10.3390/su11247158

Simmons, V., Serafin, A., Stampone, A., & Rayeski, L.A. (2024). Integrating SR into the Accounting Curriculum: Insights from Accounting Educators. *American Accounting Education*, *39*(2), May 2024, https://doi.org/10.2308/ISSUES-2022-080

Souza, R., Santos, F., Falcao, R., & Ferrara, T. (2025). Barriers and Challenges in the Integration of SR Practices: A Study on the Relevance of Accounting Information and The Role of Accountants*. Revista de Gestão Social e Ambiental*, *19*(3), e011671. https://doi.org/10.24857/rgsa.v19n3-093

Șova, A., & Popa, A. (2022). Embracing the new sustainability reporting landscape. Retrieved from https://www.ceccarbusinessmagazine.ro/imbratisand-noul-peisajul-de-raportare-a-sustenabilitatiiin-romania-a10019/ on April 27, 2025.

Szadziewska, A. (2014). Rola specjalistów z rachunkowości na tle zmian w raportowaniu biznesowym. *Journal of Management and Finance*, *12*(2), 237-254. https://repozytorium.bg.ug.edu.pl/docstore/download.seam?entityType=article&entityId=UOG58cb879851fa4303aa221c56a2e2a6f6&fileId=UOGc9ec0cfd673e4edc8bc1795f1fc86995

Tello, E., Hazelton, J., & Cummings, L. (2016). Potential users' perceptions of general-purpose water accounting reports. *Accounting, Auditing and Accountability Journal*, *29*(1), 80-110. https://doi.org/10.1108/AAAJ-12-2013-1552

Tettamanzi, P., Venturini, G., & Murgolo, M. (2022). Sustainability and financial accounting: A critical review on the ESG dynamics. *Environmental Science and Pollution Research*, *29*(11), 16758-16761. https://doi.org/1007/s11356-022-18596-2

Trzpioła, K. (2024). Raportowanie ESG to nowe wyzwanie także w księgowości. Retrieved from https://www.gazetaprawna.pl/rachunkowosc-i-audyt/artykuly/9407040,raportowanie-esg-to-nowe-wyzwanie-takze-w-ksiegowosci.html on January 22, 2025.

Williams, B., Wimshurst, T., & Clift, R. (2010). *The role of accountants in sustainability reporting – a local government study*. Asia Pacific Interdisciplinary Research in Accounting Conference (APIRA), 1-18.

Zaporowska, Z., & Szczepański, M. (2024). The Application of Environmental, Social and Governance Standards in Operational Risk Management in SSC in Poland. *Sustainability*, *16*(6), 2413. https://doi.org/10.3390/su16062413

Zyznarska-Dworczak, B. (2022). Sprawozdawczość finansowa i sprawozdawczość ESG w czasach niepewności. *Zeszyty Teoretyczne Rachunkowości*, *46*(4), 161-180. https://doi.org/10.5604/01.3001.0016.1307

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Employment and branch network effects on the efficiency of Polish cooperative banks

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ABSTRACT

Objective: The article aims to evaluate the influence of the employment structure and branch network on the capability of large cooperative banks in Poland (possessing assets exceeding PLN 1 billion) to sustain an optimal equilibrium between operational efficiency and liquidity. This article also seeks to identify the causes for the declining efficiency of cooperative banks in Poland in recent years and to evaluate the possibility of implementing solutions to enhance this efficiency.

Research Design & Methods: We used static panel models with data suitable for unit and time series analysis. The sample consisted of large cooperative banks operating in Poland (assets over 1 billion PLN). Statistical analysis involved diagnostic tests, collinearity analysis via VIF, and winsorisation at the first percentile to reduce outlier impact. We used Driscoll-Kraay standard errors to estimate the panel model.

Findings: We established that a high number of employees in a cooperative bank can negatively affect the return on assets (ROA) and lead to an increase in the cost-to-income (CtI) ratio. Similarly, an extensive branch network can lead to a decrease in the efficiency of assets used (ROA) and an increase in the CtI ratio. On the other hand, a higher bank's total assets-to-employee ratio is associated with a lower CtI ratio, suggesting improved cost efficiency. Moreover, banks with higher assets per branch achieve higher profitability (higher ROA) and better cost efficiency (lower CtI).

Implications & Recommendations: The results of our study imply that optimising the staffing structure and branch network is crucial to achieve a balance between profitability and cost efficiency in cooperative banks. The solution to the problem could be employment restructuring, the implementation of process automation technologies, precise staff planning, and investment in the development of employee competence. We also suggest optimising costs related to the branch network, implementing modern technologies, and performing operational restructuring. Cooperative banks should strive to increase the efficiency of asset allocation.

Contribution & Value Added: The article comprehensively analyses of impact of the employment structure and the branch network on the efficiency and liquidity of large cooperative banks, which complements previous research focusing mainly on financial aspects. We provided empirical evidence of the complex nature of the relationship between organisational factors and the financial performance of cooperative banks in Poland.

Article type: research article

Keywords: cooperative banks; efficiency; liquidity; employment; branch network

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INTRODUCTION

Cooperative banks play an important role in financial stability and local economic development. Cooperative banks are less involved in systemic risk mechanisms, contributing to financial stability (Pacelli *et al*., 2019). Studies indicate that cooperative banks are more stable than commercial banks due to, among others, a stable customer base. However, it affects their relatively lower profitability and capi-

talisation (Hesse & Čihák, 2007). Cooperative banks contribute to local community income, employment growth, and the development of local businesses (Coccorese & Shaffer, 2018). Furthermore, cooperative banks provide tailored financial services to SMEs, which often face significant difficulties in accessing credit offered by commercial banks (Nisha & Rani, 2024). Cooperative banks are especially crucial in crisis situations, where their influence on local communities becomes significantly impactful (Ramcharan *et al*., 2016). We observed this phenomenon also during the recent macroeconomic upheavals associated with the COVID-19 pandemic and the war in Ukraine, among other events.

The development of cooperative banks also has an important impact on the financial inclusion of society. Through their activities in smaller towns and rural areas, they are taking care of access to a wide range of financial products and services from various actors in the financial, non-financial, and governmental sectors. Moreover, as a result of the increasing digitalisation in finance, cooperative banks are expanding their activities in urban areas and are increasingly courting young customers for financial services. However, the infrastructure of cooperative banks based on relatively high staffing levels and numerous bank branches, located especially in smaller towns and cities, can significantly affect the efficiency of cooperative banks' operations. Therefore, there has been a strong trend in recent years toward a significant increase in the knowledge of cooperative banks' employees, as indicated by the fact that they have placed greater emphasis on educating their staff (Piasecki, 2024).

Previous studies on cooperative bank efficiency and liquidity have mainly focused on financial factors, including balance sheet composition, lending policy, or return on equity. However, there is a lack of comprehensive studies on the impact of the staffing structure and the number and distribution of branches on the ability of cooperative banks to maintain an optimal balance between operational efficiency and liquidity. In particular, few studies compare these relationships in large cooperative banks (with assets greater than PLN 1 billion), which operate on a larger scale and may exhibit different resource management mechanisms compared to smaller institutions. This study aims to fill this gap by assessing the impact of organisational factors on the financial stability and competitiveness of large cooperative banks.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

In recent years, the significant increase in costs (*e.g.*, related to staff remuneration levels and maintaining the branch network) poses a major challenge to the operation of cooperative banks in terms of maintaining high levels of efficiency and liquidity. Research findings indicate that compared to commercial banks, cooperative banks, display a more stable workforce and an older workforce (Bossler & Schild, 2016). Furthermore, it has been proven that larger cooperative banks, compared to smaller banks, have lower systemic and business risks, better asset quality, are more orientated towards financing the local real economy and towards the satisfaction of their customers (borrowers and depositors) (Venanzi & Matteucci, 2021). However, the high level of staffing and the number of branches may affect their profitability, efficiency, and liquidity. Therefore, the article sets out a research hypothesis:

H1: Optimising the branch structure and employment in cooperative banks positively affects their profitability, cost efficiency, and liquidity, contributing to their resilience to crises.

We aimed to identify the reasons for the low and deteriorating efficiency of cooperative banks in Poland in recent years and to assess the possibility of applying solutions and instruments that allow cooperative banks to achieve improvement in efficiency. In the literature, scholars have conducted analyses of the development of Polish cooperative banks most often in the area of threats to their efficiency. The literature provides research mainly in the area of macroeconomic factors, the current associative model, the structure of revenues and costs, the role of shareholders in the functioning of cooperative banks, changes in postcrisis regulatory burdens, the extent of centralisation and commonality of processes, and digital development. The results indicate that in light of the current macroeconomic and regulatory environment, it is important for cooperative banks to take advantage of economies of scale, with the need to preserve the social and regional aspects of the business and opportunities in the technological area to build a new relational approach based on digital proximity (Kil *et al*., 2020).

Cooperative banks continue to play a systemic role in key European countries such as Austria, Finland, France, Germany, the Netherlands, and Italy (Lang *et al.*, 2016; Poli, 2019; Migliorelli & Lamarque 2022). The high-interest-rate situation in Poland allows banks to make great profits. However, the strong growth of net profits in cooperative banks is due to their traditionally greater reliance on interest income generation (Groeneveld, 2023). Therefore, it is worth paying particular attention to the cost side in view of possible future declines in interest income.

RESEARCH METHODOLOGY

To verify the research hypothesis set out in the introduction, we used data on 19 cooperative banks with total assets exceeding PLN 1 billion at the end of 2024 (Table 1). The research period covered the years 2020-2024 (quarterly data). The analysis used both aggregated data at the national level, derived from the Central Statistical Office database (GUS, 2025), and individual bank data, obtained from the BPS Association Protection System (System Ochrony Zrzeszenia BPS).

