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The Interest Shown by Potential Young Entrepreneurs in Romania Regarding Feasible Funding Sources, in the Context of a Sustainable Entrepreneurial Education

Alexandra Zamfirache [1,*], Titus Suciu [2], Carmen Elena Anton [2], Ruxandra-Gabriela Albu [1] and Ioana-Simona Ivasciuc [3]

[1] Department of Management and Economic Informatics, Transilvania University of Brasov, 500084 Brasov, Romania
[2] Department of Finance, Accounting and Economic Theory, Transilvania University of Brasov, 500084 Brasov, Romania
[3] Department of Marketing, Tourism Services and International Business, Transilvania University of Brasov, 500084 Brasov, Romania
* Correspondence: alexandra.zamfirache@unitbv.ro

Abstract: Among the most important factors that favor the development of a sustainable business environment are the sources of financing and the skills developed by the higher education system, according to recent studies. To align with these, several universities have started providing entrepreneurship knowledge. Are these sufficiently well-known by the students in Romania? The current paper aims to carry out an in-depth analysis of concepts. The primary objective of this study is to explore the most relevant sources of entrepreneurial financing in the context of a sustainable entrepreneurial higher education. For such an endeavor, quantitative research was conducted, being designed and distributed through a questionnaire. Data were collected from a sample of 285 students of Transilvania University in Brasov interested in entrepreneurship. Results indicate that the main sources of entrepreneurial financing are retained earnings/profit, personal sources, supplier credits, European funds, loans (bank credits), leasing, and business angels. Evidence shows that most respondents assert great confidence in European funds. Notably, the entrepreneurial qualities of the founder are one of the enablers of a successful and sustainable business. Additionally, this research opens new ways of collaboration between the academic and the business environment to better train future professionals in the economic field.

Keywords: entrepreneurial intention of students; funding sources; sustainable entrepreneurial education; opening a new sustainable business

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1. Introduction

In the context of the economic cohesion policy, the development of small and medium-sized enterprises and the increase of their competitiveness envisages the use of various forms of financing. Among the most well-known ways of financially supporting a business are the European funds that contribute to supporting research and innovation through cooperation between firms and universities [1]. Depending on their strategic approach, companies also consider other sources that the financial and non-financial market offers, such as loans (bank credits), leasing, loans from natural and legal persons other than banking institutions, and equity. Financing strategies are the primary tools for implementing development in any innovative firm, and the financing methodology requires statistical studies based on qualitative and quantitative analyses. Such studies suggest that, along with European funds, bank loans are financing sources considered by firms under two circumstances. Firstly, the firm provides the necessary guarantees to cover the loan and their costs, and secondly, the beneficiary meets all the eligibility conditions required by financial and banking institutions. The interest in supporting small and medium-sized enterprises (SMEs) is noticeable within the European Union. As such, partnerships with

banks are implemented to direct firms to a platform for alternative funding in the event of refusal to grant loans [2].

Etzkowitz et al. [3] examined the developments in the role that universities play in increasingly knowledge-based societies and emphasized the need for collaboration between universities, industries, and governments with the help of the triple helix model, which outlines an emerging entrepreneurial paradigm stating that the university is an increasingly important factor regarding technological innovation. Achieving the objectives of sustainable development, as they were formulated in 2015 [4], requires the contribution of all stakeholders, especially future entrepreneurs who must have competence in economic, social, and ecological terms. Entrepreneurial education must be based on the principles of sustainable development, and educational organizations, including universities, must adapt their curricula to these principles.

In this context, the purpose of the paper is to perform a complex and detailed analysis of economics students (the first beneficiaries of entrepreneurial education) regarding the main sources of entrepreneurial financing and their future entrepreneurial intentions.

Listing on the stock exchange and investment funds are two financing sources recommended in the maturity phase of the business. In Romania, the concept of business angels should occupy a central role in economics and management books, as it is one of the topics little debated and promoted, but which can bring a competitive advantage due to the short time of providing funding.

Any project for setting up a business, depending on its nature and purpose, must identify the most appropriate sources of funding, each requiring different approaches. A thorough analysis calls for the entrepreneur to consider the costs generated by each way of securing financial capital and establish rigorous management policies based on the selected method. Hence, the analysis criteria are based on accumulated economic knowledge, information, and continuous study. Literature research [5,6] proves that each entrepreneur, depending on the dominant qualities and the economic conjuncture, resorts to various financing schemes, a fact also demonstrated by the quantitative research carried out in the present study. An overview of statistics [7] regarding entrepreneurship in Romania reflects a growing interest in starting a business. Thus, the number of new registrations in the Romanian Trade Register for 2021 was higher at 34.88% compared to 2020 and exceeded 2019 numbers by 10.48% (in this study is considered that the years 2019 and 2020 were severely affected by the COVID-19 pandemic). In the first half of 2022, compared to the same period in 2021, an insignificant decrease (1.39%) is observed, which leads us to estimate a similar number of new SMEs in 2022. To support these statements, Table 1 highlights the evolution of individual and legal entity new registrations during 2017–2021, as well as the gender distribution of shareholders within active legal entities. In addition, Table 2 rates the same indicator by 31 July 2022.

Table 1. Evolution of new registrations in the Trade Register in Romania and the distribution by gender during 2017–2021.

Indicator	2017		2018		2019		2020		2021	
New registrations in the area of entrepreneurship	136,699		135,532		134,220		109,939		148,294	
Gender distribution of the shareholders of active legal entities (Female/Male) (%)	F 37.05	M 62.95	F 37.39	M 62.61	F 37.48	M 62.52	F 37.25	M 62.75	F 36.84	M 63.16

Source: Data retrieved and processed from [7].

Note: From a legal perspective, the companies registered in the Trade Register that have not declared the suspension of their activity and are not in any of the states that can lead to the loss of legal personality are considered active. From the overall number of companies registered in the Trade Register, the following entities were excluded: companies with temporary suspension of activity, branches without legal personality, deregistered companies, and companies in dissolution, liquidation, judicial reorganization, bankruptcy, insolvency, etc.

Table 2. New registrations in the Trade Register in Romania.

Indicator	31 July 2021	31 July 2022
New registrations in the area of entrepreneurship	91,400	90,126

Source: Data retrieved and processed from [7].

The analysis of the literature concerning the entrepreneurial ecosystem indicates its evolution, but it is not limited to the mechanisms of financing the business [8], which was a point of interest for the authors of this paper. Deepening the analysis also meant studying gender relations in developing a business and choosing sources of funding for the established entrepreneurial field. According to the Romanian National Trade Register Office [7], the average share of women with entrepreneurial activity was 37.20% out of the total number of people who owned a business during 2017–2021.

Researchers agree that women do not engage so easily in the field of entrepreneurship [9,10]; hence, they are less likely to start a business [11]. However, according to the study conducted by the authors, even if the share of women entrepreneurs does not exceed 38% of the total number of businesspeople, the likelihood of using various sources of funding for starting or developing an entrepreneurial initiative is not influenced by the gender variable.

Recent studies on the field of entrepreneurship [12], as well as the results put forward by the Amway Global Entrepreneurship Report (AGER) for 2018 [13] and 2020 [12], show that among the most important factors favoring the development of a business environment are the funding sources for starting a business and skills development within the education system.

A comparison of the weight of responses regarding respondents' attitudes and opinions on entrepreneurship issues in Romania with the global average shows insignificant differences [13]. According to Amway Global Entrepreneurship Report [12], obtaining the necessary capital to start a business in Romania reached an average equal to the global average of 45%. The study also revealed that another factor influencing the development of a business is opportunities to continue learning [12], for which Romania scored 29%, while the global average is 33%. For the skills developed by the education system [12], Romania registered 35%, while the average value is 40%.

Considering that these elements participate in the initial stages of a business and that the education system is a nursery that shapes the specialists of the entrepreneurial field, this study is focused on better understanding the opinions and attitudes of future professionals regarding entrepreneurship and identifying the sources of funding in Romania. Based on such insights, the authors pursued the opportunity to conduct new research in this area. The primary objective of this study is therefore to explore the most relevant sources of entrepreneurial financing in the context of a sustainable entrepreneurial higher education. The specific objectives of the study are the following: (a) analyse the extent to which students are prepared for entrepreneurship; (b) identify the most well-known sources of financing for starting a business; and (c) drive new insights on the degree of understanding the sources of financing that ensure the achievement of the entrepreneurial process. To provide clarity and conceptual accuracy to present research, a careful focus was given to the formulation of the specific issues (determining the level of knowledge held by the respondents in the field of entrepreneurship and funding sources, identifying the main known sources of funding, and identifying the respondents' opinion on the decisions aimed at setting up their own business), as well as to the hypotheses of the study.

The paper starts with a literature review, highly needed for the solid foundation of the study. The section is divided into three subthemes: entrepreneurial education and sustainable development, sources of funding, and preconditions for starting a business. The research method comes as the following subsection, which includes the researcher's questions. The paper continues with the presentation of results and discussions, followed by conclusions. The final part is dedicated to limitations and further research.

2. Literature Review

2.1. Entrepreneurial Education and Sustainable Development

The link between sustainable development and entrepreneurial education has been studied by many researchers [14–16].

According to Cui [17], universities and entrepreneurship programme developers should pay attention when selecting suitable teaching models and must provide a favourable entrepreneurial climate in order to induce an entrepreneurial mindset amongst students, thus also promoting sustainable development.

Although entrepreneurship could be the key to sustainable socioeconomic empowerment, this is difficult to achieve without an education that uses the appropriate methods, tools, and objectives that equally targets all segments of society [18].

Fostering entrepreneurship from a young age is a factor that ensures the long-term economic growth of a country [19]. The topic of youth entrepreneurship was a study subject for many researchers [20–28]. Ragazou et al. [29] considered that the educational level is a key factor for influencing young people's entrepreneurial intentions.

Bergmann, Hundt, and Sternberg [30] argued that entrepreneurship facilitates the integration of young people into the labour market, which offers benefits such as self-confidence, development of skills, and an increase in the level of happiness [31]. Given the positive effects entrepreneurship generates for young people and the overall economy, the number of youth entrepreneurs should be increased [32].

Entrepreneurial education was also investigated from a behavioural theory perspective. The study by Liu et al. [33] analyses the effects of entrepreneurship education and students' self-efficacy on their entrepreneurial intent. A significant influence of education on the entrepreneurial intentions of students is demonstrated by Hussain and Norashidah [34]. Other researchers focused on investigating entrepreneurial skills or, like Bauman and Lucy [35], the impact of education on entrepreneurial intentions [36] and the relationship between entrepreneurship education and students' intention to start a business [37].

Based on the above, the following research question resulted: What is the level of knowledge held by the respondent in the field of entrepreneurship (part of entrepreneurship education)? (RQ1).

2.2. Sources of Funding

Young entrepreneurs face challenges in obtaining primary and alternative sources of financing unless they can turn to family or friends [38].

A business organization raises funds from several sources, either internal or external, long-term or short-term [39]. The entrepreneurial finance literature has undergone a substantial change. While new phenomena emerged, such as crowdfunding [40], researchers have also highlighted the existence of funding sources for companies that were not initially considered [41].

The influence of alternative financing sources, both in the launch stage, as business angels, and in the later stages of investments, as well as the mutual funds and other institutional investors, seem to have reduced the role of traditional venture capital [42].

There are different sources of financing mentioned in the literature, each one with advantages and disadvantages, and all must be analysed depending on the characteristics of the field covered by the proposed business [22,43–46]. Cumming and Groh [5] emphasize the growing importance of different sources of capital for entrepreneurs and emerging research trends, which are of interest to academics, practitioners, and policymakers.

Depending on the general economic context, an entrepreneur must determine the best way to find a financing source for the business. As Pticar [6] highlighted, an important goal is to resolve the problem of optimising the financial structure of the enterprise. Furthermore, the specifics of each firm, its field, and the macroeconomic environment in which it operates make any business need to search for a customised solution.

Bootstrapping involves using internal resources, making savings, and without resorting to external resources. According to Ghenea's recommendations, entrepreneurs, in the

beginning, are to start from home or a virtual office, buy everything in barter, focus on functionality, collect as many advances as possible, promote their business by word of mouth, enter the market as soon as possible, and focus on cash flow [47].

Authentic leadership promotes trust and high-quality social exchange relationships, boosts employees' work motivation, provides support, and involves appropriate action [48].

Organizations should create and develop a new way of doing business, be more agile, proactive, and prepared to cope with uncertainties or otherwise perish. Dynamic capabilities will become necessary [49].

However, the success rate of raising equity capital beyond their seed investments is very low. Existing entrepreneurship studies on financial resource acquisition have separately explored how entrepreneurs organize their networks, establish venture legitimacy, and decide on funding sources [50].

Hui's studies developed the theoretical foundation for entrepreneurial management while providing practical guidance for the allocation of equity and the design of the financing structure in the context of mass entrepreneurship and innovation. The paper also establishes a conceptual framework for solving two major problems of the technology-based entrepreneurial firm: the timely acquisition of external financing and the long-term stability maintenance for entrepreneurial management [51]. Phuong proposes a research model on the direct impact of absorption capacity, innovation capacity, and branding capacity on the company's performance [52].

Due to the heterogeneous environments and situations in which the business operates, bootstrapping techniques can take many forms as they constantly evolve. Although some of these can be customizable solutions, similar models leading to different classifications have been identified in the literature [39].

Personal sources refer to the capital owned by the entrepreneur. While private money is the cheapest, using it means having confidence in the business plan. Taking risks as an entrepreneur is the best way to attract partners. Personal resources make the entrepreneur otherwise appreciate an external source of funding.

Yasir's study reveals that the entrepreneurial intentions among students are supported by views toward sustainable entrepreneurship, societal norms, and perceived behavioural control. Self-transcendence and self-enhancement are personal values that directly or indirectly interact with sustainable entrepreneurial intentions [53].

When scientists receive partial funds from their universities, they have a higher propensity to generate more original patents. By contrast, university scientists funded by industry or other non-university organisations are more likely to develop original patents [54].

Education technology entrepreneurs should develop mature products that teachers can endorse, build a support network, which would include an advisory board and low-cost infrastructure providers, and source multiple revenue streams from the private and public sectors [55]. Education and training for economics focus on the value of entrepreneurship education and training [56].

The BAO principle says that other people's money has the following characteristics: it is the fastest and most bureaucratic; may prepare larger additional financing later; if it is a success, it is more pleasant to be shared with a relative or a friend; make a clear, formal contract; determine from the beginning if it is a loan or a shareholding in the company [47].

Construction industry development provides one of the most effective ways of economic growth and identifies the main advantages of using business networks to support small business success: providing resources, increasing labor productivity, and fostering opportunities for innovation [57].

According to Birtch, individuals high in familism are more likely to seek funds from and provide capital to family members than non-family members for new ventures. However, such relationships are more complex than prior research suggested, because when individuals' risk and return perceptions are considered, these interact with familism to

differentially influence capital financing behaviour directed at family versus non-family members [58].

The role and importance of involving business angels in the development of new businesses have preoccupied many researchers [59–67].

A business angel is a private person with business experience who directly invests part of their assets in new and developing private businesses [68]. An informal investor is a person with high financial opportunities who provides capital for start-up businesses in exchange for participation as a shareholder or as a convertible loan. The main role of a business angel is to provide financial support to a small business project that could not easily access another type of financing (bank loan or scholarship). Entrepreneurs are young and motivated, without much experience. For a business angel, the following are important to assess: the practical experience of the entrepreneur, personal reputation, assumption of business risks, passion, the chemistry between the two partners, and the potential return to be reasonable. For the entrepreneur, it counts criteria such as the success of the informal investor and his previous degree of involvement, to be closer to the business and to bring as much value as possible [47].

Tenca and Crouce consider that the growing interest in business angels (Ba's) is due to the role they began to play in facilitating growth for new ventures [69]. Based on the statistical data presented in the introduction (see Table 1—Evolution of new registrations in the Trade Register in Romania and the distribution by gender during 2017–2021) and the evidence found through the literature study on business angels as a source of financing, the authors formulated the second hypothesis of the study: *H2. There is no connection between the gender of the respondents and the extent to which they are willing to turn to a business angel as a main source of funding.*

In Romania, interest rates on bank loans are much higher than in other European countries, so this is a serious brake on a bank loan. The loan is advantageous only if the company's yield is much higher than the bank's interest.

Kamna and Ilkhanizadah [70] suggest that high-performance work practices have a significant effect on employee career competencies, and the employee career competencies significantly impact service quality, creative performance, and extra-role performance in banks.

Other authors consider that there is an inverse relationship between the largest shareholder's ownership and the loan amount and suggest that firms in the innovation process access higher loan amounts than their non-innovative peers [71].

The activation of macro-prudential policies is chiefly related to lower bank funding costs. This association is stronger for developed countries than for emerging ones. The positive links with certain macro-prudential measures to bank cost of funding offer further insight into the repercussions of calibrating and selecting macro-prudential tools [72].