Table 1. List of banks with a balance sheet total above PLN 1 billion at the end of 2024

Bank name
Bank Spółdzielczy w Białej Podlaskiej
Bank Spółdzielczy w Białej Rawskiej
Bank Spółdzielczy w Bieczu
Bank Spółdzielczy w Jarosławiu
Bank Spółdzielczy w Kielcach
Bank Spółdzielczy w Limanowej
Bank Spółdzielczy w Oleśnicy
Bank Spółdzielczy w Ostrowi Mazowieckiej
Bank Spółdzielczy w Piasecznie
Bank Spółdzielczy w Płońsku
Bank Spółdzielczy w Skierniewicach
Gospodarczy Bank Spółdzielczy w Barlinku
Małopolski Bank Spółdzielczy
Mikołowski Bank Spółdzielczy w Mikołowie
Nadsański Bank Spółdzielczy
Polski Bank Spółdzielczy w Wyszkowie
Powiatowy Bank Spółdzielczy w Sokołowie Podlaskim
Powiślański Bank Spółdzielczy w Kwidzynie
Warszawski Bank Spółdzielczy

Source: own study based on the SOZ BPS data.

The data collected were panel data, which allowed for an analysis that varied between units and time. As Dańska-Borsiak (2011) notes, the use of panel data contributes to increasing the number of degrees of freedom, reducing the collinearity problem, and facilitating the identification of economic models and the choice between competing hypotheses, while eliminating or reducing the burden on estimators.

To verify the H1, we decided to use dynamic panel models. However, despite a number of attempts, using both the first-difference estimator (Arellano & Bond, 1991) and the system estimator (Blundell & Bond, 1998), it was not possible to build an adequate model. Model significance problems, demonstrated by Hansen's test, and an excessive number of instruments relative to the number of observed units, even when using the instrument reduction (collapse) option (Roodman, 2009; Dańska-Borsiak, 2011), prevented a correct interpretation of the results obtained. Consequently, we decided to use static panel models. As part of the statistical analysis, we conducted the following diagnostic tests:

- Breusch-Pagan – to assess the functional validity of static panel models;
- Hausman – to choose between a fixed effects (FE) model and a random effects (RE) model;
- Wooldridge (Drukker, 2003; Wooldridge, 2003) – for the diagnosis of first-order autocorrelation;

– Pesaran (Pesaran, 2003; 2004) – for analysis of the spatial dependence of the random component between panels;
– modified Wald test – used, where possible, to assess heteroskedasticity.

In addition to the aforementioned tests, we also performed a collinearity analysis using the Variance Inflation Factor (VIF). Moreover, we applied winsorisation at the first percentile level to minimise the outliers' impact. Based on the statistical test results obtained, we decided to estimate panel models using Driscoll-Kraay standard errors (Driscoll & Kraay, 1998; Hoechle, 2007; Rzońca *et al*., 2013; Sztaudynger, 2018).

Table 2 shows the characteristics of the variables used, while the Appendix provides the descriptive statistics of the panel variables. We performed calculations using Gretl software.

Table 2. Characteristics of the variables used in the panel study

Dependent Variables – ZM.ZAL	
ROA	Return on assets (net)
CtI	Cost-to-income ratio
LCR	Liquidity coverage ratio (ratio of liquid assets to net outflows)
Experimental Variables – ZM.EKSP	
LN_BRANCHES	Natural logarithm of the number of bank branches (excluding the bank headquarters)
LN_EMPL	Natural logarithm of bank employment
TA_EMPL	Ratio of bank assets (in million PLN) to the number of bank employees
TA_BRANCHES	Ratio of bank assets (in million PLN) to the number of bank branches
Bank-Level Control Variables – ZM.BANK	
LN_TA	Natural logarithm of total assets
LOAN_TA	Loan-to-asset ratio
NPL	Ratio of non-performing loans (NPL) to total loans
TCR	Total capital ratio
Macroeconomic Control Variables – ZM.EKON	
GDP	Gross Domestic Product growth (quarter-on-quarter)
CPI	Inflation (quarter-on-quarter)
BC_R	NBP (National Bank of Poland) reference rate (as at the end of the given period)

Source: own study based on the SOZ BPS data.

Depending on the result of the Hausman test, the final functional form of the model adopted in the subsequent analysis was as follows:

– Fixed effects model (FE):

$$ZM.ZAL_{it} = \alpha_i + \beta_1 ZM.EKSP_{it} + \beta 2 ZM.BANK_{it} + \beta 3 ZM.EKON_{it} + \varepsilon_{it} \quad (1)$$

in which:

i - period number;
t - object number;
$\mathrm{ZM.ZAL}$ - dependent variables (ROA, CtI, LCR);
$\mathrm{ZM.EKSP}$ - experimental variables (LN_BRANCHES or LN_EMPL);
$\mathrm{ZM.BANK}$ - bank-level control variables (LN_TA, LOAN_TA, NPL, TCR);
$\mathrm{ZM.EKON}$ - control variables at the macroeconomic level (GDP, CPI, BC_R)
ε_{it} - random component.

– Random effects model (RE):

$$ZM.ZAL_{it} = \alpha_i + \beta_1 ZM.EKSP_{it} + \beta 2 ZM.BANK_{it} + \beta 3 ZM.EKON_{it} + v_{it} \quad (1)$$

in which:

i - period number;
t - object number;
$\mathrm{ZM.ZAL}$ - dependent variables (ROA, CtI, LCR);

$ZM.EKSP$ - experimental variables (LN_BRANCHES or LN_EMPL);
$ZM.BANK$ - bank-level control variables (LN_TA, LOAN_TA, NPL, TCR)
$ZM.EKON$ - control variables at the macroeconomic level (GDP, CPI, BC_R)
v_{it} - random error component consisting of an individual effect (αi) and pure random error (εit).

RESULTS AND DISCUSSION

Table 3 presents the results of the panel models on the impact of the number of employees in cooperative banks.

Analysis of the results indicates that a large number of employees in a cooperative bank can generate significant consequences in terms of profitability and cost efficiency. The observed negative impact of the number of employees on ROA may suggest that high staffing levels may translate into a reduction in the efficiency of assets used by the cooperative bank, which, in view of the relatively high interest income in cooperative banks, may have important implications for the sustainability of these institutions. This may be due to the bank generating high operating costs that are not adequately offset by income. The causes of this phenomenon can include overstaffing, inefficient personnel management, insufficient automation of operational processes, and organisational structures that prevent full exploitation of the potential of staff. Simultaneously, there was a positive impact of the number of employees in CtI, which may indicate that costs are increasing faster than revenues generated. This may be the result of high salary and benefit costs, suboptimal distribution of responsibilities, and difficulties in optimising operational processes in an environment of increased employment.

These results imply that cooperative banks with a larger number of employees may experience profitability and cost efficiency problems, which may be due to a mismatch between the staffing structure and the actual bank needs. A solution to this problem could be employment restructuring, including the implementation of technologies that automate administrative and operational processes, precise workforce planning based on current workload and projected revenues, and investment in staff competence development to increase productivity.

In conclusion, the results of the study indicate that the high number of employees in cooperative banks can lead to a decrease in the profitability of assets and an increase in the cost/income ratio, which can imply the need to optimise employment and implement effective cost control mechanisms to improve the long-term performance of the bank.

The analysis of the results shows that the number of cooperative bank branches can be a complex phenomenon. Its effects are reflected in the results for the profitability indicators (ROA) and cost efficiency (CtI) (Table 4).

The observed negative impact of the number of branches on ROA may suggest that an expanded branch network may lead to a decrease in the efficiency of the assets used by the bank. We can assume that the expansion of the branch network structure may be associated with an increase in fixed costs, such as rental fees, salaries, and administrative costs, which are not compensated by an adequate increase in revenue. Consequently, cooperative banks may have to implement stricter cost management strategies, which could allow them to limit the negative impact of the high number of branches on profitability.

The positive impact of the number of branches on CtI confirms the previous conclusions of the ROA result. We may associate a large number of branches with a higher cost-to-income ratio. An increase in the CtI ratio may imply the need to optimise internal processes, including the implementation of modern technology and operational restructuring, to minimise the cost inefficiencies associated with running too many branches.

These results may imply that cost optimisation, the implementation of modern technologies and appropriate branch management may be key elements to achieve a balance between expansion and maintaining high operational efficiency.

Table 3. Panel model estimation results for the experimental variable: Number of bank employees

Model number	1	2	3
Estimation method	**RE**	**FE**	**RE**
Variable	**ROA**	**CtI**	**LCR**
LN_EMPL	-0.005* (0.003)	0.393*** (0.146)	1.313 (1.200)
LN_TA	0.006 (0.004)	-0.034 (0.057)	-1.258*** (0.305)
LOAN_TA	0.013*** (0.004)	-0.108 (0.109)	-9.565*** (1.006)
NPL	-0.010 (0.019)	-0.150* (0.088)	-3.663* (2.105)
TCR	0.060*** (0.022)	-0.137 (0.298)	3.884* (2.034)
GDP	0.013 (0.020)	0.061 (0.154)	1.028** (0.401)
CPI	-0.096 (0.063)	-0.595 (1.033)	-14.717*** (4.147)
BC_R	0.240*** (0.036)	-4.433*** (0.484)	-7.028*** (1.794)
Const.	-0.117 (0.074)	-0.500 (1.196)	27.709*** (5.752)
Breusch-Pagan Test	0.0000	0.0000	0.0000
Hausman Test	0.3281	0.0038	0.6474
Wooldridge Test	0.0002	0.0001	0.1042
Wald Test	–	0.0000	–
Pesaran Test	0.0000	0.0000	0.0000
VIF (max)	2.2470	2.2470	2.2470

Note: Estimation Method: FE – Fixed Effects Model, RE – Random Effects Model. Number of Observations: 380. Number of Banks: 19. Robust Standard Errors: Driscoll-Kraay standard errors reported in parentheses. P-values are given for statistical tests. *** significance at 1% level, ** significance at 5% level, *significance at 10%.
Source: own study in Gretl.

Table 4. Panel model estimation results for the experimental variable: number of bank branches

Model number	4	5	6
Estimation method	**FE**	**FE**	**RE**
Variable	**ROA**	**CtI**	**LCR**
LN_BRANCHES	-0.015*** (0.003)	0.170*** (0.027)	-0.362 (0.352)
LN_TA	0.009* (0.005)	-0.061 (0.06)	-0.824*** (0.303)
LOAN_TA	0.014 (0.009)	-0.048 (0.123)	-8.508*** (1.037)
NPL	0.002 (0.010)	-0.110 (0.117)	-3.283* (1.964)
TCR	0.051** (0.026)	-0.027 (0.297)	3.469* (1.991)
GDP	0.011 (0.019)	0.016 (0.150)	0.660* (0.377)
CPI	-0.096 (0.061)	-0.776 (1.019)	-15.235*** (4.293)
BC_R	0.219*** (0.035)	-4.335*** (0.424)	-8.256*** (1.901)
Const.	-0.165	1.492	25.854***

Model number	4	5	6
Estimation method	FE	FE	RE
Variable	ROA	CtI	LCR
	(0.113)	(1.208)	(6.058)
Breusch-Pagan Test	0.0000	0.0000	0.0000
Hausman Test	0.0088	0.0250	0.1376
Wooldridge Test	0.0002	0.0001	0.1316
Wald Test	0.0000	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000
VIF (max)	2.0840	2.0840	2.0840

Note: Estimation Method: FE – Fixed Effects Model, RE – Random Effects Model. Number of Observations: 380. Number of Banks: 19. Robust Standard Errors: Driscoll-Kraay standard errors reported in parentheses. P values are given for statistical tests. *** significance at 1% level, ** significance at 5% level, *significance at 10%.
Source: own study in Gretl.

The results of the study indicate that the ratio of total assets of a bank to the number of employees shows a significant and negative effect on the dependent variable CtI (Table 5). This may imply that banks with a high ratio of total bank balance sheet to employees may have lower costs in relation to revenue generated. Such an effect may suggest that a higher level of assets per employee may contribute to improving the bank's cost efficiency. Perhaps this effect is due to economies of scale, *i.e.*, an increase in total assets need not be proportionately correlated with an increase in headcount, allowing

Table 5. Results of the panel model estimation for the experimental variable: Ratio of total assets to bank employees

Model number	7	8	9
Estimation method	RE	FE	RE
Variable	ROA	CtI	LCR
TA_EMPL	0.000 (0.000)	-0.016** (0.007)	-0.094 (0.124)
LN_TA	0.004 (0.004)	0.186* (0.111)	-0.114 (1.271)
LOAN_TA	0.010** (0.004)	0.041 (0.136)	-9.141*** (1.109)
NPL	-0.011 (0.019)	-0.052 (0.120)	-3.341* (1.940)
TCR	0.062*** (0.022)	-0.122 (0.281)	3.963** (1.931)
GDP	0.014 (0.020)	-0.024 (0.161)	0.734* (0.418)
CPI	-0.093 (0.063)	-0.706 (0.998)	-14.989*** (4.333)
BC_R	0.242*** (0.036)	-4.622*** (0.422)	-7.67*** (1.765)
Const.	-0.086 (0.082)	-3.057 (2.301)	10.95 (25.213)
Breusch-Pagan Test	0.0000	0.0000	0.0000
Hausman Test	0.7860	0.0416	0.5990
Wooldridge Test	0.000	0.0001	0.1066
Wald Test	-	0.0000	-
Pesaran Test	0.000	0.0000	0.0000
VIF (max)	2.2780	2.2780	2.2780

Note: Observations: 380. Number of Banks: 19. Robust Standard Errors: Driscoll-Kraay standard errors reported in parentheses. P-values are given for statistical tests. *** significance at 1% level, ** significance at 5% level, *significance at 10%.
Source: own study in Gretl.

for more efficient cost management. This result implies that human resource management and appropriate asset allocation may be the key to improving the cost efficiency of a cooperative bank.

The results indicate that the ratio of a bank's total assets to the number of branches is an important indicator affecting profitability and cost efficiency (Table 6). The results obtained indicate that a higher value of assets per branch may be associated with a significant increase in ROA, which may suggest a better use of resources by branches and higher profitability. At the same time, we can observe a negative effect of the ratio in question on the CtI ratio. This may imply that banks with higher assets per branch have lower costs in relation to the income generated. In general, these results suggest that optimising asset allocation in the context of the branch structure may contribute to improving profitability and cost efficiency.

Table 6. Results of panel model estimation for the experimental variable: ratio of total assets to number of bank branches

Model number	**10**	**11**	**12**
Estimation method	**FE**	**FE**	**RE**
Variable	**ROA**	**CtI**	**LCR**
TA_BRANCHES	0.000*** (0.000)	-0.002*** (0.000)	0.007*** (0.002)
LN_TA	-0.008 (0.005)	0.122** (0.049)	-1.401*** (0.341)
LOAN_TA	0.009 (0.009)	0.019 (0.122)	-8.52*** (1.161)
NPL	0.005 (0.011)	-0.134 (0.118)	-3.097 (2.006)
TCR	0.052** (0.025)	-0.051 (0.286)	3.337* (2.011)
GDP	0.014 (0.020)	-0.021 (0.156)	0.735** (0.362)
CPI	-0.091 (0.063)	-0.823 (1.001)	-14.99*** (4.201)
BC_R	0.231*** (0.036)	-4.485*** (0.408)	-8.200*** (1.545)
Const.	0.153 (0.118)	-1.726 (1.057)	36.374*** (7.453)
Breusch-Pagan Test	0.0000	0.0000	0.0000
Hausman Test	0.0109	0.0346	0.1151
Wooldridge Test	0.0002	0.0001	0.1338
Wald Test	0.0000	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000
VIF (maks.)	2.101	2.101	2.101

Note: Estimation Method: FE – Fixed Effects Model, RE – Random Effects Model. Number of Observations: 380. Number of Banks: 19. Robust Standard Errors: Standard errors are reported in parentheses. P-values are given for statistical tests. *** significance at the 1% level, ** significance at the 5% level, *significance at 10%.
Source: own study in Gretl.

Researchers draw similar conclusions from other studies available in the literature. A study by Juszczyk *et al*. (2015) shows that the number of employees in cooperative banks negatively impacts return on equity (ROE) and return on assets (ROA), and furthermore contributes to a reduction in net profit and financial margins, indicating that an increase in staffing levels can increase banks' operating costs, thereby reducing their efficiency. Barra *et al*. (2025) also argue that an increase in the network of bank branches contributes significantly to an increase in maintenance costs, which is associated with a decrease in the efficiency of resource utilisation and, consequently, can also negatively affect the bank's cost efficiency. Bernini and Brighi (2017) contribute by adding that the expansion of branch networks

generates significant investment costs in human and physical capital, which also negatively affects bank efficiency, although banks themselves see their branches as an effective channel for generating revenue.

To assess the stability of the results obtained, we conducted an additional robustness check of the panel models. The analysis procedure consisted of replacing highly correlated explanatory variables, implementing new control variables and estimating the models using a different method, in this case, the least squares method. The analysis showed that the above modifications did not qualitatively affect the results of the study, and the interpretation of the results so far remained unchanged (see Appendix, Table A4-A9).

CONCLUSIONS

Summarising the results of the study, we can conclude that both the number of branches and the level of employment in cooperative banks can influence key indicators of profitability and cost efficiency.

The bank's branch network shows a significant, albeit different, impact on the individual dependent variables. The number of branches has a negative impact on ROA, suggesting a reduction in asset utilisation efficiency, probably due to an increase in fixed costs (*e.g.*, rent, administration, employment) with inadequate levels of income. However, this impact can simultaneously increase the CtI ratio, implying that costs will increase faster than revenues.

The analysis of the impact of the number of employees confirms that an increase in staff can have a negative impact on ROA and CtI. That is, an increase in headcount generates higher costs that are not adequately compensated for by an increase in revenue, resulting in a reduction in the bank's operational efficiency. This implies that an increase in employment should be reflected in a parallel increase in revenue.

Additional research on the bank's total assets-to-employee ratio indicates that higher assets per employee are associated with lower CtI. This result may suggest that the efficient use of human resources, as measured by asset value per employee, may contribute to improving a bank's cost efficiency.

Further analysis of the ratio of total assets to number of branches shows that banks with higher assets per branch achieve higher profitability (higher ROA) and better cost efficiency (lower CtI).

In summary, the results of the study may indicate that the optimisation of both the branch structure and the staff is key to achieving a balance between profitability and cost efficiency. Cooperative banks should aim to increase the efficiency of their asset allocation to reduce costs, while at the same time maintaining an appropriate funding structure that will allow them to remain resilient to potential liquidity crises.