Based on the statistical data presented in the introduction (see Table 1—Evolution of new registrations in the Trade Register in Romania and the distribution by gender during 2017–2021), the authors aimed to investigate this funding source, thus, formulating the first hypothesis H1. *There is no connection between the respondents' gender and the intention to resort to bank loans as the main source of business financing.*

Investment funds represent the penultimate step before a final sale to a strategist or before a public listing on the stock exchange. Venture Capital (VC) funds invest in companies in the initial stage, either at the start-up or in the next period. Private equity funds are collective investment vehicles intended to make investments in taking shares in companies.

VC funds invest in high-growth, high-yield, high-risk, multi-million-dollar investments. According to Deng [73], there is an overall negative correlation between environmental uncertainty and corporate innovation. Companies facing a higher degree of uncertainty are more cautious in their innovation investment. This negative correlation was more pronounced in companies with weaker risk-taking abilities [74]. By using a novel dataset, Spilker shows that hedge fund managers connected through shared employment histories hold and trade more of the same stocks than unconnected managers [73].

The simple empirical analysis shows that cross-border VCs are more likely to invest in market-oriented high-tech sectors and regions with relatively well-established market institutions, while local VCs tend to invest in fields and regions of the nation's strategic focus [75].

Gantenbein et al. considers that individualism increases venture-capital investments. The effect of individualism on venture-capital investments is found to be partially mediated by the quality of formal institutions and entrepreneurial attitudes and moderated by economic conditions [76].

The COVID-19 pandemic crisis and its impact on the EU should also be examined in terms of entrepreneurship and the consequences for entrepreneurship, entrepreneurial intent, and resilience [77]. Following the works of Dvouletý, Shroj, and Pantea [78] about public SME grants and firm performance in the European Union, it can be noticed that it has been a long-standing tradition of allocating public grants as a direct form to support firms and entrepreneurs to increase their growth and improve their financial performance and efficiency.

European funds must be accessed for a real need of the company with careful planning of the cash flow. In general, these funds imply large amounts of money and a comparative study of the project costs, with or without the European funds, is recommended. People who undertake business activities to generate greater earnings or accumulate wealth are more likely to use their private capital or repayable funds [79]. Several studies approach the possibility for entrepreneurs to access European funds [80–84].

Special programs allowing small and medium-sized enterprises with female leadership to access non-reimbursable funds for business development are a common practice [85] representing one of the reasons for choosing the research hypotheses.

Listing on the stock exchange increases the level of capitalization, which leads to more ease in accessing a bank loan. It also contributes to a higher prestige for entrepreneurs, managers, and employees, a materialization of personal financial value, and increased liquidity for the company and shareholders. Among the disadvantages, the subsequent were considered: significant additional costs, loss of control by the funding entrepreneur, the obligation to make public any relevant information about the company, the need to implement corporate governance, and pressure on the company's growth with a focus on short-term goals.

The empirical results confirm a negative correlation between tax avoidance activities and the business leverage ratio. However, existing evidence do not support a correlation between organizational ownership and the business leverage ratio [86]. Environmental regulations seem to harm the investment efficiency of the listed manufacturing companies in the Beijing–Tianjin–Hebei region, causing the threshold in the impact on investment efficiency to move from promotion to suppression [87]. This article uses China as a case study to explore the connection between the stock market and the venture capital market. Through empirical studies, this article confirms the existing literature by demonstrating a close connection between the stock market and the venture capital market in China [88]. The results showed that the VAR model can better analyse the relationship between financial growth and economic growth, as well as the role of financial factors in the process of economic development [89]. Using the data of Chinese listed companies in 2005–2013 and 2013–2017, the results indicate that in the relationship between internationalization and firm performance, the role of social networks has a dual mechanism. Business ties play a mediating role in the relationship between internationalization and firm performance [90].

Leasing is a factor of economic growth, having as a starting point the company development strategy and the risk appetite of the shareholders. Also, using leasing as a source of finance offered the opportunity for rapid technological growth and the appearance of the modern historical challenge—globalization [91].

The main advantage of this method is the inclusion of insurance against property and financial risks in lease payments to minimize the risk of non-fulfilment of the contract. The proposed methodology, unlike the existing approaches, makes it possible for the

counterparties of the leasing agreement to manage the optimal final leasing payment throughout the entire financing process [92].

The access to flexible office space for self-employed, start-ups, and corporates is a key resource for businesses. COVID-19 has shown that space provision is becoming more flexible, and ventures increasingly use scalable space instead of long-term lease agreements for office space [93].

Retained earnings/profit does not involve interest nor requires payment of dividends, which may make it a desirable source of financing [94]. According to Shrotriya [39], the best source of financing an organization is its retained earnings, the part of profits not distributed as dividends to equity shareholders.

In the absence of sufficient capital, more and more companies choose to delay payments, resorting to supplier credit, an economic mechanism of business financing without interest, which is expanding exponentially. Furthermore, 75% of companies in the Romanian economy have come to resort to this solution, given that bank loans are, especially for SMEs, a difficult field to access [95].

Supplier credit as a source of financing businesses has been widely studied [96–104].

Following the analysis of the literature that addresses the issue of financing entrepreneurs, it can be concluded that the most used financial sources today are the following: profit, personal sources, supplier credits, European funds, bank credits, leasing, and business angels. Based on the above-mentioned studies and results, this research aims to shed light on two important gaps formulated as research questions, as follows: What are the main sources of financing known to the respondents? (RQ2) and What are the respondents' attitudes and opinions regarding the different types of financing sources? (RQ3).

Based on all the information and analyzes carried out, a brief analysis of the strengths and weaknesses of the main funding sources identified in the specialized literature is carried out (See Table 3). The purpose of the table is primarily to highlight the difference between them.

Table 3. Summary of strengths and weaknesses of entrepreneurial financing sources.

Sources of Entrepreneurial Finance	Strengths	Weaknesses
Retained earnings/profit	■ Well-known performance measuring instrument ■ Expresses the entity's ability to reimburse the invested capital ■ Assesses value creation within the entity ■ Supports the analysis of resource management and allocation plan ■ Contributes to achieving the sustainable development goals	■ Highly sensitive to the variation of macroeconomic factors (change in fiscal policies, accounting treatments) ■ Vulnerable to refinancing (new needs for financial resources vs. those already owned) ■ It is the result of the cooperation between several factors (income-to-expenditure ratio, etc.)
Personal sources	■ Low or no acquisition and administration costs ■ Does not require guarantees ■ Longer repayment of the loan ■ Enables gradual access according to the business needs ■ Possibility of withdrawing amounts without a fixed maturity	■ Creating imbalance in meeting one's own needs ■ Risk of value loss under inflationary conditions ■ Risk of non-recovery of the amounts invested
Supplier credits	■ Free source of capital ■ Source of funding for a quasi-permanent period ■ Likelihood of permanent renewal ■ Possibility to efficiently manage the volume of payment gaps compared to revenue gaps ■ Source of financing for current assets and other operational activities	■ May lead to a big financial deadlock ■ May generate additional contractually determined costs higher than legal ones ■ High risk in the financing of circulating assets involving the need to maintain close relationships with suppliers ■ Rigorous analysis of operating debts to optimally manage the dependence on suppliers

Table 3. *Cont.*

Sources of Entrepreneurial Finance	Strengths	Weaknesses
European funds	■ No guarantees involved ■ Non-reimbursable funding sources ■ Financing source for SMEs when the market does not provide sufficient funding	■ High deadlines for analysis and approval ■ No expenditure permitted within the project before approval ■ Reports are needed for documenting the implemented activities ■ Risk of price changes compared to the initial project plan ■ The obligation to sustain the business for a specific period under the conditions of a vulnerable economy
Loans (bank credits)	■ Wide range of banking institutions ■ Choice of various financing products ■ No additional costs are involved ■ Opportunity to access large amounts in real-time ■ Wide range of business areas covered ■ Potential collaboration with partners from different countries ■ Accessible, complete, and detailed information ■ Free consultancy within certain limits	■ Additional costs implied (file analysis, insurance, anticipated reimbursement, etc.) ■ High lending costs (variable interest rates, account management fees, risk commission, etc.) ■ Strict credit conditions ■ Low opportunities to negotiate the terms ■ Difficult communication with the financial institution representatives
Leasing	■ Easy to access ■ Lower costs compared to other sources of funding ■ Reduced investment effort ■ Enabling the retention of large liquidity that can be invested in other projects ■ Opportunity to novate the contract ■ Reduced approval period ■ No guarantees involved	■ Leased assets cannot be disposed of or sold ■ The goods can only be used during the contract period ■ For small entities, leasing operations influence the balance sheet asset image from an accounting point of view ■ Contractual period, as a rule, reduced
Business-angels	■ Financing opportunities for start-ups or newly developed companies ■ Opportunities for international partnerships ■ Training in the entrepreneurial field ■ Available capital in a short time ■ Free consultancy and expertise in the field ■ The presence of an investor creates stability and a favourable image for the firm	■ Disposal of a substantial share of the profit ■ Less time for project implementation ■ Short-term investment process

Source: Developed by the authors based on their teaching experience.

2.3. Sources of Funding

A study performed in 2019 [105] shows that entrepreneurial education directly influences and increases the inclination to start a business. These two factors can have a common ground for the unprecedented digital development that society is currently experiencing. The relationship between entrepreneurial education and the main stage of opening a business is largely debated in the study of Sousa et al. [106].

Although a great deal of attention has been given to entrepreneurship education, relatively few studies analysed the impact of extracurricular entrepreneurial activities on the intention of students to start a business [107]. Entrepreneurial motivation is critical in the decision to create a new business. The opportunities of the sustainable entrepreneur will depend on the level of commitment to the sustainability of the specific business and the environmental risks of the idea or product. Environmental risk training is important for young people because it raises awareness towards climate change and, in this way, can influence cognitive processes that lead to a sustainable business intention [108].

Therefore, many researchers focused on identifying what motivates young people to embark on such a journey. According to Pauceanu et al. [109], self-confidence in one's entrepreneurial skills is the only factor significantly correlated with the intent to start a business. Hence, the following research question is stated: *What is the future intention regarding the establishment of a new business? (RQ4).*

3. Research Method

3.1. Questionnaire Development

In line with the information presented, the following four Research Questions (RQ) were considered:

RQ1. What is the level of knowledge possessed by the respondent in the field of entrepreneurship (part of sustainable entrepreneurial education entrepreneurship education)?
RQ2. What are the main sources of financing known to the respondents?
RQ3. What are the respondents' attitudes and opinions regarding the different types of financing sources?
RQ4. What is the future entrepreneurial intention regarding the establishment of a new business?

To generate answers to such inquiries, a quantitative study based on a questionnaire was implemented. Data were further analysed to identify the opinions, attitudes, and behaviours of students interested in entrepreneurship, as opposed to various types of funding sources.

Based on the analysis of specialized literature, the analyzed studies, and the professional experience accumulated by the authors of the work (people working in different interdisciplinary fields), the research questionnaire was prepared. Before distributing the questionnaire to the researched population, there was a pre-test stage on a sample of 11 people, students of the same university included in the study. The pre-tests had the role of identifying and eliminating all possibilities of ambiguities. Following this pre-test stage, one open-ended question was excluded (considered unclear by all 11 respondents) and two other questions were reformulated (in order to be better understood by the respondents).

The final version of the questionnaire (obtained after the pretest stage) consisted of 24 items clustered into several sections that strongly cover the researched theme and achieve the intended goal. For more details, see Table 4.

Table 4. List of questions included in the questionnaire and their corresponding objectives.

	Questions	Research Questions (RQ)
Q1	You are interested in entrepreneurship?	Interest in entrepreneurship—eliminatory question
Q2	Do you intend to open your own business in the following 5 years?	Interest in entrepreneurship—eliminatory question
Q3	How well do you know the potential sources of financing for your own business?	RQ1, RQ2
Q4	To what extent do you think you have potential managerial qualities?	RQ1
Q5	What rating do you give when performing your tasks?	RQ1
Q6	How solid do you think your financial knowledge is?	RQ1
Q7	What sources of funding do you know of?	RQ2
Q8	To what extent do you think funding sources are being used for financing the business (Retained earnings/profit, Personal sources, Supplier credits, European funds, Loans (bank credits), Leasing, and Business-angels)?	RQ2
Q9	What is the extent to which you think you would be willing to use the company's equity?	RQ3
Q10	How well do you know the sources of financing for your own business?	RQ1, RQ2
Q11	From the profit of the firm, what is the percentage that you are willing to invest (in the first year, in the second year, in the third year)?	RQ3, RQ4
Q12	What importance do you attach to using relationships with other individuals to finance your business?	RQ4

Table 4. *Cont.*

	Questions	Research Questions (RQ)
Q13	How do you assess knowing the following information: *How well are you aware of the advantages of using European funds?How well do you know the disadvantages of using European funds?*	RQ3
Q14	To what extent are you willing to make use of bank loans?	RQ3
Q15	Indicate your degree of agreement or disagreement with the following statement: *Requiring the provision of guarantees for the amount borrowed represents a barrier to accessing the financing source.*	RQ4
Q16	Do you think that the decision on the form of financing also considers the tax aspects (*given that the choice of leasing as a form of financing involves VAT, whereas the traditional loan from the bank has no impact on VAT*)?	RQ3
Q17	To what extent would you choose leasing as a possible alternative form of financing (given its greater flexibility than in the case of traditional bank financing)?	RQ3
Q18	To what extent do you think you would seek the support of a business angel?	RQ3
Q19	To what extent do you know the market characteristics of your product/service?	RQ4
Q20	List three factors (the most important ones) that enable business success:	RQ3
Q21	To what extent are you willing to: - Risk all personal money in your own company - Work hard for your business - Put aside your hobbies until you succeed - Leave aside your group of friends until you succeed - Work without being rewarded until the business is successful	RQ4
Q22	To what extent do you think that the information from the courses on entrepreneurial education you attended at the university will help you in opening a business?	RQ1
Q23	You participated in external entrepreneurial training courses (outside of the courses taken at the university)?	RQ1
Q24	What is the level of your experience in your current workplace?	Identification questions
Q25	Your gender?	Identification questions
Q26	What is the year of study you are currently in?	Identification questions

Source: Developed by the authors.

The first section contained eliminatory items to filter respondents not interested in entrepreneurship (Q1–Q2). The last section (Q22–Q24) requested information about the demographic profile of respondents, such as year of study, gender, and age. The core section of the research tool (Q3–Q21) aimed to answer the researcher's questions.

Relying on the existing evidence, the present study proposes the following, emerged from the literature review (see Section 2):

H1. *There is no connection between the respondents' gender and the intention to resort to bank loans as the main source of financing the business.*

H2. *There is no connection between the gender of the respondents and the extent to which they are willing to turn to a business angel as a main source of funding.*

3.2. Data Collection, and Location of the Survey

Study respondents were students interested in entrepreneurship who expressed their intention to start a sustainable business. Two questions were addressed at the beginning to check whether the students are interested in entrepreneurship or if they want to open a business in the following five years. If respondents' answers were negative, their further involvement in the study would have been over. To choose the university centre where the questionnaire would be applied, the authors have made thorough documentation of the universities in the Central Region of Romania. As a result, Transilvania University of Brasov was chosen as the largest university in the region. In addition, it benefits from its research institute (ICDT), which is composed of the Student Entrepreneurial Society (SAS-UTBv). SAS-UTBv is a structure within the Transilvania University of Brasov that aims to organize and carry out activities to promote entrepreneurship among the university's students (Student entrepreneurial society Transilvania University of Brasov 2022) [110].

The first step was to find the students enrolled in the higher education institution targeted by the research (Transilvania University of Brasov) who would be interested in entrepreneurship. To reach the target group, the authors used a database containing all institutional email addresses of enrolled students. Subsequently, the invitation to participate in the study was sent (the invitation was sent three times, once every month).

The data collection was performed using an electronic questionnaire adapted to CAWI (computer-assisted web interviewing) [111].

3.3. Study Sample

The final sample for the quantitative research comprised 285 respondents, students of Transilvania University in Brasov interested in entrepreneurship. Students enrolled in all study cycles (bachelor, master, doctorate) were targeted. The sample structure it can be seen in Table 5.The primary data was collected between June–August 2022.

Table 5. Sample profile.

		Sample Structure						
Criteria	Sample (285 respondents)	**Men** 26.3%					**Women** 73.7%	
	Form of education	**License degree** 90.5%		**Master's degree** 6%			**Ph.D.** 3.5%	
	Current workplace experience	**Unemployed** 34.0%	**<1 year** 37.2%	**1 year** 17.2%	**2 years** 5.6%	**3 years** 5.3%	**4 years** 0.4%	**5 years and more** 0.4%

Source: Author's calculation based on collected data.

3.4. Data Analysis Techniques

The selected data analysis techniques were chosen in harmony with the objectives of the study. For this purpose, IBM SPSS Statistics 20 program was utilized to estimate the descriptive analysis, illustrate the respondents' characteristics, perform two Chi-Square Analysis, and perform Principal Component Analysis (method that is part of multivariate data analysis).