The results obtained may influence supervisory and regulatory decisions concerning the cooperative banking sector in Poland, as well as the management boards of cooperative banks, for decision-making purposes, as to the day-to-day operations. The study focused on large cooperative banks (with assets above PLN 1 billion), which may limit the generalisability of the results to smaller institutions in this sector. Future research could focus on comparing the impact of staffing structure and branch network on the efficiency of small and large cooperative banks and examining the impact of digitalisation and technological developments on optimising staffing structure and branch network.

REFERENCES

Arellano, M., & Bond. S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, *58*(2), 277-297. https://doi.org/10.2307/2297968

Barra, C., Papaccio, A. & Ruggiero, N. (2025). Management Cost Efficiency and Technology Gap: Cooperative vs. Non-Cooperative Credit Banks. Journal of the Knowledge Economy. https://doi.org/10.1007/s13132-025-02612-0

Bernini, C., & Brighi, P. (2017). Bank branches expansion, efficiency and local economic growth. *Regional Studies*, *52*(10), 1332-1345. https://doi.org/10.1080/00343404.2017.1380304

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*. https://doi.org/10.1016/S0304-4076(98)00009-8

Bossler, M., & Schild, C-J. (2016).The employment structure of cooperative banks – a test of institutional hypotheses. *European Economics: Labor & Social Conditions eJournal*, *87*(1). https://doi.org/10.1111/apce.12084

Coccorese, P., & Shaffer, S. (2018). Cooperative Banks and Local Economic Growth. *CAMA Working Paper*, 11/2018. Available at SSRN: https://ssrn.com/abstract=3125909 or https://doi.org/10.2139/ssrn.3125909

Dańska-Borsiak, B. (2011). *Dynamiczne modele panelowe w badaniach ekonomicznych*. Łódź, Wydawnictwo Uniwersytetu Łódzkiego.

Driscoll, J.C., & Kraay, A. (1998). Consistent Covariance Matrix Estimation With Spatially Dependent Panel Data. *The Review of Economics and Statistics, MIT Press*, *80*(4). https://doi.org/10.1162/003465398557825

Drukker, D.M. (2003). Testing for serial correlation in linear panel-data models. *Stata Journal*, *3*(2). https://doi.org/10.1177/1536867X0300300206

Kil, K., Folwarski, M. & Walitza, A. (2020). *Optymalne ścieżki dojścia do zbudowania efektywności banków spółdzielczych*. Warszawa, WIB.

Groeneveld, H. (2023). European Co-operative Banks in 2022: A Concise Assessment (October 30, 2023). Available at SSRN. https://doi.org/10.2139/ssrn.4641319

GUS (2025). Retrieved from https://stat.gov.pl/wskazniki-makroekonomiczne/ on March 12, 2025.

Hesse, H., & Cihak, M. (2007). Cooperative Banks and Financial Stability. *IMF Working Paper*, *07*(02). Retrieved from SSRN: https://ssrn.com/abstract=956767 on March 12, 2025.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, *7*. https://doi.org/10.1177/1536867X0700700301

Juszczyk, S., Balina, R., & Kowalski, O. (2015). Efficiency Determinants of Cooperative Banks in Poland in 2005-2012. *Krakow Review of Economics and Management Zeszyty Naukowe Uniwersytetu Ekonomicznego W Krakowie*, *10*(934), 35-50. https://doi.org/10.15678/ZNUEK.2014.0934.1003

Lang, F., Signore, S., & Gvetadze, S. (2016). The role of cooperative banks and smaller institutions for the financing of SMEs and small midcaps in Europe. *EIF Working Paper, 2016*(36).

Migliorelli, M., & Lamarque, E. (2022). *Contemporary Trends in European Cooperative Banking*. Palgrave Macmillan. (No. hal-03665298).

Nisha, & Rani, R. (2024). Co-operative Banks – A Helping Hands for Small and Medium Entrepreneurs in Saharanpur District. *Integrated Journal for Research in Arts and Humanities*, *4*(2). https://doi.org/10.55544/ijrah.4.2.3

Pacelli, V., Pampurini, F., & Sylos Labini, S. (2019). The peculiarity of the cooperative and mutual model: evidence from the European banking sector. *Journal of Financial Management, Markets and Institutions*, *07*(01). https://doi.org/10.1142/S2282717X19400012

Pesaran, M.H. (2003). A Simple Panel Unit Root Test in the Presence of Cross Section Dependence. *University of Cambridge, Cambridge Working Papers in Economics*, 0346. https://doi.org/10.2139/ssrn.457280

Pesaran, M.H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels. *CESIFO Working Papers Series*, 1229, *IZA Discusion Paper* 1240. https://doi.org//10.2139/ssrn.572504

Piasecki, P. (2024). The influence of training, membership and employee age on turnover intention in co-operative financial institutions. *International Journal of Contemporary Management*, *6*(1), 109-124. https://doi.org/10.2478/ijcm-2024-0005

Poli, F. (2019). *Co-operative banking networks in Europe*. Cham: Palgrave Macmillan.

Ramcharan, R., Verani S., & Skander J. (2016). From Wall Street to Main Street: The Impact of the Financial Crisis on Consumer Credit Supply. *The Journal of Finance*, *71*(3), 1323-1356. https://doi.org/10.1111/jofi.12209

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9. https://doi.org/10.1177/1536867X0900900106

Rzońca, A., Ciżkowicz, P., & Albinowski, M. (2013). Links between the trust in the ECB and its interest rate policy. Warsaw, Economic Institute, *NBP Working Paper*, *158*. Retrieved from https://static.nbp.pl/publikacje/materialy-i-studia/158_en.pdf on March 12, 2025.

Sztaudynger, M. (2018). Czynniki makroekonomiczne a spłacalność kredytów konsumpcyjnych. *Gospodarka Narodowa*, *4*(296). https://doi.org/10.33119/GN/102228

Venanzi, D., & Matteucci, P. (2021). The largest cooperative banks in Continental Europe: a sustainable model of banking. *International Journal of Sustainable Development & World Ecology*, *29*(1), 84-97. https://doi.org/10.1080/13504509.2021.1919784

Wooldridge, J.M. (2003). *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press, https://doi.org/10.1007/s00712-003-0589-6

APPENDIX

Table A1. Characteristics of additional independent variables used in the panel study for robustness Check

Bank-Level Control Variables – ZM.BANK	
LOAN_DEPO	Loan-to-deposit ratio
A_QUAL	Ratio of impaired assets to total assets
LOAN_D	Loan growth (quarter-on-quarter)
DEPO_D	Deposit growth (quarter-on-quarter)
TIER_I	Tier I capital ratio
Macroeconomic Control Variables – ZM.EKON	
UN	Unemployment rate (registered unemployment rate at the end of the period)
Source: own elaboration.	

Note: Table A1 provides a detailed description of additional independent variables included in the robustness check of panel models.
Source: own elaboration.

Table A2. Statistics for variables used in the panel study

Variable	Mean	Median	Minimum	Maximum	Standard Deviation
ROA	0.0143	0.0128	0.0010	0.0456	0.0108
CtI	0.5027	0.4557	0.2166	0.8929	0.1622
LCR	3.7399	3.2027	1.5511	10.4160	1.8113
LN_EMPL	5.0055	5.0434	4.1744	5.4806	0.2853
LN_BRANCHES	2.8235	2.7726	1.6094	3.4657	0.3182
TA_EMPL	8.4752	7.8242	4.5006	21.8000	2.6299
TA_BRANCHES	76.4070	70.8590	32.4270	198.1800	26.4150
LN_TA	20.9190	20.8910	20.4650	21.5880	0.2351
LOAN_TA	0.4432	0.4425	0.2166	0.6716	0.1039
NPL	0.1077	0.0961	0.0278	0.3567	0.0561
LOAN_DEPO	0.4936	0.4844	0.2352	0.7521	0.1199
LOAN_D	0.0036	-0.0002	-0.0796	0.1616	0.0351
DEPO_D	0.0253	0.0229	-0.1140	0.1483	0.0463
TCR	0.1903	0.1835	0.1269	0.2961	0.0367
TIER_I	0.1787	0.1730	0.0991	0.2961	0.0399
A_QUAL	0.0194	0.0145	-0.0069	0.1123	0.0209
GDP	0.0072	0.0095	-0.0920	0.0680	0.0288
UN	0.0548	0.0535	0.0490	0.0640	0.0046
CPI	0.0057	0.0020	-0.0040	0.0320	0.0080
BC_R	0.0373	0.0575	0.0010	0.0675	0.0281

Note: This Table shows the descriptive statistics of the variables used in the baseline and robustness testing of the models. *i.e.*, mean, median, minimum, maximum, and standard deviation. Table 1 and Table A1 define all variables.
Source: own calculations in Gretl.

Table A3. Correlation matrix for the variables used in the panel study

	ROA	CtI	LCR	LN_TA	LOAN_TA	NPL	LOAN_DEPO
ROA	1						
CtI	-0.831	1					
LCR	0.114	-0.097	1				
LN_TA	0.404	-0.338	0.046	1			
LOAN_TA	-0.233	0.273	-0.384	-0.022	1		
NPL	-0.354	0.262	-0.196	-0.237	0.16	1	
LOAN_DEPO	-0.153	0.206	-0.396	0.003	0.994	0.133	1
LOAN_D	0.085	0.017	-0.045	0.123	0.045	-0.054	0.062
DEPO_D	-0.036	0.128	0.064	0.154	-0.139	-0.064	-0.132
TCR	0.568	-0.508	0.099	0.257	-0.439	-0.394	-0.371
TIER_I	0.56	-0.541	0.188	0.305	-0.459	-0.489	-0.399
A_QUAL	-0.447	0.422	-0.17	-0.197	0.407	0.88	0.362
TA_EMPL	0.399	-0.488	-0.005	0.345	-0.486	-0.206	-0.44
TA_BRANCHES	0.412	-0.453	-0.136	0.418	-0.255	-0.087	-0.204
LN_BRANCHES	-0.149	0.252	0.212	0.31	0.213	-0.092	0.178
LN_EMPL	-0.069	0.213	0.052	0.489	0.406	0.003	0.38
GDP	-0.023	0.068	0.032	0.049	-0.038	-0.004	-0.043
UN	-0.654	0.685	-0.106	-0.354	0.301	0.215	0.247
CPI	-0.163	-0.009	-0.139	-0.146	0.113	0.095	0.082
BC_R	0.747	-0.819	0.064	0.34	-0.33	-0.222	-0.275
	LOAN_D	**DEPO_D**	**TCR**	**TIER_I**	**A_QUAL**	**TA_EMPL**	**TA_BRANCHES**
LOAN_D	1						
DEPO_D	0.215	1					
TCR	0.122	0.131	1				
TIER_I	0.108	0.12	0.946	1			
A_QUAL	-0.06	-0.065	-0.541	-0.611	1		
TA_EMPL	0.041	0.178	0.569	0.565	-0.402	1	
TA_BRANCHES	0.095	0.176	0.441	0.419	-0.302	0.661	1
LN_BRANCHES	0.002	-0.03	-0.252	-0.186	0.157	-0.417	-0.706
LN_EMPL	0.063	-0.022	-0.316	-0.264	0.228	-0.624	-0.304
GDP	0.094	-0.148	0.023	0.029	-0.012	0.048	0.025
UN	-0.101	-0.043	-0.522	-0.485	0.369	-0.357	-0.379
CPI	-0.258	-0.477	-0.353	-0.315	0.122	-0.139	-0.144
BC_R	-0.024	-0.118	0.484	0.45	-0.387	0.348	0.372
	LN_BRANCHES	**LN_EMPL**	**GDP**	**UN**	**CPI**	**BC_R**	
LN_BRANCHES	1						
LN_EMPL	0.704	1					
GDP	0	-0.019	1				
UN	0.144	0.067	0.057	1			
CPI	0.016	-0.004	0.096	0.203	1		
BC_R	-0.161	-0.079	-0.096	-0.85	-0.021	1	

Note: The Table shows Pearson's correlation coefficients for the dependent and independent variables in the baseline and robustness tests of the models. Table 1 and Table A1 define all variables.

Source: own calculations in Gretl.

Table A4. Results of the OLS panel model: Robustness check for the experimental variable: number of bank employees and number of bank branches

Model number	A1	A2	A3	A4	A5	A6
Variable	ROA		CtI		LCR	
LN_EMPL	-0.003*** (0.001)		0.165*** (0.033)		1.887*** (0.466)	
LN_BRANCHES		-0.003* (0.001)		0.083*** (0.018)		1.699*** (0.141)
Wooldridge test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wald Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
VIF (max)	2.2470	2.0840	2.2470	2.0840	2.2470	2.0840

Note: The Table shows the results of the panel models using the least squares method and the control variables used in the baseline survey (see Tables 3 and 4). Control variables: LN_TA, LOAN_TA, NPL, TCR, GDP, CPI, BC_R, included in the panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 380; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A5. Results of the panel model, robustness check for the experimental variable, and number of bank employees

Model number	A7	A8	A9	A10	A11	A12
Model type	OLS	RE	OLS	RE	OLS	RE
Variable	ROA		CtI		LCR	
LN_EMPL	-0.003*** (0.001)	-0.010*** (0.003)	0.148*** (0.029)	0.166*** (0.062)	2.190*** (0.375)	0.888 (1.331)
Breusch-Pagan Test	-	0.0000	-	0.0000	-	0.0000
Hausman Test	-	0.1033	-	0.1547	-	0.9065
Wooldridge Test	0.0000	0.0001	0.0000	0.0000	0.0000	0.2892
Wald Test	0.0000	-	0.0000	-	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
VIF (max)	2.1620	2.1620	2.2900	2.2900	2.2900	2.2900

Note: The Table shows the results of panel models using the least squares (OLS) method and the estimation method for models with random effects (RE). Control variables: LN_TA, LOAN_DEPO, A_QUAL, LOAN_D, DEPO_D, TIER_I, GDP, CPI, UN, included in panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 360; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A6. Panel model results – robustness check for the experimental variable: number of bank branches

Model number	A13	A14	A15	A16	A17	A18
Model type	OLS	RE	OLS	RE	OLS	RE
Variable	ROA		CtI		LCR	
LN_BRANCHES	-0.003*** (0.001)	-0.010*** (0.003)	0.092*** (0.014)	0.149*** (0.029)	1.916*** (0.144)	-0.450 (0.359)
Breusch-Pagan Test	-	0.0000	-	0.0000	-	0.0000
Hausman Test	-	0.1033	-	0.1036	-	0.6189
Wooldridge Test	0.0000	0.0001	0.0000	0.0000	0.0000	0.3486
Wald Test	0.0000	-	0.0000	-	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
VIF (max)	2.1620	2.1620	2.1620	2.1620	2.1620	2.1620

Note: The Table shows the results of panel models using the least squares (OLS) method and the estimation method for models with random effects (RE). Control variables: LN_TA, LOAN_DEPO, A_QUAL, LOAN_D, DEPO_D, TIER_I, GDP, CPI, UN, included in panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 360; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A7. Results of the OLS panel model, robustness check for the experimental variable, and the ratio of total assets to the number of bank employees and the ratio of total assets to the number of bank branches

Model number	A19	A20	A21	A22	A23	A24
Variable	ROA		CtI		LCR	
TA_EMPL	0.000* (0.000)	-	-0.016*** (0.003)	-	-0.201*** (0.048)	-
TA_BRANCHES	-	0.000* (0.000)	-	-0.001*** (0.000)	-	-0.020*** (0.001)
Wooldridge Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wald Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
VIF (max)	2.278	2.101	2.278	2.101	2.278	2.101

The Table shows the results of the panel models using the least squares method and the control variables used in the baseline survey (see Tables N3 and N4). Control variables: LN_TA, LOAN_TA, NPL, TCR, GDP, CPI, BC_R, included in the panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 380; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A8. Panel model results, robustness check for the experimental variable, ratio of total assets to bank employees

Model number	A25	A26	A27	A28	A29	A30
Model type	OLS	RE	OLS	RE	OLS	RE
Variable	ROA		CtI		LCR	
TA_EMPL	0.000** (0.000)	0.000 (0.000)	-0.014*** (0.002)	-0.013*** (0.004)	-0.232*** (0.040)	-0.099 (0.131)
Breusch-Pagan Test	-	0.0000	-	0.0000	-	0.0000
Hausman Test	-	0.8801	-	0.4913	-	0.9408
Wooldridge Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.2899
Wald Test	0.0000	-	0.0000	-	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
VIF (max)	2.361	2.361	2.361	2.361	2.361	2.361

The Table shows the results of panel models using the least squares (OLS) method and the estimation method for models with random effects (RE). Control variables: LN_TA, LOAN_DEPO, A_QUAL, LOAN_D, DEPO_D, TIER_I, GDP, CPI, UN, included in panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 360; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p-values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

Table A9. Panel model results, robustness check for experimental variable, ratio of total assets to number of bank branches

Model number	A41	A42	A43	A44	A45	A46
Model type	OLS	RE	OLS	RE	OLS	RE
Variable	ROA		CtI		LCR	
TA_BRANCHES	0.000*** (0.000)	0.000*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.022*** (0.002)	0.006*** (0.002)
Breusch-Pagan Test	-	0.0000	-	0.0000	-	0.0000
Hausman Test	-	0.3288	-	0.4356	-	0.6360
Wooldridge Test	0.0000	0.0001	0.0000	0.0000	0.0000	0.3483
Wald Test	0.0000	-	0.0000	-	0.0000	-
Pesaran Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
VIF (max)	2.181	2.181	2.181	2.181	2.181	2.181

The Table shows the results of panel models using the least squares (OLS) method and the estimation method for models with random effects (RE). Control variables: LN_TA, LOAN_DEPO, A_QUAL, LOAN_D, DEPO_D, TIER_I, GDP, CPI, UN, included in panel models but not reported. Table 1 and Table A1 define all variables. Number of observations: 360; Number of banks: 19. Driscoll-Kraay robust standard errors in parentheses. The p values for the statistical tests are given. *** significance at the 1% level, ** significance at the 5% level, *significance at the 10% level.
Source: own calculations in Gretl.

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Use of Artificial Intelligence

In the article, we did not use AI or Generative AI.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Using guarantees of origin for electricity from renewable energy sources as an instrument for reducing product carbon footprint: A case study

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ABSTRACT

Objective: The article aims to demonstrate the potential for reducing the carbon footprint of products through the use of guarantees of origin (GOs) for electricity from renewable energy sources, based on a case study of an energy-intensive company.

Research Design & Methods: We employed regulatory source analysis and a case study methodology to evaluate the use of GOs within a company.

Findings: The research results demonstrate that GOs can serve to reduce a product's carbon footprint only for purchased electricity. The study also indicates that we cannot recognise such instruments in the cost of generating electricity produced using conventional fuels.

Implications & Recommendations: The study highlights the regulatory and accounting consequences of the use of GOs. Our findings imply the use of a separate allocation method to ensure compliance with ISO 14067 and European Union sustainability reporting standards.

Contribution & Value Added: The study contributes to the literature on carbon footprint reduction by combining aspects of renewable energy certification, legal compliance, and corporate sustainability strategy in the Polish context.