Statistical and descriptive indicators were used, including mean, median, frequency, standard deviation, correlation matrix, and Varimax Rotation Method. The authors have fully organized and supervised the entire research process [112,113].

4. Results and Discussions

Results are grouped according to the RQ, while the analyses performed are presented following a logical sequence. At the end of the section, the results of the multivariate data analysis can be found.

RQ1. What is the level of knowledge possessed by the respondent in the field of entrepreneurship (part of sustainable entrepreneurial education entrepreneurship education)?

The information obtained from university entrepreneurship education courses are useful (Q22) to the respondents to a very large extent (39.6%) and to a large extent (35.1%). A minority percentage (6%) chose the middle level of the scale, and the rest of the respondents checked the answer in small (10.5%) and very small (8.8%) measure. The obtained results support the idea that the respondents consider that the information obtained from university entrepreneurship education courses is useful to them.

For the question *How solid do you think your financial knowledge is?* (Q6), the authors used a semantic differential scale. Almost half of the respondents (47%) checked the answer option neither. Similar scores were obtained for satisfying (24.2%) and solid (23.9%). The not at all solid answer was chosen by 4.9% of the respondents, while the very solid option was not chosen by any respondent. This highlights the fact that no respondent believes to have very solid financial knowledge. The obtained results support the idea that the respondents are open to acquiring, deepening, and developing already held knowledge. Their interest is also revealed by their participation in the competition "Be in the centre!" 2021–2022, launched at Transilvania University of Brasov, involving a business plan development for which participants received guidance from their teachers concerning key aspects of the future business. The submitted projects are available following the URL: https://www.unitbv.ro/documente/Studenti/fii_%C3%AEn_centru/Fii_in_centru_competitia_2021-2022_site.pdf (accessed on 31 January 2023).

Such actions empower students, lead them to form groups from different fields of study, work in a team, and accept the coordination of colleagues with potential managerial skills. This is also emphasized by subsequent results obtained in the study. The respondents do not perceive themselves as having managerial skills, admitting that these are acquired over time through new information and practical experience. Hence, participating in the business plan implementation is a dynamic, passionate, and dedicated endeavour.

Subsequently, the research continued with the question regarding the extent to which the respondents consider that they have potential managerial qualities (Q4). More than half of the respondents (54%) indicated the average measure of the scale, 24.9% selected the option to a large extent, while 14.0% of them indicated to a little extent. Equal percentages were obtained for the option to a very small extent, respectively to a very large extent, with 3.5% each. The mean score was 3.11 (with a minimum of 1, respectively a maximum of 5).

Another question contained in the research highlights the students' participation in external entrepreneurial training courses (Q23), and the results obtained show the fact that most respondents did not participate in such courses (70.1%). It is interesting to make the connection between the two questions when, although the respondents consider that they do not have managerial skills to a great extent, they have not participated in external entrepreneurial education courses.

When evaluating the personal efforts involved when performing tasks (Q5), the respondents gave ratings from 1 to 5, where 1 represents to a very small extent and 5 stands for excellent. More than half of the respondents (54%) rated their response at 4, followed by 22.5% who indicated excellent as a response. The middle variant (rating 3) was chosen by 20.7%, followed by 2.5% who awarded level 2, respectively 0.4% with level 1—to a very small extent. It can be concluded that most of the respondents perceive themselves as performing the tasks they feel responsible for. Statistical results also indicate a mean score of 3.9 and a median value of 4.00 for this item.

Once again, respondents' involvement in carrying out student activities with theoretical and practical content is demonstrated. The concern for success and the achievement of the proposed goals will eventually lead to the development of an action plan with set indicators and a desire to monitor the progress of reaching the objectives. Results show that more than half of the respondents (54%) assigned a score of 4, which may indicate objectivity, a good sense of reality, and a high degree of honesty.

The survey also sought answers from the respondents on the list of the main three factors (the most important) considered to ensure success in business (Q20). Responses accurately illustrate the respondents' interest in starting a business, as 63.51% indicated in the

listed factors qualification criteria in the category of entrepreneurs (38.6%). Entrepreneurial qualities such as creativity, seriousness, discipline, self-confidence, and the ability to make decisions come first, followed by factors related to human capital, which was selected by 38.94% of the respondents.

Almost 33.68% of the participants in the survey reported financial capital as one of the main success factors in business (11.81% of responses). These findings reveal the depth of the respondents' perception and high levels of understanding of the entrepreneurial field.

In a logical sequence, any business is designed by a person with professional qualities and skills, a well-defined strategy, and clear goals. Achieving such goals implies establishing the necessary human and financial resources and effectively implementing each stage of the project. Therefore, the undertaken analysis reflects the concern shown among respondents for applying and extending their theoretical knowledge in real-life situations, starting from clearly defining the traits that any successful entrepreneur should possess.

A particular interest is given to the knowledge of the market on which the company should operate, but also to the products/services offered to consumers (24.91% of respondents indicated 9.35% of the answers), followed by the interest given to marketing actions (5.03%) and managerial aspects (4.1%). In the category of other factors, some other indicated responses were information, interest, communication, and politics.

RQ2. What are the main sources of financing known to the respondents?

The study also aimed at identifying the financing sources known by the respondents (Q7). Results revealed unequivocally that the European funds rank first, with 28.83% of the total sources indicated by most respondents (83.16%), followed by bank loans with a share of 25.79%. The answer does not contradict the current state of the Romanian companies that have faced a series of problems during the pandemic. Given that most companies are going through a period of recession, indicating that the most well-known sources of financing leaves on an average rank the reference to profit, not because it is not a studied source, but because now it is not a viable one.

Bank credit is almost as well known, with a much higher history of use than European funds, but the qualification criteria for eligibility are very rigorous. The findings follow the European Commission's report on targeting loans to SMEs, where banks are at its core, followed by alternative funding providers [2].

The results obtained while identifying the most well-known funding sources available to firms correlate perfectly with the answers to the question regarding the most used sources of financing (Q8). Any funding program chosen by the firm must initially use the available profit and then turn to other ways of support. Personal sources scored 11.81%, immediately after bank loans, which indicates that their existence transfers confidence and security for the future to any entrepreneur. In an economy deeply affected by the COVID-19 pandemic, entrepreneurs reluctantly turn to other sources of financing, such as leasing and attracting new investors, with both responses reaching close percentages (7.87% and 7.62%, respectively).

In response to the question on how well they know the sources of financing for their business (Q10), 40.7% of respondents indicated the mid score neither, closely followed by 39.9% assessing the level of knowledge as satisfying. Another 20% of participants in the survey reported a strong level of understanding and only 0.4% admitted to having a very strong knowledge. Correlated with the answer regarding the practical experience, a high degree of seriousness in assessing the factual situation as the opening of the horizon to the financing paths offered by the market economy deepens as a business of its own is started can be observed. Naturally, the first stage in starting a business is gathering information on the field of entrepreneurship and ways of financing, and then documenting and deepening the right paths to bring the business to life.

Table 6 portrays the overall results scored for the main sources of financing available to companies, assessed by the respondents and correlated with the outcomes of the literature review.

Table 6. Summary of consolidated results on the use of financing sources.

		Retained Earnings/ Profit	Personal Sources	Supplier Credits	European Funds	Loans (Bank Credits)	Leasing	Business Angels
Criteria	**Mean**	3.80	3.67	3.29	3.74	3.64	3.12	2.62
	Median	4.00	4.00	3.00	4.00	4.00	3.00	3.00
					Percent (Frequency)			
Categories	**1—Least utilized**	3.2	3.5	3.5	3.5	6.0	5.3	16.5
	2	10.5	10.9	18.6	10.9	10.5	24.9	31.2
	3	24.6	24.6	36.1	24.6	22.8	33.0	31.2
	4	27.0	37.2	28.4	30.2	34.7	26.3	15.4
	5—Most utilized	34.7	23.9	13.3	30.9	26.0	10.5	5.6
	Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Author's calculation based on collected data.

Of the seven sources of financing, the highest average is recorded for profit (with an average of 3.80), followed by European funds (3.74). Lastly, it can be noticed that business angels scored an average of 2.62. The answer most utilized obtained the highest percentages for profit (34.7%), followed by European funds (30.9%). For the option least utilized, business angels obtain the highest percentage, 16.5%.

These results emphasize the current action course of most companies operating in the business environment and demonstrate "prudence" in the analysis, namely that the existence of profit and its use for business development is supported by the interest given and trust in their internal capabilities and resources. Equally important is the solution of accessing European funds involving large-scale projects and objectives in sustainable areas. In this context, the interest granted by the competent institutions to support new business development through a program such as the Start-up Nation-Romania 2022 (cited by the respondents) should be remined.

The attention paid by the respondents to bank credit was the third nominee source of financing (26%), considering the difficult methodology approached by financial institutions for granting loans.

The analysis also reveals an interest in equity (23.9%). Share capital, as part of equity, represents the shareholders' contribution when setting up the legal entity, which may increase as the business works and develops. Other means of increasing the capital are the deductions from the profit obtained, given that a large share of capital provides the users of accounting information (business partners) credibility and further interest in developing current and new partnerships.

RQ3. What are the respondents' attitudes and opinions regarding the different types of financing sources?

Considering that the choice of leasing as a form of financing implies VAT and the traditional loan from the bank has no impact on VAT, the respondents had to indicate if they consider tax aspects when choosing the main form of financing. A majority percentage was obtained for the affirmative answer (89.5%), while 9.8% ticked the no option. A small percentage of respondents (0.7%) said they didn't know. Analysis shows that taxation plays an important role in entrepreneurship, and respondents know the advantages and disadvantages of a VAT payer.

However, the European funds are the best known and most accessed ways of financing through the programs offered by the Ministry of Investments and European Projects, an assertion proven by the following analysis. Regarding how well the respondents know the advantages and disadvantages of using European funds, the research results show that the average response is higher in terms of the advantages of accessing European funds (average of 3.36) at the expense of disadvantages (with an average of 2.91). Regarding the distribution of the answers on each construct, a percentage of 44.6% of the respondents display a satisfactory level of knowledge of the advantages of using European funds, while a large percentage of the respondents, almost half of them (46.3%), consider that their level of knowledge is neither satisfactory nor unsatisfactory in terms of disadvantages.

For the question "To what extent are you willing to make use of bank loans" (Q14), the response variants for scales four and five are combined, representing the Top Two Box

(T2B) score that recorded 25.3% of the responses provided, as can be seen in the Figure 1. On the opposite spectrum, the score called Bottom Two Box (B2B) totals 47%, thus noting a mistrust of respondents regarding bank loans (B2B = 47%).

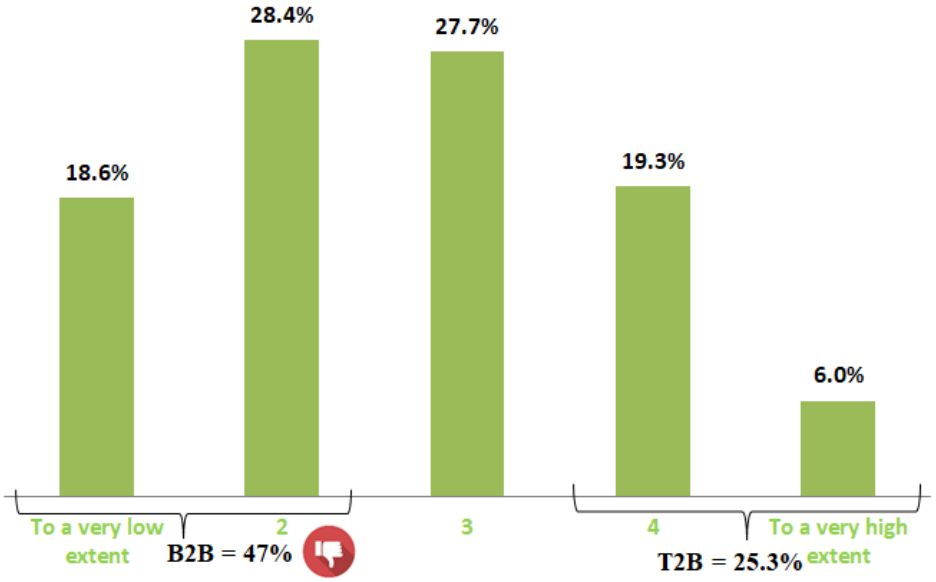

Figure 1. Extent to which the respondents are willing to resort to bank loans. Source: Author's calculation based on collected data.

The crostabulation on observed and expected frequencies can be found in Appendix A Table A1. Accessing bank loans is not a solution for small and medium-sized firms, as the eligibility conditions are demanding and less encouraging, and the costs are high compared to the other sources of financing. The authors assess that respondents can evaluate the implications of hiring a bank loan due to the knowledge they acquired through studying the banking domain in the school curriculum at various specializations. Their analytical capacity and ability to make potential decisions on financing their own business was highlighted. Thus, it can be said that most young entrepreneurs do not choose to resort to bank loans in the first stage of running a business, considering that the implications on costs are significant. Further analysis aimed to identify whether there are differences between the gender of the respondents and the extent to which they are willing to resort to bank loans, thus reaching the testing of hypothesis H1. There is no connection between the respondents' gender and the intention to resort to bank loans as the main source of financing the business.

The summary analysis of differences between the observed and expected frequencies (see Appendix A Table A1) indicates variations among the subgroups formed by crossing the two variables. Major differences are recorded within the female group for the construct neither/nor (the level is higher than expected, with a corresponding decrease within the male group for the same response category). However, to test the global significance of these differences, the authors conducted a Chi-Square Test, defining the following hypotheses:

H0. *There is no connection between the respondents' gender and the intention to resort to bank loans as the main source of financing the business (there are no significant differences between the observed and expected frequencies)*

H1. *There is a connection between the respondents' gender and the intention to resort to bank loans as the main source of financing the business (there are significant differences between the observed and expected frequencies)*

The Chi-Square test (Table 7) showed that the calculated level of significance (0.378) was higher than its theoretical level (0.05); therefore, it can be concluded that ***there is***

no connection between the gender of the population under investigation and the desire to resort to bank loans as a source of financing. Under such circumstances, it may be assumed that the choice of bank loans as a source of financing is not influenced by the variable gender type of the entrepreneur. Women entrepreneurs are involved in various firms alongside men and equally participate in decision-making, including accessing funding such as bank loans. Moreover, they seek with great rigor to follow the repayment schedules and to use the amount borrowed according to the approved destination. Along with male entrepreneurs, they show openness, courage, and initiative in accessing sources of financing such as bank loans. Results are supported by financial institutions that act without gender discrimination in selecting their entrepreneur partners.

Table 7. Critical report for the Chi-Square analysis for first test.

	Value	Df.	Asymp. Sig. (2-Sided)
Pearson Chi-Square	4.212 [a]	4	0.378
Likelihood Ratio	4.223	4	0.377
Linear-by-Linear Association	2.004	1	0.157
N of Valid Cases	285		

Source: Author's calculation based on collected data. [a]. A total of 1 cell (10.0%) has an expected count of less than 5. The minimum expected count is 4.47.

When assessing business angels as a funding source, almost half of the respondents indicated level 3 (42.5%), followed by 27% of respondents who scored for level 2. The results reinforce that respondents do not properly know this type of funding source, which may explain why the middle answer variant (level 3—level regardless) was an option for so many participants in the survey. Notably, only an insignificant percentage of 4.2% is willing to seek the support of a business angel. The crostabulation on observed and expected frequencies can be found in Appendix B Table A2. The phenomenon can be explained by the early stage of this source of financing, or rather, by the desire of individual investors to remain in the "shadow" of the small firms. It is a prudent path for the investor and the one who receives the financing. The advantages given by such capital could balance the requirement regarding the share of profit that must be ceded as an exchange. Therefore, choosing a source of financing available at the beginning of the business should be based on a complex, profound, and severe analysis, which was also indicated by respondents.

The study continues with Investigating the differences between the respondents' gender and the extent to which they are willing to turn to business angels, thus reaching the testing of Hypothesis H2. There is no connection between the gender of the respondents and the extent to which they are willing to turn to a business angel as a key funding source.