Article type: research article

Keywords: guarantee of origin; carbon footprint; energy transition; sustainability; renewable energy; cost accounting

JEL codes: Q42, Q56, M14

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INTRODUCTION

About half of Poland's GDP relies on exports, with around 3/4 of this export volume headed to European Union countries (Broniewski & Liszka-Dobrowolska, 2024). Currently, the competitiveness of exports to the EU depends on climate competitiveness, considered on par with other factors determining the survival and profitability of individual industries, such as product quality and production costs. The Polish economy is facing the need to adapt to new climate realities and undergo an energy transition. The core components of climate competitiveness include corporate climate strategies, the carbon footprint of both organisations and products, and the progressive reduction of emission levels (Draghi, 2024). The unfavourable structure of electricity generation in Poland means that the carbon footprint of Polish electricity is 2 to 15 times higher than in other EU countries. The greatest challenges that Poland needs to face in terms of its energy transition are, above all, time and costs. According to estimates, the cost of the transition to a net-zero economy is projected to reach EUR 380 billion by 2050.

Due to its high energy intensity and emission levels, the industrial sector is particularly vulnerable to the negative effects of climate competition within the European Union. This sector reveals the greatest disparities between Polish and foreign companies, which justifies addressing this issue given its urgent and significant implications for the competitiveness of the Polish economy. In addition to improving energy efficiency, Polish companies operating in the country's energy-intensive industries face the need to undertake measures aimed at reducing emissions and carbon footprint in the short, medium, and long term alike. Simultaneously, they are struggling with a significant deterioration in profitability indicators, which, in turn, hampers their access to funding for costly transition projects.

ISO 14067 defines the carbon footprint of a product (CFP) as 'the sum of greenhouse gas emissions (3.1.2.5) and greenhouse gas removals (3.1.2.6) in a product system (3.1.3.2), expressed as carbon dioxide equivalents (3.1.2.2) and based on a life cycle assessment (3.14.3) using the single impact category (3.14.8) of climate change.' To enable the reduction of the carbon footprint in relation to electricity use, ISO 14067 allows the application of so-called contractual instruments, understood as any type of agreement between two parties regarding the sale and purchase of energy bundled with energy generation attributes or claims concerning unbundled attributes. For example, contractual instruments may include energy attribute certificates, renewable energy certificates (RECs), guarantees of origin (GOs), or green energy certificates.

The article aims to present the possibilities of reducing product carbon footprint through the use of GOs for electricity from renewable energy sources, based on a case study of an energy-intensive industrial company with its own generation source that uses conventional fuel in the combustion process. We argue that GOs can serve to reduce the product carbon footprint in the company under examination, but only in relation to purchased electricity. More specifically, we conjecture that under the currently applicable legal framework, GOs cannot serve to reduce the carbon footprint of a product with respect to electricity generated on-site using conventional fuels in the combustion process. The research methods applied include an analysis of regulatory sources and a case study of the company under examination.

The remainder of the article is structured as follows. Section 2 provides a literature review, followed by a research methodology that outlines the characteristics of the company under study. Section 4 analyses the legal requirements related to accounting records in connection with licensed activities and the redemption of the GOs as a method to reduce the product carbon footprint (PCF). The final section concludes the most significant findings of the study.

LITERATURE REVIEW

Nowadays, many EU countries have adopted ambitious plans to increase the share of renewable energies in the so-called electricity mix. For EU countries, 75% of energy-related greenhouse gas (GHG) emissions come from energy sources (International Energy Agency). Therefore, reducing GHG emissions strongly depends on the energy sector's investment in renewable energy sources (RES) and the abandonment of fossil fuels. For example, in France, the government aims to generate 40% of the electricity from renewable sources (Galzi, 2023). Achieving the goal involved a huge amount of public support and various tools. A special role belongs to GOs, the EU's electricity-tracking system based on certificates that one can transfer independently of the physical energy (Holzapfel *et al.*, 2024). Companies in the energy industry are obliged to use GOs, which allow them to earn additional income or incur additional expenses depending on the 'energy quality.' However, the main function of GOs is to inform final consumers about the energy source (Hamburger, 2019).

The research on energy transformation driven by green energy has been dated since at least the 1990s and addressed the socio-economic factors (Bollino, 2009; Calikoglu & Aydinalp Koksal, 2022), environment (Saidi & Omri, 2020), consumer profile (Hansla *et al.*, 2008; Zografakis *et al.*, 2010), product attributes (Borchers *et al.*, 2007; Kalkbrenner *et al.*, 2017), EU targets for RES (Knopf *et al.*, 2015; Poschmann *et al.*, 2022) or GOs system (Hulshof *et al.*, 2019; Wimmers & Madlener, 2024). The last strand of research investigates how effective the incentive and support system for investments in renewable energy is.

The research on the GO system remains scant and inconclusive. We aim to fill this gap by presenting findings of a case study of a Polish energy company. Poland's case is especially intriguing because its energy sector is based on fossil fuels and is underinvested. The case study provides insights into GO's problems in practice and the potential to reduce the product's carbon footprint. Whereas the existing research literature addresses the GOs system, RES targets, and carbon footprint reporting separately, there is a lack of literature that addresses all of those issues together.

RESEARCH METHODOLOGY

The company under examination (hereinafter: 'the Company') was a Polish business operating in Poland's energy-intensive industry. The Company's business operations encompass the following operational segments:

1. 'Export production' segment.
2. 'Domestic production' segment.
3. 'Energy' segment.

The Company qualifies as an energy enterprise within the meaning of the Energy Law (hereinafter: 'the EL'). When it comes to its 'Energy' segment, the Company conducts licensed activities based on concessions issued by the President of the Energy Regulatory Office, including for electricity generation (under a so-called WEE licence), electricity trading (so-called OEE licence), and electricity distribution (so-called DEE licence). The individual electricity supply points (so-called PPEs) and the Company's own generation source under its WEE electricity generation licence are integrated into a common internal electricity grid, which is connected in turn to the National Power System (so-called KSE). The Company uses electricity in the course of its operations through:

- the purchase of electricity for internal use (including within the 'Export Production' and 'Domestic Production' segments),
- the purchase of electricity for generation purposes (WEE),
- the consumption of electricity for distribution purposes (DEE),
- the purchase of electricity for resale (OEE), in accordance with the relevant regulations of the Energy Law, as well as,
- the consumption of electricity by the Company as a WEE-licensed entity, in accordance with the relevant provisions of the Excise Duty Act, or the generation of electricity for its own use.

The Company is listed in the Register of Industrial Consumers who have submitted the declaration referred to in the Renewable Energy Sources Act. Electricity cost allocation for the 'Export Production' and 'Domestic Production' segments is based on the calculation of a unit electricity cost for the Company as the volume-weighted average of the purchase price and the cost of electricity generation (including any necessary costs associated with public-law obligations borne by energy enterprises or industrial consumers). Subsequently, the total electricity cost for the 'Export Production' segment and the 'Domestic Production' segment, respectively, in a given period, is calculated as the product of the unit electricity cost and the actual consumption volume in that period.

Seeking to enhance both climate and cost competitiveness of its products offered to Western European markets, The Company was considering the purchase of GOs (as an instrument for reducing its product carbon footprint, referred to either as CFP or PCF), along with a change in the electricity cost allocation model (because electricity market prices are significantly lower than the cost of generating electricity using the Company's own source that makes use of conventional fuels in the combustion process). The following potential solutions to achieve the stated objectives have been identified:

1. changing the current electricity cost allocation model so that the unit price of purchased electricity for internal use, increased by the unit cost of acquiring the GOs and considering the actual electricity consumption volume by the 'Export Production' segment in a given period, would make up the total electricity cost allocated to that segment for the respective period;
2. maintaining the current cost allocation method, whereby the Company would purchase Guarantees of Origin in a volume equal to the volume of electricity purchased for internal use. Regardless

of the actual volume of GOs purchased, the total cost of their acquisition would be evenly distributed across each MWh of actual electricity consumption solely within the 'Export Production' segment for the given period (based on the so-called isolated allocation model).

The term 'isolated allocation' refers to a cost allocation method where the costs assigned to a given segment do not affect the results of other segments (Dobija & Kucharczyk, 2014).

RESULTS AND DISCUSSION

Legal Requirements Concerning Accounting Records in Connection With Licensed Activities

Since the Company is an energy enterprise conducting licensed economic activities under WEE, OEE, and DEE licences, it is subject to the provisions of Article 44 of the Energy Law. This provision requires the Company to maintain accounting records in a manner that makes it possible to calculate costs, revenues, profits, and losses separately for:

- activities conducted under each of the licences held, especially WEE, OEE, and DEE licences;
- separately with respect to customer groups[1] specified in the tariff (within the scope of OEE activity), and
- separately in relation to other areas of activity, in particular the 'Export Production' and 'Domestic Production' segments.

This provision aims to eliminate the so-called cross-subsidisation, meaning the covering of part of the costs incurred for one type of economic activity (or in connection with the generation of energy or provision of services for one customer group) using revenues derived from another type of activity (or from activity serving other customer groups). The statutory obligation to maintain separate accounting records does not require identifying and determining the cost of electricity from own generation consumed by the Company in the 'Export Production' and 'Domestic Production' segments. The use of electricity from its own generation is not based on an agreement, as the Company cannot enter into an agreement with itself. Therefore, the drawing of electricity from own generation at electricity supply points earmarked for 'Export Production' or 'Domestic Production' does not constitute consumption by a 'customer' within the meaning of Article 3(13) of the EL.

The requirement for the Company to determine the cost of electricity from its own generation arises from its status as an industrial consumer as defined in the Renewable Energy Sources Act. One of the statutory conditions in this respect is to determine the so-called electricity intensity ratio. It is defined as the ratio, expressed as a percentage, of the cost of electricity consumed for own use to gross value added. The detailed method for calculating the electricity intensity ratio is defined in the provisions of the Regulation of the Minister of Climate of 27 August 2020 on the method of calculating the electricity intensity ratio for industrial consumers, issued pursuant to Article 53(4) of the Renewable Energy Sources Act (hereinafter: 'Regulation on the Method of Calculating the Electricity Intensity Ratio'). The cost of electricity consumed for own use includes, *e.g.*, the cost of electricity from own generation and the cost of purchased electricity for own use.

Considering the legislative requirements described above, we must conclude that they necessitate the maintenance of separate accounting records, along with appropriate classification of each business transaction as constituting or not constituting an entry in such separate records for the relevant type of activity.

At this point, it seems reasonable to consider the correctness and justification of the Company's potential application of solution (A), consisting in a change in the allocation of electricity costs such that electricity from purchases, together with GOs, would be allocated to the 'Export Production' segment. However, given the actual technical situation, in which individual electricity supply points (including those assigned to the 'Export Production' segment) are connected to an internal electricity network linked both to the Company's own generation source (using conventional fuel in the combustion process) and to the National Power System, there are no grounds to attribute only purchased electricity to the 'Export Production' segment. Furthermore, considering the provisions of the Accounting Act (hereinafter: 'the AA')

[1] A customer, according to Article 3(13) of the Energy Law, is any person who receives or draws fuels or energy based on an agreement with an energy enterprise.

regarding the reliability of accounting books, we must conclude that changing the method of electricity cost allocation would not reflect the actual state of affairs in a better way, which is a fundamental condition for justifying any change in the method of recording electricity costs. It should be noted that, according to accounting regulations and pursuant to Article 24(2) of the Accounting Act, accounting books are deemed reliable if the entries made therein reflect the actual state of affairs. Any business arguments in this regard do not justify such a change because, under the AA, all modifications in the accounting treatment of individual items must aim to reflect the actual state better.

In light of the analysis of the applicable regulatory sources, we emphasise that implementing solution (A) under the current factual circumstances carries the risk of being challenged by auditors as a breach of the reliability of accounting records. These circumstances include, first, that the 'Export Production' segment is neither a separate enterprise nor a customer within the meaning of the EL (organisational aspect), and second, that the actual electricity flow within the internal network makes it technically impossible to attribute purchased electricity specifically to this segment (technical aspect)

Redemption of Guarantees of Origin as a Method to Reduce Product Carbon Footprint (PCF) Through Accounting Records Based on Isolated Allocation of Indirect Costs

In accordance with the Rules of the Guarantees of Origin Register (hereinafter: 'the GOR'), GOs maintained by the Polish Power Exchange (Towarowa Giełda Energii S.A., hereinafter: 'TGE'),[2] serve as confirmation for the final customer that exactly 1 MWh (one megawatt hour) of electricity generated from renewable energy sources in a renewable energy installation (or generated in a renewable energy source) has been fed into the distribution or transmission grid. Alternatively, a GO may confirm that exactly 1 MWh of electricity has been generated in high-efficiency cogeneration and introduced into the distribution or transmission grid (§2(1) of the Rules of the Guarantees of Origin Register of 1 February 2024).

The acquisition and redemption of GOs is not a legal obligation, but rather a right granted to final customers of electricity. Moreover, TGE records GOs held by a given GOR member in its system. Guarantees are credited to the register account of a given GOR member, and TGE records all changes in holdings between GOR members occurring within the framework of the GOR. Transfer of a GO occurs at the moment the relevant entry is made in the GOR. Contracts concerning GOs are concluded off-exchange and exclusively between GOR members. GOR members enter into contracts for the sale of GOs only by means of the GOR ICT system. TGE is not a party to such contracts, does not act as an intermediary in their conclusion, and does not participate in their financial settlement, nor does it assume any liability in relation to transactions involving contracts for the sale of GOs concluded between GOR members.

According to Article 120(1) of the Renewable Energy Sources Act, a GO is an electronic document certifying to the final customer that a specified amount, expressed in MWh, of, respectively, electricity, biomethane, heat or cooling, renewable hydrogen, biogas or agricultural biogas was generated from renewable energy sources and fed into the appropriate grid of the relevant grid operator. The essence of a GO under the Renewable Energy Sources Act is to certify that the electricity consumed by a given final customer originates from renewable energy sources. This certification is possible only through the redemption of GOs for the benefit of the final customer, confirming that the volume of electricity consumed corresponds to the volume of GOs redeemed and is thus considered non-fossil-based (*i.e.*, zero-emission).

Based on this statutory condition (the requirement to be a final customer – Article 2(21) of the Renewable Energy Sources Act, which defines the term 'final customer' by reference to Article 3(13a) of the Energy Law), we must conclude that it is not possible for the Company to certify, by way of redemption of a GO, that the consumption of electricity from its own generation constitutes consumption of electricity from renewable sources. Since a 'final customer' is anyone purchasing electricity for own use, and the Company does not purchase electricity from itself, it does not meet the statutory definition in question. This means that the possibility of certifying renewable electricity consumption through the acquisition and redemption of GOs applies exclusively to purchased electricity.

[2] Pursuant to Article 124(1) of the Renewable Energy Sources Act, the entity authorised to maintain the register of Guarantees of Origin is the entity operating a commodity exchange within the meaning of the Commodity Exchange Act or a regulated market within the meaning of the Act on Trading in Financial Instruments.

In the European Sustainability Reporting Standards (ESRS), the European Commission recognises GOs as a valid method of confirming renewable energy sourcing for the market-based emissions calculation method. The ESRS are components of the Corporate Sustainability Reporting Directive (CSRD). According to paragraph AR 32 of the Regulation of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council with regard to sustainability reporting standards, an entity may identify consumed energy as energy obtained from renewable sources only where the source of the purchased energy is clearly specified in contractual arrangements with its suppliers, *e.g.*, through GOs.

The CSRD requires certain entities to disclose organisational carbon footprint data in their non-financial reports. Although the directive does not directly regulate product carbon footprint calculation, it is referenced here to support the credibility of using GOs to confirm renewable energy sourcing and to anchor this practice within the EU legal framework.

The legal solutions currently in force in Poland concerning GOs should be considered consistent with ISO 14067. This standard includes guidelines on how electricity should be treated in the context of product carbon footprint calculations, especially with regard to GOs for renewable electricity and other contractual instruments used for disclosing environmental characteristics of electricity generation (see ISO 14067, sub-clauses 6.4.9.4.2 – 6.4.9.4.4).

At this point, we should also note that these statutory solutions translate into a legal fiction. This fiction consists of the fact that a producer of electricity from a renewable energy source is entitled to receive a GO for electricity that has (essentially) been generated and fed into the grid during a period covering between one and six calendar months of a given calendar year (Article 121(2)(1) of the Renewable Energy Sources Act, pursuant to which an application for the issuance of a GO for electricity that has been generated and fed into the grid is submitted to the electricity distribution system operator or transmission system operator in whose area of operation the renewable energy installation is connected).[3] At the same time, the certification for the final customer, confirming that the electricity consumed by that customer originates from a renewable energy source, is possible for a period of 12 months, counted from the last day of the period covered by the application for the issuance of the GO (Article 122(3) of the Renewable Energy Sources Act, pursuant to which a GO is valid for a period of 12 months from the end date of electricity generation in the renewable energy installation covered by the application for the issuance of the GO, and may not be transferred after this period).

The cost of acquiring GOs for the purpose of their redemption on the Company's own behalf is an indirect cost, since they cannot directly attribute it to specific revenue or its timing. However, incurring this type of cost is clearly justified in terms of achieving a certain level of revenues and maintaining a portfolio of customers who consider climate aspects (such as carbon footprint levels in this particular case) in their purchase-related decisions (see Letter of 10 March 2023, issued by: Director of the National Tax Information Office, reference: 0111-KDIB1-2/4010/13/2023/2/AK, published at http://sip/mf.gov.pl). Therefore, recording this cost in the accounting system as an indirect cost of the 'Export Production' segment (in addition to separately recorded electricity costs for this segment), based on the so-called isolated allocation method, is both appropriate and justified. It also supports the adoption of a zero-emission factor for the volume of electricity purchased and used within this business segment. ISO 14067 does not prohibit an approach based on allocation of emissions via accounting operations, provided that the Company can demonstrate compliance with the principles of credibility, consistency, and transparency, as well as its avoidance of double counting, as defined in clause 5.12 of ISO 14067. This means that organisations must use GOs only once for a given volume of electricity and only for products manufactured within a single business segment (in this case, the 'Export Production' segment) and limited to the volume of electricity purchased.

To summarise, reducing the carbon footprint of products (CFP) manufactured under the 'Export Production' segment through redemption of GOs for the Company's benefit in a volume of purchased elec-

[3] See Article 121(3)(4) of the Renewable Energy Sources Act, pursuant to which an application for the issuance of a guarantee of origin must specify the period covering one or more consecutive calendar months of a given year during which electricity was generated from renewable energy sources in a renewable energy installation, indicating the start and end dates of generation, with the period not exceeding six months.

tricity consumed in this segment over a given period (no less than one calendar month and no more than six calendar months within a single year), in which both the acquisition (incurring the cost) and accounting of such costs are allocated within the same business segment is compliant with ISO 14067, particularly with its electricity-related provisions defined under clauses 6.4.9.4.2 – 6.4.9.4.4. Therefore, we should consider solution (B) feasible and implementable within the Company, and the acquisition and redemption of GOs will positively contribute to reducing the product carbon footprint (PCF).