The summary analysis of the differences between the observed and expected frequencies (see Appendix B) shows there are differences within all subgroups formed by crossing the two variables. Thus, differences are recorded for the female subgroup in case of agreement (where the level is higher than expected, with a corresponding decrease on the level scored by the male subgroup for the same category of response). A reverse situation occurs in the case of the indifferent (undecided) answer variant. To test the overall significance of these differences, the Chi-Square Test is applied. The assumptions proposed for testing are the following:

H0. *There is no connection between the gender of the respondents and the extent to which they are willing to turn to a business angel as the main source of funding (there are no significant differences between the observed and expected frequencies).*

H1. *There is a connection between the gender of the respondents and the extent to which they are willing to turn to a business angel as the main source of funding (there are significant differences between the observed and expected frequencies).*

The Chi-Square test (Table 8) showed that the calculated level of significance (0.504) was higher than its theoretical level (0.05). Therefore, it can be concluded that ***there is***

no connection between the gender of respondents and the extent to which they are willing to turn to the business angel as a source of funding. The study confirms the perceived responsibility of the female gender in business, as in any activity. It is worth noting their involvement in the field of entrepreneurship. At the same time, regardless of the entrepreneur's gender, finding new sources of financing for business development is among one's target objectives. Even if business angels are not in the first places in the hierarchy of the most famous forms of financing, resorting to its use is not dependent on the gender type of entrepreneurs. Such funding requires, first and foremost, openness to new agreements with partners, courage, and responsibility [114].

Table 8. Critical report for the Chi-Square analysis for second test.

	Value	Df.	Asymp. Sig. (2-Sided)
Pearson Chi-Square	1.370 [a]	2	0.504
Likelihood Ratio	1.368	2	0.505
Linear-by-Linear Association	0.179	1	0.672
N of Valid Cases	285		

Source: Author's calculation based on collected data. [a]. A total of 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 17.89.

RQ4. What is the future entrepreneurial intention regarding the establishment of a new business?

The item for the perceived barriers in accessing a funding source was measured through a five-point Likert-type scale, ranging from 1 = completely disagree to 5 = completely agree. Thus, the following statement, "Requiring the provision of guarantees for the amount borrowed represents a barrier to accessing the financing source", scored 33% for agree and 2.8% for completely agree. A total of 20.7% of the respondents opted for disagree, while 1.8% scored completely disagree. However, the highest percentage (41.8%) of respondents mentioned neither agreement nor disagreement.

During the first year of their own business, 27.7% of the respondents are willing to invest between 11-25% of the registered profit. With equal and close relative percentages (18%), the answers recorded for the following intervals were 0–10%, 26–50%, and 51–75%. A total of two percent less, 16.5% of the respondents, are willing to reinvest almost all the profit obtained in the first year of business (with relative percentages between 76–100% of the profit). The distribution of the answers shows that the highest reinvested profit is recorded in the second year, ranging between 26–50%.

The result is fully justified because, during the first year, the business and the fiscal environment are scanned and analysed, and most partnerships are founded or strengthened. It is the period during which the directions of action are assessed, following the objectives pursued. For a young entrepreneur, it means fixing the coordinates of the newly started business and assessing all financing opportunities. As experience grows, the degree of confidence in the negotiating power with partners, including financial institutions, also increases. In this context, openness to using external financing sources attracts and conditions, in a certain way, reinvesting the profit in a firm's development. Results of the current study argue that tax incentives gained while reinvesting profit, as regulated by the Fiscal Code, are prerequisites for thinking in the sense of reusing the results obtained.

The respondents were further asked to indicate the extent to which they are willing to use the firm's capital. A percentage of 38.2% consider that, to a large extent, they are willing to resort to the firm's equity, while 31.6% chose the neutral response option. A source of financing worth considering is equity, which helps to convey a favourable image of the entity's credibility. A large equity capital based on the share capital and high profits develops an interest in front of potential investors.

A sensitive question refers to the importance that respondents attach to the use of relationships with other individuals for financing the business. More than half of the respondents consider this type of relationship to be important (52.3% of the subjects). A significant percentage of 20.7% have an indifferent approach, and 15.8% consider such a

relationship as very important. Small importance is shown by 10.2% of the respondents, while 1.1% of them indicated a very small importance toward a such relationship.

The result of this question reveals the same degree of caution manifested in the respondents' answers throughout the research. The phenomenon contributes to a forethought on behalf of the entrepreneurs, whose approach is mainly that of small but safe "steps". A different approach was notable for 15.8% of the respondents, who are more experienced in working with funders and more comfortable in managing these relationships.

A topic of interest for any entrepreneur is the ability to understand and assess the characteristics of the market, depending on their products or services. Thus, respondents were asked to evaluate the extent to which they possess such knowledge. A large percentage of respondents (41.1%) consider they have this knowledge to a large extent (granting level 4), followed by 34% of respondents who scored the neutral level. Level 5, to a very large extent, was awarded by 15.4% of respondents, followed by 7.7% who indicated level 2. The lowest percentage recorded is for level 1, the smallest extent, with 1.8% of the recorded responses. According to a study conducted in 2021 [115], the qualities of a successful entrepreneur are relevant and defined by a clear vision of the business, creativity, and imagination in designing the products or services. The question becomes the link between implementing planned strategies and finding financial resources for achieving objectives. A significant percentage of respondents (41.1%) allocated a great importance to knowing the market characteristics of their product or service. The ability to adapt to any market requirements and create long-term collaborative relationships, in addition to consumer loyalty, are qualities meant to give courage and optimism to entrepreneurship.

As a notable contribution to the scientific literature, the authors developed an entrepreneurship program framework, which aims to improve the entrepreneurial skills of future graduates. This framework is based on three major pillars (P1, P2, P3) drawn from the research results and amply described in Figure 2.

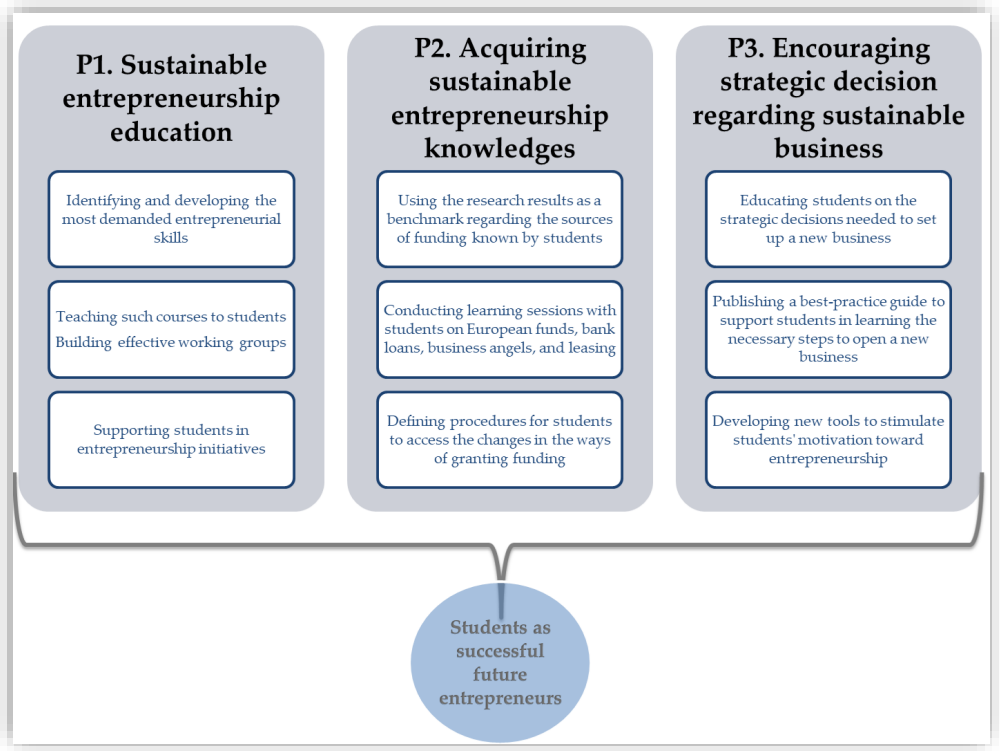

Figure 2. Program proposal to support entrepreneurship among students as seen by the authors. Source: Developed by the authors.

Based on the proposed stages, a significant impact on self-confidence and a change of attitude towards the approach to business risk is considered.

Regarding the extent to which respondents are willing to risk all the money in their own business, 30.9% of the answers were target level 2, followed by 26.7% for level 3. Thus, a thoughtful spirit of the respondents is observed. Asked about how hard they are willing to work for their business, 75.8% of the respondents indicated to a very large extent. An insignificant percentage of 1.1% of respondents consider that they are willing to work only to a small extent. Even if prudence pervades most of the respondents' responses, there is a strong dedication to achieving the proposed objectives, regardless of all the material and financial challenges.

Results reveal an increased interest toward reaching the success of the business and the tendency to give up many of the dimensions of social life for such a purpose. Although most of the respondents are young, they are willing to put aside their hobbies until they succeed in their own business, with a percentage of 34% for level 4, respectively 24.2% for level 5, which represents the level of a lot. A small percentage of 5.6% mentioned that they are not willing at all to give up hobbies until they succeed with their own business. The extent to which the respondents are willing to put aside their group of friends until they succeed in their own business received a more balanced distribution of the answers. When asked about the extent to which respondents are willing to work without being rewarded until they achieve success, most respondents' answers were situated around levels 4 (33%) and 5 (26%). A quarter of the respondents (26.7%) chose level 3.

Principal Component Analysis (PCA)

In order to identify interdependencies between the several variables of the research, the Principal Component Analysis (PCA) method was applied with the aim of obtaining a small number of components which explain the respondents' attitudes regarding the extent to which funding sources are used to finance the business (Q8 = To what extent do you think funding sources are being used for financing the business). Starting from the seven analyzed variables (retained earnings/profit, personal sources, supplier credits, European funds, loans (bank credits), leasing, and business angels), two main components were further identified to simplify the process of interpreting the results.

Some relevant correlations were found (Table 9) between the assessments regarding the greater use of bank credit and leasing, which represent long-term loans, as well as between the assessments regarding the use of profit-based financing and capital financing, both elements belonging to their own sources of financing. Minor correlations were also found between the assessments regarding the use of financing in the form of loans and personal sources, as well as between leasing and profit, which can be explained by the ratio between them.

Table 9. Correlation Matrix.

		Retained Earnings/ Profit	Personal Sources	Supplier Credits	European Funds	Loans (Bank Credits)	Leasing	Business-Angels
Correlation	**Retained earnings/ profit**	1000	0.306	0.116	0.101	−0.078	−0.089	−0.002
	Personal sources	0.306	1000	0.215	0.011	−0.097	−0.062	0.029
	Supplier credits	0.116	0.215	1000	0.202	0.107	0.083	−0.001
	European Funds	0.101	0.011	0.202	1000	0.106	0.029	0.204
	Loans (bank credits)	−0.078	−0.097	0.107	0.106	1000	0.334	−0.006
	Leasing	−0.089	−0.062	0.083	0.029	0.334	1000	0.134
	Business angels	−0.002	0.029	−0.001	0.204	−0.006	0.134	1000

Source: Author's calculation based on collected data.

In order to continue the analysis, the Component Matrix is created (Table 10).

Table 10. Component Matrix.

	Component [a]	
	1	**2**
Retained earnings/ profit	0.650	−0.267
Personal sources	0.680	−0.257
Supplier credits	0.604	0.258
European Funds	0.459	0.379
Loans (bank credits)	−0.034	0.717
Leasing	−0.037	0.723
Business-angels	0.210	0.330

Extraction Method: Principal Component Analysis. [a] 2 components extracted. Source: Author's calculation based on collected data.

It is observed that the respondents' assessments regarding the use of financing sources from profit, personal sources, and European funds are strongly correlated with the first component, while the assessments regarding the use of financing sources from loans, leasing, and business angels are strongly correlated with the second component.

Analyzing the variables that explain the two components, it can be observed that the first component is associated with the company's own sources of financing (profit, other components of the capital) to which are added the European funds—non-reimbursable sources that have become income with influence on the result of the activity, i.e., the profit. The second component reflects borrowed (repayable) sources that involve additional costs. While the level registered by the variables in the first component conveys an increase in credibility in the entrepreneurial environment (stability, safety, performance), the degree of indebtedness reflected with the help of the variables in the second component describes the vulnerable character of the business (insecurity, instability, exposure to risk).

The results regarding the correlation coefficients between the analyzed variables and the two main components, obtained after rotating the axes according to the Varimax method (Table 11), represent the continuity of the performed analysis.

Table 11. Correlations between variables and factors following axis rotation.

	Component [a]	
	1	**2**
Retained earnings/ profit	0.696	−0.100
Personal sources	0.722	−0.083
Supplier credits	0.523	0.398
European Funds	0.352	0.480
Loans (bank credits)	−0.208	0.687
Leasing	−0.212	0.692
Business angels	0.123	0.372

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. [a] Rotation converged in 3 iterations. Source: Author's calculation based on collected data.

The obtained results demonstrate that following the rotation of the axes, no substantial changes can be observed in the values of the correlation coefficients compared to the situation presented previously. The graph is represented in Figure 3, for demonstration.

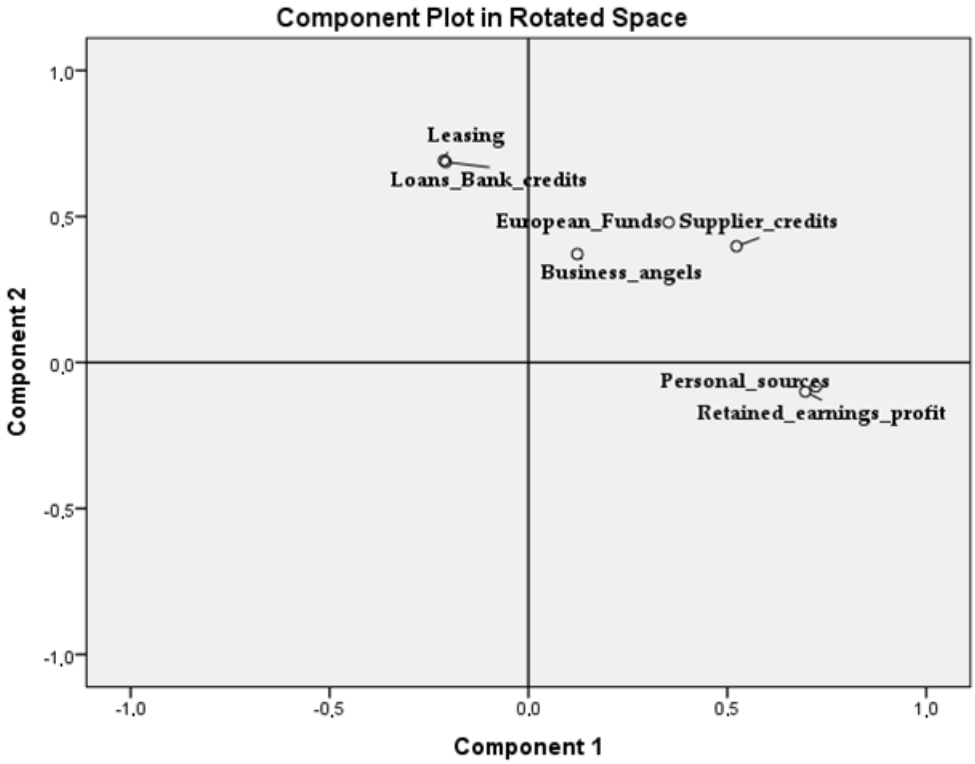

Figure 3. Graphical representation of the association between variables and factors. Source: Author's calculation based on collected data.

By reducing the seven variables to the two main components, an attempt was made to identify certain links between them and the different variables of the research. With this goal in mind, two new variables were created, calculated based on the individual average values of the variables included in each component. Thus, the variable "Situations regarding own financing sources" consisted of profit, capital, and revenues from European funds, and the variable "Situations regarding the components of the degree of indebtedness-financial leverage" was obtained based on the other variables (long-term loans).

This analysis demonstrates, once again, the current trend that orients entrepreneurs towards financing their business during the economic crisis and reinforces the results obtained through the present study. Careful consideration and balance in action are skills indicated by the young potential entrepreneurs interviewed.

5. Conclusions

In today's market economy, carrying out an activity with the aim of obtaining profit involves taking risks arising from the essential aspects of a business aimed at leading innovation in a field, market, or industry. In a dichotomous dimension, entrepreneurship advances from the strict objective of obtaining profit so that the entrepreneurial spirit gets positioned above the financing resources. This study also showed that entrepreneurial skills are a success factor in business, as confirmed by 38.80% of the given answers. The sources of entrepreneurial financing identified in the paper are the following: retained earnings/profit, personal sources, supplier credits, European funds, loans (bank credits), leasing, and business angels.

As a relevant aspect of the study, most of the respondents give great confidence in funding through European funds and having knowledge of most of the programs on start-ups. The result of the campaign carried out by the competent institutions is the consultancy firms for accessing European funding. The interest is also visible in the relationship (in the negotiation stage) built by the European Union with the banking network, which will get involved and direct the refused loan applications to other alternative sources of financing.

Thus, companies rejected by financial and banking institutions for not having necessary guarantees can participate in alternative lending platforms that may be interested in offering a loan/financing to a newly founded enterprise, although most likely at a higher interest rate. This paper also supports the study carried out by the European Commission [2], which highlights the interest in supporting entrepreneurial initiatives by accessing bank funds.