CONCLUSIONS

We achieved the study's objective, defined as a presentation of the possibility of reducing the product carbon footprint level through the use of GOs for electricity from renewable energy sources, based on an analysis of regulatory sources and a case study. The subject of the case study was an energy-intensive enterprise which, in addition to its production activities (within the 'Export Production' and 'Domestic Production' segments), conducts licensed activities in the fields of electricity generation, trading, and distribution, and holds the status of an industrial consumer within the meaning of the Renewable Energy Sources Act. The situation was also caused by the fact that the Company's electricity supply points (PPEs) and its own generation source operated under the WEE licence are interconnected within a common internal electricity grid, which in turn is connected to the National Power System (KSE).

We argue that GOs can serve to reduce the product carbon footprint in the Company, but only in relation to purchased electricity. We provided evidence supporting this thesis. Furthermore, we conjectured that GOs cannot serve to reduce the carbon footprint of electricity generated in the Company's own generation source using conventional fuel in the combustion process, and again, we provided another evidence supporting our thesis.

Seeking to enhance both climate and cost competitiveness of its products offered to Western European markets, the Company was considering the purchase of GOs as an instrument for reducing its product carbon footprint, referred to either as CFP or PCF, along with a change in the electricity cost allocation model because electricity market prices are significantly lower than the cost of generating electricity using the Company's own source that makes use of conventional fuels in the combustion process.

An enterprise's ability to present confirmation of the redemption of GOs in its favour, issued by TGE as the entity maintaining the Guarantees of Origin Register, contributes to the reduction of that enterprise's carbon footprint by recognising that the given volume of purchased electricity for which the GOs have been redeemed has a zero emission factor. However, it is not possible to certify, through the redemption of Guarantees of Origin in favour of the enterprise as a final customer, that electricity from the Company's own generation is electricity obtained from renewable energy sources. This restriction results from a statutory requirement under which such certification is only available to a final customer within the meaning of Article 3(13a) of the Energy Law. A 'final customer' is any entity that purchases electricity for their own use. A business entity that generates electricity for its own use does not engage in a purchase transaction (and therefore does not meet the legal definition in relation to electricity generated in its own sources). Any potential change in the allocation of electricity costs under these factual circumstances is not permissible for the Company, as it creates a risk of being challenged by auditors as a breach of the reliability of accounting records.

Recognising the cost of acquiring GOs in the accounting records as an indirect cost under the 'Export Production' segment (in addition to separately recording the cost of electricity consumed within this segment), based on the so-called isolated allocation method, is justified (including in terms of compliance with ISO 14067), and also supports the adoption of a zero emission factor for the volume of purchased electricity used for own needs within this business segment. Moreover, such a solution seems to comply with the requirements of the Accounting Act, especially Article 4(1).

REFERENCES

Act of 10 April 1997 – Energy Law. (2024). *Journal of Laws of the Republic of Poland*, items 266, 834, 859. Retrieved from https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20240001361 on June 17, 2025.

Act of 20 February 2015 on Renewable Energy Sources. (2024). *Journal of Laws of the Republic of Poland*, item 1361. Retrieved from https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20240001361 on June 17, 2025.

Act of 29 July 2005 on Trading in Financial Instruments. (2024). *Journal of Laws of the Republic of Poland*, item 722. Retrieved from https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20240001361 on June 17, 2025.

Act of 29 September 1994 on Accounting. (2023-2024). *Journal of Laws of the Republic of Poland*, 2023 items 120, 295, 1598; 2024 items 619, 1685.

Act of 6 December 2008 on Excise Duty. (2023). *Journal of Laws of the Republic of Poland*, items 1542, 1598, 1681, 1723. Retrieved from https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20240001361 on June 17, 2025.

Bollino, C.A. (2009). The willingness to pay for renewable energy sources: The case of Italy with socio-demographic determinants. *The Energy Journal, 30*(2), 81-96. https://doi.org/10.5547/ISSN0195-6574-EJ-Vol30-No 2-4. Retrieved from https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20240001361 on June 17, 2025.

Borchers, A.M., Duke, J.M., & Parsons, G.R. (2007). Does willingness to pay for green energy differ by source?. *Energy Policy, 35*(6), 3327-3334. https://doi.org/10.1016/j.enpol.2006.12.009

Broniewski, Ł., & Liszka-Dobrowolska, A. (Eds.). (2024). *Lepiej późno niż później. Redukcja śladu węglowego a konkurencyjność klimatyczna polskich firm*. Fundacja Climate Strategies Poland. Retrieved from https://odpowiedzialnybiznes.pl/publikacje/lepiej-pozno-niz-pozniej-redukcja-sladu-weglowego-a-konkurencyjnosc-klimatyczna-polskich-firm/ on May 16, 2025.

Calikoglu, U., & Aydinalp Koksal, M. (2022). Green electricity and renewable energy guarantees of origin demand analysis for Türkiye. *Energy Policy, 170*, 113229. https://doi.org/10.1016/j.enpol.2022.113229

Dobija, D., & Kucharczyk, M. (Eds.). (2014). *Rachunkowość zarządcza. Analiza i interpretacja* (2nd ed., revised and expanded). Wolters Kluwer.

Draghi, M. (2024). The future of European competitiveness: The Draghi report on EU competitiveness. European Commission. Retrieved from https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en on June 4, 2025.

Galzi, P.-Y. (2023). Do green electricity consumers contribute to the increase in electricity generation capacity from renewable energy sources? Evidence from France. *Energy Policy, 179,* 113627. https://doi.org/10.1016/j.enpol.2023.113627

Grabski, M., & Czarska, K. (Eds.). (2024). *Dekarbonizacja. Konkurencyjność klimatyczna 2.0*. Fundacja Climate & Strategy. Retrieved from https://konkurencyjnoscklimatyczna.pl/ on June 4, 2025.

Hamburger, Á. (2019). Is guarantee of origin really an effective energy policy tool in Europe? A critical approach. *Society and Economy, 41*(4), 487-507. https://doi.org/10.1556/204.2019.41.4.6

Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2008). Psychological determinants of attitude towards and willingness to pay for green electricity. *Energy Policy, 36*(2), 768-774. https://doi.org/10.1016/j.enpol.2007.10.027

Holzapfel, P.K.R., Bánk, J., Bach, V., & Finkbeiner, M. (2024). Relevance of guarantees of origin for Europe's renewable energy targets. *Renewable and Sustainable Energy Reviews, 205*, 114850. https://doi.org/10.1016/j.rser.2024.114850

Hulshof, D., Jepma, C., & Mulder, M. (2019). Performance of markets for European renewable energy certificates. *Energy Policy, 128*, 697-710. https://doi.org/10.1016/j.enpol.2019.01.051

International Energy Agency. (2021). Global energy review: CO_2 emissions in 2021 – Global emissions rebound sharply to highest ever level. Retrieved from https://www.iea.org/reports/co2-emissions-in-2022 on June 4, 2025.

ISO. (2018). *ISO 14067: Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification*. International Organization for Standardization.

Kalkbrenner, B.J., Yonezawa, K., & Roosen, J. (2017). Consumer preferences for electricity tariffs: Does proximity matter?. *Energy Policy, 107*, 413-424. https://doi.org/10.1016/j.enpol.2017.04.009

Knopf, B., Nahmmacher, P., & Schmid, E. (2015). The European renewable energy target for 2030 – An impact assessment of the electricity sector. *Energy Policy, 85*, 50-60. https://doi.org/10.1016/j.enpol.2015.05.010

Letter of 10 March 2023, issued by Director of the National Tax Information Office. (2023). Reference: 0111-KDIB1-2/4010/13/2023/2/AK. Retrieved from http://sip/mf.gov.pl on June 2, 2025.

Poschmann, J., Bach, V., & Finkbeiner, M. (2022). Are the EU climate ambitions reflected on member-state level for greenhouse gas reductions and renewable energy consumption shares?. *Energy Strategy Reviews, 43,* 100936. https://doi.org/10.1016/j.esr.2022.100936

Regulation of the Minister of Climate of 27 August 2020 on the method of calculating the electricity intensity ratio for industrial consumers. (2020).

Regulation of the Minister of Economy of 6 October 1998 and Regulation of the Minister of Economy of 12 October 2000. (1998, 2000).

Rules of the Guarantees of Origin Register maintained by the Polish Power Exchange. (2024). Consolidated text approved by way of the Management Board Resolution no. 31/07/24 of 1 February 2024. Retrieved from https://www.tge.pl/regulacje#rejestr-gwarancji-pochodzenia on June 4, 2025.

Saidi, K., & Omri, A. (2020). The impact of renewable energy on carbon emissions and economic growth in 15 major renewable energy-consuming countries. *Environmental Research, 186*, 109567. https://doi.org/10.1016/j.envres.2020.109567

Wimmers, A., & Madlener, R. (2024). The European market for guarantees of origin for green electricity: A scenario-based evaluation of trading under uncertainty. *Energies, 17*(1), 104. https://doi.org/10.3390/en17010104

Zografakis, N., Sifaki, E., Pagalou, M., Nikitaki, G., Psarakis, V., & Tsagarakis, K.P. (2010). Assessment of public acceptance and willingness to pay for renewable energy sources in Crete. *Renewable and Sustainable Energy Reviews, 14*(3), 1088-1095. https://doi.org/10.1016/j.rser.2009.11.009

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Use of Artificial Intelligence

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