The authors outlined defining aspects regarding entrepreneurial initiatives and their ways of financing, considering the broad perspective of the creative potential supported by the academic environment. The research highlights the importance given by respondents to the process of starting a business, drawing up a work plan, building a budget, and identifying the most appropriate sources of funding for a business development strategy (see Figure 4 for main research highlights). Thus, caution in appreciation, a high degree of awareness of the features of successful entrepreneurship, the openness to know and understand all the ways of financing, the maturity in identifying the current financing methods, and the trust invested in their use are noted.

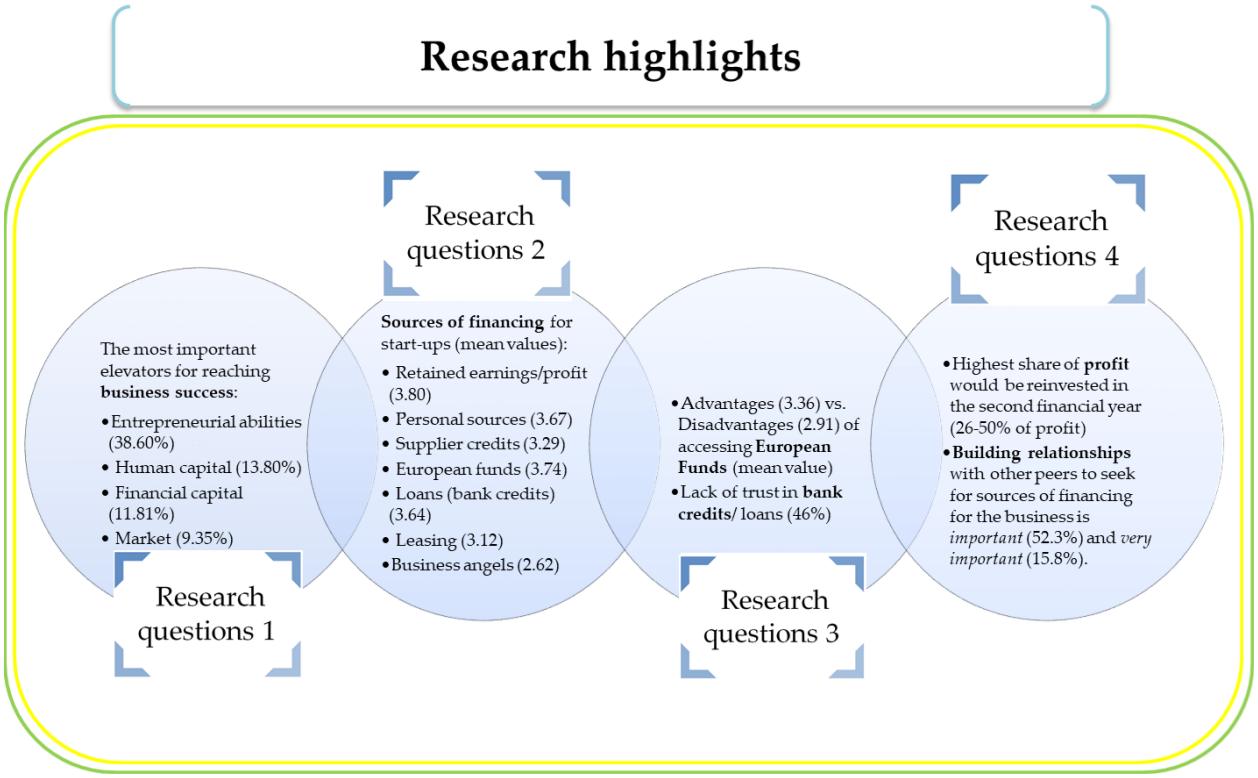

Figure 4. Overview of the main research conclusions. Source: Developed by the authors.

The results of this research lead to the idea that collaboration with the business environment, a close connection between the student and the entrepreneurial environment, and effective participation in teamwork during the student practice all contribute to the discovery of yet insufficiently unknown valences of professional competencies. Thus, a high degree of satisfaction in applying creative ideas, strengthening confidence in entrepreneurial capacities, assuming responsibilities, and aspiration to performance derives as relevant elements also visible from the study presented in this paper. As Astuty, Yustian, and Ratnapuri [116] also state, student entrepreneurial activities can be a launching pad for new entrepreneurs and universities to make efforts to prepare their students for a competitive university entrepreneurial ecosystem.

Thus, this research opens new ways of collaboration between the academic and business environments to train future professionals in the economic field whose training allows for the capitalization of creative thinking, the application of innovative ideas, and the development of managerial and entrepreneurial skills. The involvement of the business field

in the academic education of future entrepreneurs opens new opportunities for developing solid professional training. Considering the dynamics and constant development of the business environment, which requires graduates to face unique challenges, building strong partnerships with universities for future specialists' recruitment must be a necessity. It is argued that students' education should imply knowing the power of corporate culture, value systems, and behaviours based on ethical conduct [117,118]. Thus, attention must be focused on cultivating professional ethics in any field of activity and students developing their critical thinking skills in a morally correct framework [119]. The development of such behaviour can be achieved through most courses on entrepreneurship, management, finance, and accounting by discussing ethical issues related to technical topics, specialized training programs of ethics in accounting or business, and critical thinking training.

6. Limitations and Further Research

The current study, like other studies, is no exception to limitations. One limitation is that it was impossible to carry out non-random sampling, although this does not mean that the research is less valuable. Research has included data collected from students enrolled in the Transilvania University of Brasov. Therefore, the results cannot be generalised, and do not represent the entire student population. The inability to assist respondents in real-time and the distribution of questionnaires strictly in the online environment are other limiting conditions of this research. Future research directions should aim at conducting studies among entrepreneurs to determine the funding sources used. A future research direction concerns the opinion of entrepreneurs regarding supplier finance programs. Implementing such financing programs affect the liquidity and efficient use of the working capital of the companies [120].

In this future research, the aim is to achieve the division of financing sources by the stages of business development. The results of such studies, combined with the results obtained in the present study, will provide an overview of the area of entrepreneurship, thus developing appropriate learning directions.

The research carried out and presented in this article is up-to-date and extremely important both for the business environment and the representatives of the academic environment (who can adapt to the school programs).

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to we conducted a non-interventional study (questionnaires type) and all participants were fully informed that the anonymity is assured. All the participants agreed to answer the questions, taking into account that the data obtained were used strictly for statistics.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Crosstabulation on observed and expected frequencies for Q14.

			Q14					Total
			To a Very Low Extent	2	3	4	To a Very High Extent	
Gender	Male	Count	18	24	16	12	5	75
		Expected Count	13.9	21.3	20.8	14.5	4.5	75.0
	Female	Count	35	57	63	43	12	210
		Expected Count	39.1	59.7	58.2	40.5	12.5	210.0
Total		Count	53	81	79	55	17	285
		Expected Count	53.0	81.0	79.0	55.0	17.0	285.0

Source: Author's calculation based on collected data.

Appendix B

Table A2. Crosstabulation on observed and expected frequencies for Q18.

			Q18			Total
			Disagree	Undecided	Agree	
Gender	Male	Count	17	36	22	75
		Expected Count	17.9	31.8	25.3	75.0
	Female	Count	51	85	74	210
		Expected Count	50.1	89.2	70.7	210.0
Total		Count	68	121	96	285
		Expected Count	68.0	121.0	96.0	285.0

Source: Author's calculation based on collected data.

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Sustainable Entrepreneurship: Romanian Entrepreneurs' Funding Sources in the Present-Day Context of Sustainability

Carmen Elena Anton [1], Alexandra Zamfirache [2,*], Ruxandra-Gabriela Albu [2], Titus Suciu [1], Sergiu Mihai Sofian [3] and Oana-Andreea Ghiță-Pîrnuță [4]

[1] Department of Finance, Accounting and Economic Theory, Faculty of Economic Sciences and Business Administration, Transilvania University of Brasov, 25 Eroilor Bd., 500030 Brasov, Romania; carmen.anton@unitbv.ro (C.E.A.); titus.suciu@unitbv.ro (T.S.)
[2] Department of Management and Economic Informatics, Faculty of Economic Sciences and Business Administration, Transilvania University of Brasov, 25 Eroilor Bd., 500030 Brasov, Romania; ruxandra.albu@unitbv.ro
[3] Doctoral School of Accounting, Faculty of Accounting, Bucharest University of Economic Studies, Romana Square, No 6, District 1, 010374 Bucharest, Romania; sofian.sergiu.mihai@gmail.com
[4] Department of Literature and Cultural Studies, Faculty of Letters, Transilvania University of Brasov, 25 Eroilor Bd., 500030 Brasov, Romania; p.oana-andreea@unitbv.ro
* Correspondence: alexandra.zamfirache@unitbv.ro

Abstract: This paper aims to provide an in-depth analysis of the knowledge of and access to funding sources in the context of sustainability. Additionally, it seeks to analyse the perspectives and intentions of entrepreneurs regarding the use of such sources in the future. For this purpose, quantitative research was conducted, and data were collected from a sample of 267 respondents, companies operating in the Central Region of Romania. The evidence indicates that reinvestment of profits is the most commonly used funding source, followed by bank loans and leasing. The least-used and least-known funding source are Business Angels. Among the conclusions of the study, the demonstration of the link between the level of use of the funding sources, which moderates the close relationship between sustainability and the financial performance of a company, is noteworthy. Ultimately, this research opens new ways for collaboration between the academic environment, government, and local authorities. The results can be beneficial for stakeholders at both the micro- and macroeconomic levels interested in the sustainable development of the SME sector.

Keywords: sustainable entrepreneurship; sustainable performance; funding sources; sustainability; strategies; quantitative research

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1. Introduction

In the current economic context, characterised by multiple recent crises (e.g., the crisis triggered by the war, the energy crisis, the food crisis, and the international economic crisis, etc.) and an unprecedented development of sustainability [1], entrepreneurs are seeking to identify effective cost reduction initiatives based on resource reallocation [2] and the most creative ways to finance their businesses, precisely due to the challenges posed by the economic environment. Funding concerns the allocation of internal resources, from the state budget or from international bodies and institutions, for the purpose of establishing and operating a company. The most well-known methods of financial support for a business are reinvestment of profits, various forms of loans (bank loans, etc.), leasing [3], and accessing various forms of funding (European, governmental, etc.).

In Romania, according to the context of sustainable development, entrepreneurship aims at designing business models that contribute to the promotion of sustainable development objectives. The activity of entrepreneurs is manifested within the framework of an ecosystem where access to financing can be favoured.

The micro-, small-, and medium-sized companies (SMEs) represent the engine of global economy (and of regional economies), employing 50% of the global workforce, by 2030, it is estimated that they will provide approximately 600 million jobs [4,5].

In this context, for long-term sustainable economic growth, national authorities are called to develop economic policies that facilitate the access of the SMEs to appropriate funding sources.

In the business development process, the SMEs face multiple difficulties in obtaining capital, especially in the start-up phase. In this context, the increase of the capacity to access financing and face the present challenges and opportunities could bring added value to the competitiveness of international markets [6].

Financial institutions, governments, and public institutions must understand how SMEs access funding and the future intentions of entrepreneurs. This understanding can lead to a better promotion of financial access or even the modification of policies in this area [7]. Furthermore, the current economic context, along with the recent sustainability trend, also influences and changes the way companies choose the best options for accessing funding sources.

The necessity and actuality of the study are revealed in the section focusing on the analysis of the specialised literature, where it may be observed that most of the bibliographic references deal with the funding sources for each component or group and not for the entire range known to entrepreneurs. In their minute analysis of the specialised literature, the authors identified studies on the funding sources, sustainability, and performance of companies, but each of them analysed the terms separately [8–10]. The authors of the paper searched the Web of Science Core Collection database for the three terms (sources of funding, sustainability, and company performance). Filtering the results by *Keyword Plus*, no result was displayed; filtering by *Topic*, only 26 results were displayed, but these analyse specific topics (such as supply chain, food industry, etc.). The identified gap starts by combining the study of the previously mentioned three concepts at the level of SMEs, which are extremely important in the current context. The main purpose of the study is to develop a comprehensive and detailed analysis of the opinions formulated by entrepreneurs from the Central Region of Romania regarding the knowledge, application, and future intentions of accessing funding sources in the context of sustainability. The paper investigates the funding sources that Romanian entrepreneurs can call upon in the current context of sustainability. In order to understand the implications of the use of funding sources for the sustainable development of businesses, the following research questions were formulated: (i) What are the ways in which entrepreneurs can implement sustainability strategies?; (ii) What are the types of funding sources that entrepreneurs know?; (iii) What are the types of funding sources that entrepreneurs want to use in the future in the current context of sustainability? Elaborating on the answers to these research questions, the study transmits information about the potential for identification by entrepreneurs of the most suitable economic sustainability strategies while preserving environmental and social objectives [11], their knowledge of the funding sources available to SMEs, and the link between sustainability and company performance moderated by the used funding sources.

The notable contribution of this research consists of explaining the connection between sustainability and company performance, moderated by the level of use of the funding sources, based on which the authors developed the *CSFS model* that systematically presents the Connection between Sustainability, Funding Sources and Performance.

Taking into account the above-mentioned premises, the authors have structured the work into five sections. After the literature review and hypotheses development, the research method and objectives section are described, followed by the presentation of the research results and discussions. The final section includes the conclusions and implications of the study.

2. Literature Review and Hypotheses Development

A specialised literature review based on solid information, which led to the formulation of three hypotheses.

2.1. Ways of Implementing the Sustainability Strategies Used by Entrepreneurs

Considering that SMEs represent 99% of all businesses in the EU and provide two-thirds of private sector employment, special attention is given to programmes of action aimed at enhancing competitiveness through research, innovation, and access to financing [12]. In turn, SMEs pay close attention to accessing funding programmes through European funds while also carefully analysing the structure of their own funding sources. A study concerning the impact of funding sources on sustainable development across 24 countries in the European Union reveals that the combination of their own resources and European funds has a positive impact on sustainable development in only five countries (the Czech Republic, Denmark, Spain, Slovenia, and Austria). In the rest of the countries, the use of European funds has a positive impact on sustainable development [13].

According to the Global Entrepreneurship Monitor GEM [14], entrepreneurial activity in Romania is below the average calculated for middle-income economies as well as below the average of the GEM participating countries, and the rate of those who in the next three years intend to start a business is 14.93% of the adult population. This rate is higher than that registered in Hungary (10.66%) or Poland (3.69%). In the case of the countries analysed within GEM, in Croatia this rate is slightly higher (3:1), in case of Hungary it is lower (1:1), and in Poland the rate is 0.18 (there are five times fewer entrepreneurs at an early stage than established entrepreneurs).

The rate of business angel investments in the analysed countries is lower than the considered averages. Only 2.61% of the adult population of Romania stated that in the last three years they provided funds for the start of a new business by another person [14].

Furthermore, according to the GEM, established entrepreneurs in Romania consider sustainable entrepreneurship to be important, taking into account the social (71.25%) and environmental (82.33%) implications of decisions in a higher proportion than the average of middle-income countries and the GEM average. A significant proportion of experienced entrepreneurs (67.98%) consider that the social and/or environmental impact must be placed before the criterion of profitability or business development. It should be noted that Poland has extremely low weights regarding these aspects [14].

In the current context, companies are increasingly interested in identifying the most suitable strategies that offer long-term economic, social and environmental advantages, which can be achieved by using so-called *sustainability strategies*. Although at the moment in Romania the obligation to develop a sustainability code and, implicitly, a strategy in this regard is restricted only to companies with over 500 employees [15], in the future the measure will also be extended to small organisations and small businesses [16]. For any responsible entrepreneur, awareness of the real effect of their company's activity, positive or negative, on all categories of stakeholders is a priority. The research carried out by Allal-Chérif et al. [17] suggests the use of strategies that contribute to the differentiation of sustainable entrepreneurs from other categories of entrepreneurs, namely: to collaborate with integrated suppliers as business extensions, to embrace open innovation of sustainable products, and to acquire leadership technology in order to transform the present markets and create new ones promoting sustainable values and practices in business and society. According to Manninen and Huiskonen [18], applying an integrated strategy that correlates business strategy with sustainability principles can contribute to solving the global sustainability challenges important to the company. This is influenced by conditions related to the organisation, by the employees that allow the implementation, and by the market that can favour or prevent the implementation of the strategy, but also by activities such as those internal and external to the organisation.

In the specialised literature, different methods of implementing sustainability strategies are presented, depending on the geographical area in which the entrepreneurs op-

erate [19–24], the areas of business approached [25–27], or the integration of the pillars of sustainable, economic, social, and environmental development in the implemented strategy [20].

The way in which the gender of entrepreneurs influences the leaning of organisations to implement certain strategies to promote sustainability is a topic analysed in several studies that discuss the gender component as well as other elements, such as the culture of the country from which the entrepreneurs come or the region's level of economic development [28,29]. The analysis of different funding sources provides a picture of their influence on sustainability practices. For example, in the case of the capital market (a funding source with a high degree of vulnerability), the attitude of this type of investor towards certain actions of the leadership can be felt in the investment decisions and the appreciation of the company strategy [30]. Based on the information under study, the authors aim to investigate this process, starting with the first hypothesis,

Hypothesis 1 (H1). *There is a connection between the gender of the respondents and the sustainability strategy that they choose.*

The literature and practice of sustainability innovations are vast but fragmented, with diverse conceptual works and many potential innovative approaches that can contribute to the creation of a business model suitable for achieving sustainable development goals [31]. The idea of using business models to support business performance and sustainability seems to be widely accepted in the industry, and the involvement of banking and consulting companies indicates that the interest in Sustainable Business Model (SBM) is certainly not just an academic niche, but it transcends sectoral boundaries [32]. There is a great diversity of studies that analyse how entrepreneurs guide their sustainability strategies according to the 17 objectives of sustainable development [33–35].

Based on the presented information, the following research question was formulated: *"What are the ways in which entrepreneurs can implement sustainability strategies (**RQ1**)?"*

The implementation of sustainability strategies is also correlated with the CSR-type actions, whether it is involvement in actions related to environmental protection or with an impact on the social dimension of sustainability [36–38]. Considering all these aspects, the researchers have identified and formulated the second hypothesis,

Hypothesis 2 (H2). *Verification of the connection between the definition of the sustainability strategy and the priority of CSR-type actions.*

2.2. Funding Sources Applied for by Companies

In order to ensure good functioning of the business, each company must select the financing policy of the most suitable funding sources in an appropriate way. Any entity can resort to its own funding sources, attracted sources, and borrowed sources.

Internal financing resources represented by the reinvestment of profit or the sale of assets from the company patrimony and loans from shareholders or capital increases represent the main funding source for companies in Romania [39]. According to the study carried out by the National Bank of Romania (NBR) [39], among the least pressing problems faced by companies is access to financing, in which 78 percent of companies did not turn to funding sources from the banking sector (loans or overdrafts) in the last 12 months.

However, in contradiction with the NBR study, in their concern for development in the context of sustainability, the companies take decisions regarding the reinvestment of profit for financing activities, taking into account that accessibility to other funding sources is more difficult [40].

The most common source of SMEs financing is bank lending in the form of asset-based loans and cash flow loans. Along with these, trade finance and leasing represent the largest part of corporate credit [41,42]. In an extremely competitive environment, banks are adapting to optimise their loan portfolio [43] and turning to internet financing, open

banking, and Fintech lending [44–46]. Fintech has contributed to the creation of a wide range of new services, including asset management and online banking services [47], and can add value to the quality of financial services. Numerous companies have added to their objectives the provision of advanced technological support to financial institutions, but also to non-financial ones, contributing to their digital transformation [48]. Fintech promotes internet credit and instant payment, reducing the financing constraints for SMEs [49]. According to Carson Mencken's study [50], small business loans are important for socio-economic development, and they are positively associated with the increase in average income per family.

Another funding source used by SMEs is short-term financing—commercial credit [51–54]. Commercial credit is the most important source of short-term financing for any company, and it can increase sales and profit [55]. A recent study [56] highlights the dominant role of commercial credit in corporate growth, underscoring a non-linear relationship between the use of commercial credit and corporate growth. This suggests that the use of commercial credit requires a balance between benefit and cost for corporations to enhance their growth. In addition, it reflects the idea that the use of commercial credit is sensitive to financial constraints and financial crises [56,57]. It was also found that companies with more redistributable assets adjust their commercial credit relatively quickly compared to others [58]. Commercial credit also has a signalling role in relation to bank credit. Thus, companies that grant commercial credit are more likely to access bank loans at lower costs [59].

The European funds are non-refundable financing instruments allocated to the Member States of the European Union (EU) in order to reduce the economic and social development gaps between them. Funds for SMEs help companies develop their businesses in different fields of activity; their absorption represents a barometer for intelligent and sustainable growth [60]. According to a 2020 study [61], a series of difficulties were recorded in accessing the European funds, which could be overcome by a simplification of the bureaucracy in allocating them both at the European and national level as well as by the consolidation of financial security through audit measures [62]. The effect of structural funds have positive implications for public investments and aggregate well-being [63,64].

Leasing is an innovative form of financing equipment for all companies, and the practiced forms are operational leasing and financial leasing [65,66], requiring a certain flexibility for online leasing [67]. Extensive studies reveal that in retail companies, this form of financing recorded an increase of about twenty percent of the company's assets and liabilities [68] as well as profitability [69].

Undoubtedly, in order to carry out an innovative activity at SME level, it is necessary to have own financial surpluses [70]. Net profit represents the safest funding source, and between net profit and equity, there is reciprocity and strong correlation, [71]. The structure of equity depends on executive management [72], factors related to the external environment (economic uncertainties) [73] and, last but not least, environmental, social, and governance (ESG) performance [74].

Another form of financing is represented by Business Angels with contributions at the beginning of a business, but also during its development [75,76]. Together with other sources, crowdfunding [77–79] and Social Impact Bonds (SIB) represent innovative funding sources for projects that are extremely dynamic. Sustainable financing and impact funding use financial instruments, such as SIBs [80,81] and green bonds, and they are usually owned by those who are interested not only in financial return of their investments, but also in their social impact. In the variety of funding sources available on the business market, the following question arises: "*What are the types of funding sources that entrepreneurs know (**RQ2**)?*"

2.3. Types of Funding Sources That Entrepreneurs Want to Use in the Future in the Context of Sustainability

Economic development from the perspective of sustainability implies for SMEs finding new funding sources that allow innovative business models. In this context, the entrepreneurs link traditional debt and equity financing with microfinancing, crowdfunding, peer-to-peer lending, and other financial innovations [82] together with bootstrapping, which involves optimising the use of internal resources and the cost structure of the business [83–86].

In the last 30 years, venture capital (VC) has been an important funding source for innovative companies (Amazon, Apple, Facebook, Gilead Sciences, Google, Netflix, Starbucks, and others). Startups are looking for financial and non-financial resources from a corporate venture capitalist (CVC) even in the early stages of development; only that a significant role in gaining access to financing is represented by the confidence transmitted by the entrepreneurs [87–90].

The programmes offer various ways of financing a business, such as grants, loans from government agencies and tax credits. Government policies and programmes can encourage entrepreneurship [91–93].

Another funding source is Vendor financing, which is a form of loan from the seller to the customer that can take the form of debt financing or equity funding (the transfer of shares to the seller) [94]. In the supply chain, cooperation among suppliers is crucial for the success of the business. [95–97].

Business incubators are meant to accelerate growth and ensure the success of entrepreneurship [98]. Certain studies show that they can contribute to increasing the confidence of VCs to invest in startups [99], with virtual incubators becoming a phenomenon on the rise [100], although there are situations where the excess of entrepreneurial confidence can cause a decrease in the performance of the incubator [101].

Angel Investors, in general, are individuals (or a group) that provide financial support and backing to start-ups and early-stage businesses but usually take an equity stake in the company. Complex studies show that occasional angels and angel funds are stronger substitutes for venture capitalists (VC) than serial angels, and the companies in which angels invest are unlikely to ever switch to VC financing [102]. The business angel market manifests itself through a process of searching for and matching entrepreneurs with financiers [103]. It has been demonstrated that political decision-makers must be involved in increasing the confidence of angels in tax benefits and the creation of networks and online communities that offer consultancy to entrepreneurs in order to attract angels [104].

Analysing new ways of funding, the following question arises: "*What are the types of funding sources that entrepreneurs want to use in the future in the current context of sustainability (**RQ3**)*?"

In the end, it can be concluded that funding sources are influenced by sustainability, since SMEs—in order to reach sources for business development—must meet not only financial criteria but also criteria related to environmental, social, and corporate governance aspects. Thus, in order to be eligible, companies—either public or private—must present projects to financing institutions to demonstrate that they have implemented and embraced solid environmental and social practices and that they have performance in sustainability [105]. Thus, awareness of the existence of financing instruments is crucial for the transition to sustainability [106–111]. Based on the information provided by the specialised literature on this topic, the authors emphasised the third hypothesis,

Hypothesis 3 (H3). *There is a moderating effect of the relationship between the sustainability level of the companies included in the research and turnover, moderated by the level of use regarding the 7 funding sources.*

3. Research Method and Objectives

In order to achieve the objectives of the research, a quantitative method was conducted. The authors chose this type of research, taking into account the fact that it provides more information for decision-makers [112].

For this reason, a survey was conducted using the questionnaire as a data collection tool [113]. The data have been analysed with the aim of identifying the opinions, attitudes, and perceptions of entrepreneurs in companies regarding their knowledge, application, and future intentions concerning funding sources in the context of sustainability. The ultimate goal of the research is to identify the characteristics that underline the choice of the appropriate funding source for each company, with a focus on the influence of sustainability.

The objectives of the research have been established, starting from the research questions detailed in the analysis of the specialised literature, which are considered appropriate to achieve the proposed goal. The objectives are the following:

- **O1**. Discovering ways to implement the sustainability strategies by the entrepreneurs;
- **O2.** Identifying the types of funding sources that are most frequently used by the entrepreneurs;
- **O3.** Determining the future intentions of the entrepreneurs regarding the strategy of the companies to use various funding sources.

In order to achieve the purpose of the present study, the research design (Figure 1) is presented, based on the key concepts analysed in the specialised literature.

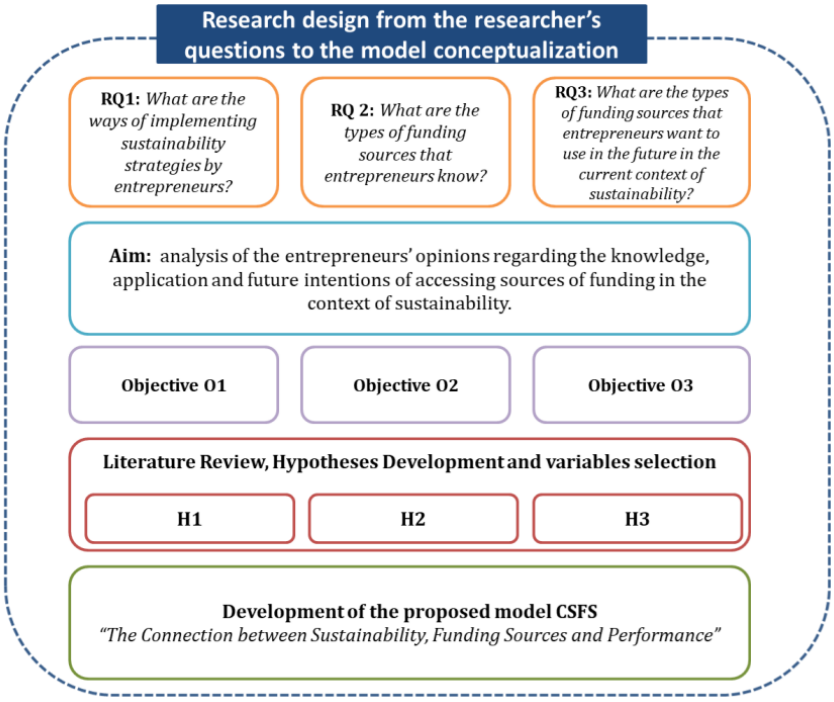

Figure 1. Research Design from the Researchers' Questions to the Model Conceptualization. Source: Carried out by the Authors of the present paper.

In order to understand and deepen the entrepreneurs' decisions regarding the choice of funding sources, the research design is quantitative. The research started by formulating the three questions of the researcher, thus managing to outline the aim of the research. The three objectives of the research are established, supplemented by the development of the hypotheses (which are strongly supported by the specialised literature). The CSFS model is developed in order to achieve the proposed objectives and to obtain the most effective solution for the research problem.

3.1. Questionnaire Development

To achieve the objectives, data were collected using a questionnaire, which was drawn up after thorough research of the specialised literature, existing studies, and the professional experience gained by the authors of the present paper (persons working in various interdisciplinary fields). The questionnaire was developed by the authors, and in order to better measure the researched characteristics, several types of scales were used. The nominal scale was used with the possibility of simple choice, multiple choice, and also the binary scale. There are also questions with a numerical measurement scale as well as a Likert scale (to find out the opinions of the subjects regarding certain statements).

Before distributing the questionnaire to the target population, a pre-testing phase was conducted on a sample of five people. The role of pre-testing was to identify and eliminate any ambiguities. As a result of this pre-testing phase, two questions were reformulated to be better understood by respondents. The final version of the questionnaire (obtained after the pre-testing phase) includes items that comprehensively cover the research topic and achieve the proposed goal, but there are also items that aim to identify the respondents.

3.2. Data Collection and Location of the Survey

To decide on the target population, it was first necessary to delineate the geographical area of the respondents. Following a rigorous analysis of the eight development regions into which Romania is divided, the decision was made to select a single region to include in the research. To make this choice, the authors examined the eight development regions from an economic perspective, as well as other available data attesting to the authorities' concern for ensuring balanced and sustainable economic and social growth [114–116]. The Central Region was chosen because it presents a balanced structure with both an active industrial sector and a significantly developed tertiary sector. Considering the Gross Domestic Product (GDP) per capita (51,365 RON in the year 2020), the Central Region ranks third in Romania, following the Western Region and the Bucharest-Ilfov Region. It should be mentioned that in 2020, the GDP per capita registered 67% of the European average (this average at the level of the European Union was the equivalent of 20,100 euros). Additionally, the Central Region has a diverse potential for tourism, ranking first in terms of the number of accommodated tourists in the year 2021 (2.25 million arrivals, accounting for 24.1% of the total number of tourists accommodated in Romania) [117].

The next step consisted of selecting and defining the research population, which comprised micro-, small-, and medium-sized enterprises (SMEs) from the Central Region of Romania. The Central Region includes six counties: Brasov, Sibiu, Covasna, Harghita, Mures, and Alba, and had the highest number of registered companies as of the year 2020—73,744 companies [118], after the Western Region and Bucharest—Ilfov Region [119]. Indeed, the population is relevant since SMEs represent approximately 99% of the registered companies in Romania [120]. Considering that most of these companies have outsourced the organisation of their accounting, a database containing all firms with CAEN (NACE—Classification of Economic Activities) code 6920—Accounting, financial auditing, and tax consulting activities was used [121], based on the premise of forming a sample within the customers of small-, medium-, and micro-companies that benefit from accounting services. Companies providing accounting services in the Central Region of Romania were selected and arranged in descending order according to their turnover for each county.

To obtain more accurate results, the method of stratified proportional random sampling was chosen for sampling accounting companies to distribute the questionnaire [122] A total of 40 accounting companies were established for the sample, distributed as follows: 14 companies from Brasov county, 8 companies from Sibiu county, 3 companies from Covasna county, 3 companies from Harghita county, 7 companies from Mures county, and 5 companies from Alba county. The second step of stratification involved categorising the entities (micro-entities, small- and medium-sized entities) to which the accounting companies in the Central Region belong, based on criteria, such as: turnover, total assets, and number of employees (Table 1). It is noted that micro-enterprises dominate in all counties.

Table 1. Structure of Accounting Companies in the Central Region of Romania.

Central Region	Turnover 2021 (Thousands of Lei)	I (%)	Number of Accounting Companies	I (%)	Categories of Accounting Companies	Number of Companies by Categories	Number of Selected Companies
Brașov	93,893.02	34.27	554	33.82	Micro Small	552 2	14 0
Sibiu	62,756.12	22.90	328	20.01	Micro Small	327 1	8 0
Covasna	19,893.89	7.26	101	6.16	Micro Small	100 1	3 0
Harghita	22,644.03	8.26	157	9.57	Micro Small	156 1	3 0
Mureș	50,054.56	18.29	318	19.40	Micro Small	317 1	7 0
Alba	24,756.85	9.02	181	11.04	Micro Small	181 0	5 0
Total	273,998.47	100	1639	100		1639	40

Source: https://www.listafirme.ro/, accessed on 23 March 2023.

Therefore, the 40 accounting companies (micro-enterprises) were contacted in order to participate in the opinion survey by instructing a person within their company. Each accounting company has a strict procedure for receiving documents for processing. This procedure requires that, in the first 10 (ten) days of the following month for which accounting is organised, a representative expert from the client company should deliver the documents in person based on minutes. To ensure reasonable representativeness for our research, a planned sample size of 280 companies was chosen, and 267 companies accepted the questionnaire, the refusal rate being 4.64%.

In the final stage of sampling, using systematic sampling [122], the researchers arrived at a mechanical step of 7 (seven). The interviewers (represented by the trained individuals within the accounting companies) applied this mechanical step and monitored the filling in of the questionnaire by the designated person responsible for submitting the documents and discussing with the accounting company (every 7th customer, in the order of their arrival at the accounting company). For each company, the authors instructed the interviewers to stop after filling in 7 (seven) questionnaires.

3.3. Study Sample

The final sample for the conducted quantitative research consisted of 267 respondents, representing companies operating in the Central Region of Romania (Table 2). This region, with its privileged location, offers significant entrepreneurial development potential and, besides its tourist sights, provides many business opportunities. Entrepreneurial development directly impacts local economic growth and social development. In addition to the service sector, the construction sector also presents a wide interest in this area. Alongside the strengths of this region, there is also a noticeable presence of insufficient funding for business technological upgrades and sustainable development [123]. The data collection period was from April 2023 to June 2023.

The distribution of respondents based on their roles was as follows: managers (36%), administrators (21.3%), owners (9%), founding members (2.2%), CEOs (1.1%), directors (9.4%), associates (4.9%). Additionally, 16.1% of the subjects did not declare their specific roles.

Table 2. The Sample Structure.

Sample Structure							
Sample (267)	Men 62.9%				Women 37.1%		
VAT Payers	Yes 59.2%				No 40.8%		
Legal Status	SRL (ltd.) 95.5%	SNC (General Partnership) 0.7%	SA (Joint Stock Company) 0.4%		PFA (Registered Sole Trader) 3%		Individual Entrepreneur 0.4%
No of Employees	Between 1–9 85%	Between 10–49 12.7%	Between 50–249 1.5%		Between 250–999 0.4%		Over 1000 0.4%
Time on the Market	Under 1 Year 6.7%	1–3 Years 24.0%	4–6 Years 25.8%	7–10 Years 25.5%		11–14 Years 9.7%	Over 15 Years 8.2%
Field of Activity	Industry 3.7%	R&D, High Tech 4.5%	Agriculture, Fishing 2.6%	Constructions 13.5%	Services 43.1%	Commerce, Tourism 32.2%	Pharmaceutical 0.4%
Turnover in 2020	Under 51,000 EUR—55.4%	Between 51,001–102,000 EUR—25.1%	Between 102,001–153,000 EUR—9.7%	Between 153,001–204,000 EUR—2.2%	Between 204,001–255,000 EUR—4.9%		Over 255,000 EUR—2.6%
Turnover in 2021	Under 51,000 EUR—40.1%	Between 51,001–102,000 EUR—33.7%	Between 102,001–153,000 EUR—10.5%	Between 153,001–204,000 EUR—8.2%	Between 204,001–255,000 EUR—4.9%		Over 255,000 EUR—2.6%

Source: Carried out by the Authors based on the results registered within quantitative research.

3.4. Measurement for Designing the Regression Function

In order to express the statistical link between sustainability and performance, the regression analysis was used. Thus, the values of the dependent variable (sustainability level) are estimated by the independent variable (turnover), and the market model should be written as:

$$Y = f(X) + \varepsilon, \quad (1)$$

where:

Y—the random (outcome) dependent variable;
X—the (non-random) independent variable;
ε—error or residual random variable.

The random variable ε represents the summation of the influences of the variables not included in the model on the variable Y. The simple linear regression model is the following one:

$$Y = \alpha + \beta X + \varepsilon \quad (2)$$

Then, in order to see if the funding sources influence the intensity of the link between the two variables, the indicator of the utility of funding sources is used as a moderator.

The literature on SME funding is extensive and there are many empirical studies. The authors have selected some relevant studies from the scientific field, in which similar variables are used. The nexus between environmental, social and governance (ESG) performance and corporate capital financing decisions is analysed by Zahid [73]. Another research in the field shows the moderation of financial objectives [124]. Other studies that used variables similar to those included in the present study are relational capital [8], sustainable business models [9], SME growth [10] and CSR Audit Quality [125].

In order to design the regression function, it was necessary to create the following factors, starting from the theoretical foundation supported in works by the specialised literature:

- The average regarding the use of the analysed funding sources (which represents W (MO))—this indicator has been created by calculating the average for the values registered in the following question: "To what extent do you think that the funding sources available to the company are used?." The scale includes 7 variants (representing the 7 analysed funding sources, namely: Profit, Equity, Supplier Credit, European Funds, Bank Credit, Leasing and Business-Angels), assessed on a 5-point Likert scale, from 1 ("the least used") to 5 ("the most frequently used").

- The level reached by the company for sustainability (which represents Y (VD))—this indicator has been calculated as the average for the responses registered to the questions: Defining the sustainability strategy, and the items that are measured with a 5-point Likert scale, from 1 ("total disagreement") to 5 ("total agreement") for the statements: Involvement in the community is a priority for company; The company has well-established responsible purchasing policies (e.g., reduced consumption of resources, collaboration with certified supplies, etc.); The company's sustainability strategy is successfully applied; Corporate social responsibility actions are a priority for the company.
- The average of the registered turnover (which represents X (VI))—indicator calculated as an average for the turnover declared by the respondents within the framework of the research for the year 2020.

3.5. Data Analysis

The obtained data were processed using the SPSS program, employing various data analysis methods. The selected data analysis techniques were aligned with the study objectives. To achieve this, IBM SPSS Statistics 26 was used for estimating descriptive analysis and illustrating respondent characteristics. Statistical and descriptive indicators were employed, including the mean, median, frequency, and standard deviation methods [126–129]. To understand the pattern of the entrepreneurs' reactions regarding the funding sources, the Principal Component Analysis—PCA (a method that belongs to multivariate data analysis) was used. In order to complete the analysis, we used the correlation matrix, Varimax rotation method and the Graphical Representation of the Association between Variables and Factors.

In order to test the correlations between the variables (Hypothesis 1), the descriptive statistics were inspected and the Chi-square analysis (χ^2) performed, which confirmed with a probability of 95% that there is a connection between the existence of a sustainability strategy and the gender of the respondents (χ^2_{calc}= 6.241 > $\chi^2_{0.05;2}$ 5.99).

In order to check the second hypothesis (H2), the non-parametric Kolmogorov–Smirnov test was applied. After applying the test, the alternative hypothesis is accepted and the null hypothesis is rejected, which means that there are significant differences between the definition of the sustainability strategy and the priority of the CSR companies ($D_{obs} = 37.1\% > D_{\alpha} = 16.66\%$).

In order to test the moderating role of the relationship between the level of sustainability of companies and their turnover, moderated by the level of the use of the funding sources (Hypothesis H3), model 1 of the Hayes PROCESS macro for SPSS [130,131] was used. We chose the PROCESS macro over SEM because it is a more recent method for data analysis, which provides a graphical description of moderate correlations. In addition, this approach generates a moderate mediation index that indicates whether the study model should be accepted or rejected. All calculations of statistical indicators were performed in SPSS, being calculated: R^2, *F test*, *Coefficients* β, *Standard Error*, *t test*, *p value*, *Coefficient Effects*. In order to sketch and develop the moderation link, a regression function was created which shows that the global regression is statistically significant (R^2= 0.100, F (3, 263) = 9.703, p = 0.000).

4. Results and Discussions

The results are presented and grouped by research objectives, and the analyses are logically sequenced, allowing for relevant and easily comprehensible outcomes.

Objective 1 (O1). *Discovering Ways to Implement Sustainability Strategies by Entrepreneurs.*

The measurement of the importance of sustainability among the surveyed entrepreneurs highlights a very important level for 36% of them and an important level for 32.6%. A percentage of 17.2% marked the level as neither important, nor unimportant, 13.1% as

somewhat important and 1.1% as not important at all. Overall, it is noted that the surveyed managers consider sustainability to be important or very important.

Almost half of the respondents (47.6%) defined a sustainability strategy, while similar percentages did not have such a strategy (42.7%). There were also 9.7% of subjects who stated that they did not know whether their company had defined such a strategy. It is noticeable that more than half of the respondents (36% + 32.6%) give great importance to the concept of sustainability and sustainable business. According to the elaborated strategy, the SMEs aim for acquisitions that meet environmental requirements, with a reduced consumption of conventional energy and the use of energy from renewable resources, offering sustainable services, and engaging in social life [132].

The analysis undertaken in this study demonstrates that the majority of entrepreneurs appreciate the importance of funding sources in the transition towards a more sustainable future. Implementing sustainable projects that target environmental concerns, social responsibility, and governance requires financial strategies that bring more opportunities for small entrepreneurs [133].

By creating and studying the contingency table regarding the existence of sustainability strategies and the gender of the respondents, it can be observed that the percentage of companies that do not have a defined sustainability strategy is higher among men. For companies where a sustainability strategy exists, the percentages are almost equal (47% among men and 48.5% among women). A non-parametric test was conducted to determine whether the differences between the variables were significant or not. The non-parametric test is used when the data do not meet the assumptions of normal distribution required for parametric tests.

For applying χ^2 test, the following hypotheses are considered:

$\boldsymbol{H}_0$—*There is no correlation between the existence of a sustainability strategy and the gender of the respondents*;

$\boldsymbol{H}_1$—*There is a correlation between the existence of a sustainability strategy and the gender of the respondents*.

Based on calculations performed in SPSS, it is noticed that the level for $\chi^2_{calc} = 6.241 > \chi^2_{0.05;2}$ 5.99, $\boldsymbol{H}_1$ hypothesis is accepted, which means that it can be stated with 95% probability that there is a connection between the existence of a sustainability strategy and the gender of the respondents. The same decision can also be made based on the minimum significance level of 0.044, which is smaller than $\alpha = 0.05$, confirming once again the existence of the relationship between the two analysed variables. The validity of the test is ensured since none of the cells contains expected values of less than 5 (0 cells (0.0%) have expected count less than 5).

The results of the test were predictable, as females tend to be more cautious, forward-thinking, and meticulous. They often face more challenges in funding their businesses compared to males [134,135] and may face doubts about their credibility. However, female entrepreneurs are highly concerned about the future of their businesses and meticulously plan all activities regarding the sustainability of their business.

The degree of agreement or disagreement among the surveyed managers regarding four statements related to the importance of sustainability and the implementation of sustainability strategies is analysed and presented in Table 3.

The distribution of the results for all four statements shows a higher weight of responses towards the agreement side of the scale. Thus, it can be noted that involvement in the community is a priority for 40.8% of the respondents who gave an agreement response. Responsible purchasing policies receive 34.8% agreement responses and 30.3% complete agreement responses, together exceeding half of the respondents. The sustainability strategy of the company has been successfully implemented, obtaining 34.1% agreement responses and 24.3% total agreement responses. The statement that corporate social responsibility actions are considered a priority for the company records 36.3% of the answers at level 3, representing neither agreement nor disagreement, followed by 34.1% for agreement responses. Entrepreneurs consider the implementation of sustainability strategies an im-

portant issue for achieving smart and sustainable economic growth based on digitalisation, sustainable development, and innovation. Analysing the field of activity in relation to sustainability challenges serves as an argument for entrepreneurs to view the development of a sustainable business model as a competitive advantage [136,137].

Table 3. The Distribution of Agreement and Disagreement among Respondents regarding Four Statements Related to Sustainable Entrepreneurship in the Conducted Research.

Statements	Complete Disagreement	Disagreement	Neither/Nor	Agreement	Complete Agreement
A [1]	1.9%	4.9%	28.1%	34.8%	30.3%
B [2]	8.2%	8.2%	32.6%	40.8%	10.1%
C [3]	1.5%	7.5%	32.6%	34.1%	24.3%
D [4]	7.1%	7.5%	36.3%	34.1%	15.0%

[1] Statement A: *The company has well-established policies for responsible purchasing (e.g., reduced resource consumption, collaboration with certified suppliers, etc.).* [2] Statement B: *Involvement in the community is a priority for the company.* [3] Statement C: *The company's sustainability strategy is successfully implemented.* [4] Statement D: *Corporate social responsibility actions are a priority for the company.* Source: Carried out by the Authors based on the results registered within quantitative research.

A contingency table has been created between the level of agreement on the CSR-type actions that represent a priority for the company and the definition of a sustainability strategy at the company level. From the distribution of relative frequencies on the two groups, it can be seen that at the level of the companies that have defined a sustainability strategy, most of the respondents agree and fully agree that CSR is a priority for the company (68.5%), compared to the same percentage at the level of the companies that have not defined a sustainability strategy (31.6%).

In order to check if there are differences between the samples, the non-parametric Kolmogorov–Smirnov test is used (Table 4). The testing hypotheses are the following ones:

Table 4. Calculated Values for the Kolmogorov–Smirnov Test.

The RSC Actions Represent a Priority for the Company		
Most Extreme Differences	Absolute	0.371
	Positive	0.371
	Negative	0.000
Kolmogorov–Smirnov Z		3.025
Asymp. Sig. (2-tailed)		0.000

Source: Carried out by the Authors based on the results registered within quantitative research.

$\boldsymbol{H}_0$—*Between the companies which have defined a sustainability strategy and those that have not, there are no significant differences regarding the opinion on the priority of the CSR actions;*

$\boldsymbol{H}_1$—*Between the companies which have defined a sustainability strategy and those that have not, there are significant differences regarding the opinion on the priority of the CSR actions.*

The maximum difference between the accumulated relative frequencies is D_{obs} =0.371 ≅ 37.1% (Table 5), being greater than the calculated value D_{α} = 16.66%, which means that the alternative hypothesis $\boldsymbol{H}_1$ is accepted, and the null hypothesis $\boldsymbol{H}_0$ is rejected. In conclusion, there are significant differences between the definition of the sustainability strategy and the priority of the CSR companies. The same decision can be taken based on the minimum significance level for which the alternative hypothesis $\boldsymbol{H}_1$ can be accepted (this significance level being lower than the threshold of 0.05, which means that it can be guaranteed with a probability of 95% that there are significant differences between the two groups).

Table 5. The Distribution of Registered Responses regarding the Future Intentions of the Surveyed Companies concerning the Use of Analysed Funding Sources.

Funding Source	Answer Variants (%)									
	1—Very Unlikely	2	3	4	5	6	7	8	9—Very Probable to Resort to	I Do not Want to Resort to
Profit	2.6	4.1	1.1	4.5	4.9	5.6	11.6	1.1	59.6	4.9
Personal Funds	8.6	5.6	7.9	6.4	10.5	14.2	16.5	1.9	27.7	0.7
Trade Credit	16.5	9.7	7.5	11.2	10.1	11.6	9.4	2.6	10.5	10.9
European Funds	20.6	6.0	9.4	11.2	9.0	14.6	4.9	1.5	10.5	12.4
Bank Loan	8.2	3.4	4.1	3.4	6.4	9.4	18.0	3.7	36.0	7.5
Leasing	8.2	2.2	4.9	3.7	8.6	11.6	18.0	2.2	33.7	6.7
Business-Angels	47.9	13.5	3.7	3.7	0.7	1.9	2.2	3.7	1.1	21.3

Source: Carried out by the Authors based on the results registered within the quantitative research.

Objective 2 (H2). *Identifying the Types of Funding Sources that are Most Frequently Used by the Entrepreneurs.*

The research included a filter question: *Have you used any funding sources for your company in the past?* to which all the registered responses (267—representing 100%) were affirmative, suggesting that every company requires financing. This finding is also supported and confirmed by the specialised literature [134,138]. In the context of a sustainable economy, emphasis is placed on the presence of both governmental and non-governmental funding sources [139,140], the SMEs are increasingly interested in finding alternative funding sources [141].

The choice of funding sources requires economic and financial knowledge from the representatives of the companies. Thus, the respondent managers were asked to assess the soundness of their financial knowledge. Half of them considered their financial knowledge to be sound (50.2%), but an interesting finding is that only 15% selected the option very sound. This suggests that there may be a need for additional training or education in the financial knowledge field. A percentage of 21.3% chose options indicating moderate knowledge, neither/nor, while 13.5% rated their knowledge as satisfactory. It is worth to consider that none of the respondents chose the option 'not at all' sound, which is as expected, considering the respondents are represented by decision-makers.

It is necessary to examine the extent to which the respondents are familiar with the funding sources for their own businesses. The responses indicate that nearly half of the subjects (49.8%) have a good understanding of the funding sources. The transition from general to specific, that is, from the general knowledge of funding sources to the knowledge of the most suitable sources for their own business aligns well with the score registered at the first level. The middle option answer, neither/nor, was chosen by 21.7% of respondents, followed by 17.6% for the option very good. 10.9% indicated a satisfactory level of knowledge, and no respondent chose the option 'not satisfactory at all.'

In response to the open-ending question *What funding sources do you know?*, respondents had the possibility to mention all the funding sources with which they were familiar. These sources were classified and divided into categories, and the results show that the most well-known funding sources among the respondents are bank loans, with 78.7%, followed by leasing (63.7%), profit (52.8%), and European funds (19.9%). Personal funds received 19.9% of the responses, while trade credit was mentioned by 18% of the respondents. The least known source is Business Angels, with only 0.4%. Other sources mentioned and classified under a different type of funding sources include: subsidies (45.5%), credit lines (11.4%), investments (9.1%), microgrants (4.5%), trade credit, factoring, and share capital (each with 4.5%), stocks, capital contributions, associate loans, public funds, bond and share issuances, investors, government funds—all with 2.3% each.

In conclusion, the majority of respondents (76.03%) base their business operations on collaborative relationships with business partners, emphasizing respect and diligence in adhering to contractual agreements. This finding is also supported by other studies [142].

Regarding the statement "Requesting guarantees for the borrowed amount represents a barrier to accessing funding sources," respondents were asked to indicate their level of agreement or disagreement. The results show that 41.6% of the respondents agree, followed by total agreement at 28.8%. The option of neither agreement nor disagreement is chosen by almost a quarter of the respondents (21.7%). Significantly lower percentages were registered for the disagreement option at 6% and total disagreement at 1.9%, respectively. Despite appearances, bank loans are not among the most accessible sources for all entrepreneurs [6], since bank loans require the establishment of guarantees by SMEs, and these represent burdensome costs for most companies (41.6%). Under these circumstances, many entrepreneurs opt for factoring as a funding source. Factoring does not involve any type of material guarantee, and the expenses consist of the commission charged by the bank and the interest calculated for the loan [143]. Many entrepreneurs choose factoring as a funding source due to the benefits it offers [144,145].

Most respondents (73%) consider that the choice of the financing method also takes into account the tax aspects (considering that opting for leasing as a financing method involves VAT, whereas a traditional bank loan does not impact on VAT), while 18% hold the opposite view. Additionally, 9% of respondents mentioned that they were not aware of this aspect.

As a rigorous and comprehensive organisation and management of company activities are not sufficient to ensure development in the context of new daily challenges, every company manager considers resorting to various funding sources.

Objective 3 (O3). *Determining the Future Intentions of the Entrepreneurs regarding the Strategy of the Companies to Use Various Funding Sources.*

The results regarding the identification of funding sources used by the companies surveyed for sustaining and developing their business activities it can be noted that reinvesting profit is the most commonly used source of funding (79.4%), followed by bank loan (62.2%), and leasing, respectively (52.1%). The least used source is Business Angels [146], with only 1.1%, a result also confirmed by the study [147–149]. Under the option "Other sources of financing," it is noted that subsidies are considered the most used sources of funding by the responding managers. Microgrants, loans between subsidiaries and parent companies, and loans from associates are equally noted, with only 2.38% each. During the business recovery period, the majority of the SMEs resorted to non-repayable sums, such as microgrants, for the purpose of acquiring services, inventory items, and other equipment to resume current activities [150]. The choice of funding sources is undoubtedly an important decision, even for small enterprises, where obstacles encountered can pose development issues. Some studies even show a correlation between the choice of funding sources and the performance achieved [151]. The intention to use bank loans should be mentioned, as they are among the most well-known sources of financing, even though they can generate burdensome costs. However, business development and achieving performance objectives always require taking certain risks in relation to funding sources. It has been proven that in certain situations, such as the financial crisis of 2008, bank financing served as a means of recovery for SMEs, rather than relying solely on the internal resources of the company [152].

To better observe future intentions, the results reflecting the respondents' choices regarding funding sources are presented in Table 5.

From the seven funding sources analysed, it can be noted that the highest level of intention for future use is obtained for profit reinvestment (59.6%). With a high possibility of future use, we can see bank loans (36%), leasing (33.7%), and personal funds (27.7%). Correlating these results with the ones obtained in the previous question (where profit showed 79.4%, followed by the bank loan with 62.2%, and the leasing with 52.1%, respectively),

it becomes obvious that the managers of the respondent companies have the intention of using the same funding sources they have already used.

To understand the pattern of entrepreneurs' reactions regarding the funding sources and to draw logical conclusions, the principal component analysis was used, which reduces the variables to a smaller number. Seven variables measured with an interval scale were included in the analysis, so that the means for each variable were calculated [126,153].

It can be noted that among the 267 respondents included in the analysis, relatively different means were obtained for the seven variables analysed—funding sources. From the correlation matrix, it is obvious that there are two groups of variables that are closely related: profit and personal funds form the first component, while trade credit, European funds, bank loans, leasing, and Business Angels form the second component.

These two components are rotated in an orthogonal plane, and the weight of the seven variables in the two factors is presented in the "Rotated Component Matrix" table (Table 6). The variables are ordered based on their weight in the first factor, representing the group that describes "external funding sources," while the second factor represents "internal funding sources." In this way, two new variables were formed based on the individual average values of the variables included in each component. Therefore, the variable "Situation regarding self-financing capacity," which includes profit and personal funds, and the variable "Situation regarding external funding sources," obtained from the other five variables. This grouping explains how entrepreneurs think of using them, namely, supplementing internal funding sources with external ones, exactly in the order indicated by entrepreneurs (trade credit, European funds, bank loan, leasing, and Business Angels).

Table 6. Component Matrix for Principal Component Analysis.

	Component	
	1	**2**
Profit	0.271	0.730
Personal Funds	0.641	0.501
Trade Credit	0.745	0.067
European Funds	0.742	−0.298
Bank Loan	0.624	−0.131
Leasing	0.633	−0.045
Business_Angels	0.379	−0.625

Extraction Method: Principal Component Analysis.
Matrix component: 2 components extracted.

Source: Carried out using SPSS software by the Authors of the present paper, based on research data.

The results obtained demonstrate that after the rotation of axes (Table 7), there are no substantial changes in the correlation coefficients compared to the situation presented earlier. The graph is represented in Figure 2, for demonstration, where the two variables, named by the authors of the article as "Situation regarding self-financing capacity" and "Situation regarding external funding source," can be found.

The analysis conducted by the authors confirms that funding for the SMEs has an impact on their continuous and sustainable growth. The SME sector facilitates the creation of new businesses, promotes innovation, and also contributes to national economic growth.

To further investigate and understand the extent to which funding sources available to the companies are used, respondents were asked to indicate a level between 1 and 5, considering distances between the scale levels equal, where 1—the least used and 5—the most frequently used. The results once again confirm that profit is the most frequently used financing source, with the maximum percentage for level 5 on the scale (at 60.7%). Relatively close percentages are registered for level 4 of the scale for sources, such as personal funds (31.1%), bank loans (30.3%), and leasing (32.2%). It is noteworthy that the least used sources are trade credits, European funds, and Business Angels (82%).

Table 7. Rotated Component Matrix for Principal Component Analysis.

	Component	
	1	**2**
Profit	0.028	0.778
Personal Funds	0.451	0.677
Trade Credit	0.686	0.298
European Funds	0.798	−0.049
Bank Loan	0.634	0.071
Leasing	0.615	0.156
Business Angels	0.556	−0.475

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalisation.
Rotated Component Matrix: Rotation converged in three iterations.

Source: Carried out using SPSS software by the Authors of the present paper, based on research data.

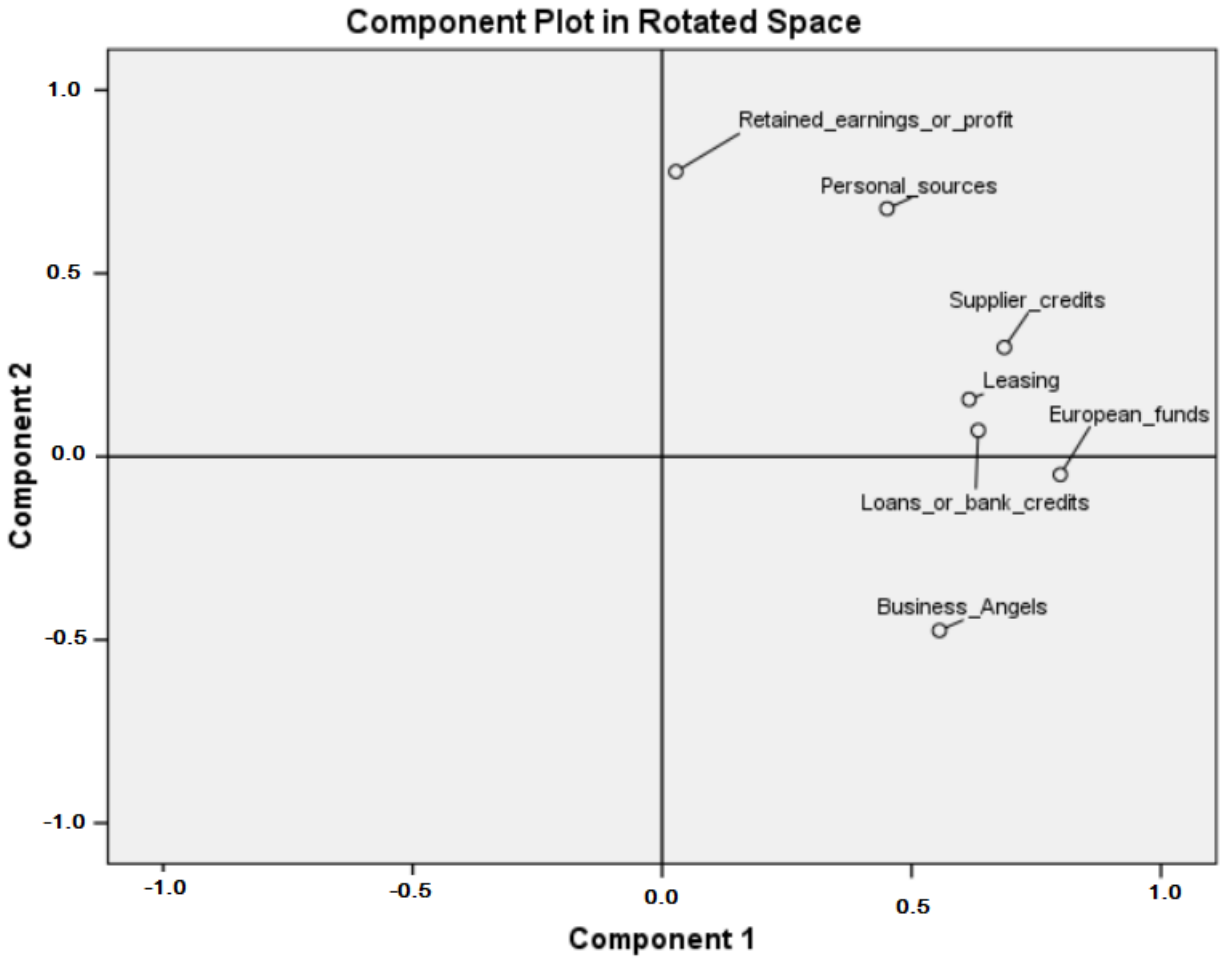

Figure 2. Graphical Representation of the Association Between Variables and Factors. Source: Carried out using SPSS software by the Authors of the present paper, based on research data.

Considering that profit is the most significant funding source, the analysis focuses on its distribution, specifically whether it is spread over a longer period (the study has set a time horizon of three years) or fully allocated in the year following its generation. Thus, in the first year, most respondent managers state that they are willing to reinvest a percentage between 0 and 10% of the profit, followed by 35.2% with a reinvestment percentage between 10 and 25%. It can be noted that in the second year, the situation changes, and reinvested profit falls between 25 and 50% for 41.6% of the respondents, followed by 30.7% with values

between 10 and 25%. In the second year, the reinvested profit with values between 0 and 10% was chosen by 15.4% of the respondents. The third year follows a similar trend to the second year, with very close values: 43.1% of the respondents for 25–50%, and 24% for 10–25% of the profit.

The obtained results confirm the prudence in company management and the quality of entrepreneurs' ability to make decisions that target a longer period of time. In their view, the results achieved through the use of profit (the source with the least significant or non-existent costs) for business development must be convincing and sustainable. It should be mentioned, in this context, that assuming a moderate level of risk is the path to the success and durability of a business, and the results obtained are also supported by other studies [154]. Furthermore, this distribution of profit reflects decisions regarding the funding of activities or investments based on a strategy that focuses resources on specific factors to ensure the efficiency of the business and its subsequent development, considering that the accessibility to other funding sources is more difficult [40]. In conclusion, the behaviour of reinvesting profits is influenced by factors such as taking certain risks, business experience, competitive advantage, the possibility of accessing external funding sources, and, finally, the basic economic background and preparedness of entrepreneurs.

The distribution of responses regarding the willingness of respondents to use the company's own capital shows that the option much accounts for 49.1% of the answers, followed by neither/nor with 21.7%. The responses for very much constitute 12.4%, not at all with 9.7%, and considerably with 7.1%.

The analysis of the respondents' willingness to resort to bank loans shows that 30.3% marked the response option 5—very much, followed by level 4 with 24%. The middle level, 3, is indicated by 15.4% of the subjects, followed by 12.4% for level 2. The minimum level 1—which indicates the response not much, registers 18%. It can be concluded that most of the respondents have the intention to use bank loans in the future.

The next two questions show the respondents' future intention to use Leasing and Business Angels as funding sources. For the first one, the measure to which respondents intend to use leasing as a possible alternative form of financing (considering its greater flexibility compared to traditional bank financing), the results indicate that almost half of the respondents have the future intention to resort to Leasing (with 37.1% for level 5 "very much", followed by 26.6% for level 4). The mid-level, 3, is indicated by 18% of respondents, followed by 5.2% for level 2, and 13.1% for level 1—"not much".

The structure of funding sources contributes to a company's competitiveness and influences its ability to expand the business. In the complex conditions of running a business, there is a significant number of funding sources available on the financial market, but each entrepreneur, based on a development plan, analyses the competition, types, deadlines, interest rates, and other contractual terms of suitable sources. They orient themselves towards achieving a financial mix between their own and borrowed funding sources. Besides funding sources such as bank and commercial loans, companies are increasingly turning to financing through leasing. Leasing represents a form of financing commercial activities when they do not have sufficient resources for acquiring necessary assets, and resorting to bank loans is very costly [155].

While nearly half of the respondents showed their intention to use Leasing as a funding source, the results for Business Angels indicate exactly the opposite. Specifically, 68.2% of the respondents indicated level 1—"not much", followed by 14.6% for level 2. The mid-level, 3, is marked by 5.6% of the surveyed managers, followed by 9% for level 4, and 2.6% for level 5, respectively.

It can be concluded that most respondents have the intention to resort to Leasing as a funding source. At the same time, most of the subjects do not have the intention to use Business Angels. As it is a less well-known funding source, entrepreneurs are less inclined to resort to this option. Moreover, there is a manifestation of mistrust in collaborating with financially stronger individuals. Businesses that would be of interest to a Business Angel are those with high returns that can also cover a higher level of risk [148].

The Influence of the Funding Sources in the Sustainability-Performance Relationship

In order to identify the relationship between performing-sustainable development and the choice of funding sources, a moderation analysis was performed, and the PROCESS SPSS macro was used [109].

The suggested model consists of the components shown in Figure 3.

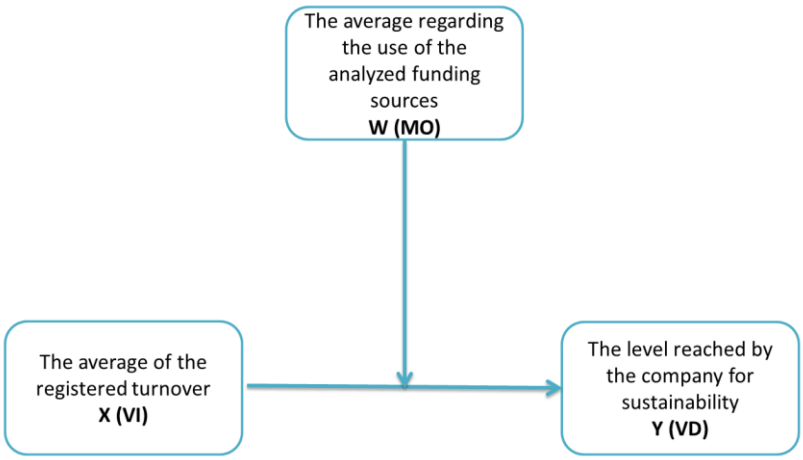

Figure 3. The Relationship between the Sustainability Level of the Companies Included in the Research and the Turnover, Moderated by the Level of Use of the Analysed Funding Sources (Included in the Study). Source: Carried out by the Authors of the present paper.

For this model, we observed a R^2 = 0.100, this means that 10% of the variance in the level achieved by the company for sustainability is explained by the level of using the funding sources, the turnover of the company and the interaction between them. This amount of explained variance is significant and the interaction term is significant, considering that F(3, 263) = 9.703 and p = 0.000.

Table 8 displays the Unstandardised Regression Coefficients. The interaction effect was statistically significant (p = 0.000 and is no zero in the confidence interval), indicating that the relationship between the turnover and the level achieved by the company for sustainability is moderated by the level of using funding sources. This moderating effect is shown in Figure 4.

Table 8. Summary of Moderated Regression Analysis.

	β	Se	t	*p*	95%CI—Low	95%CI—Up
Constant	3.301	0.036	92.574	0.000	3.231	3.371
Turnover (A)	0.080	0.029	2.787	0.006	0.023	0.136
Level Achieved by the Company regarding the Use of Funding Sources (B)	0.120	0.046	2.610	0.010	0.029	0.210
Interaction Term (A * B)	0.082	0.039	2.081	0.038	0.004	0.159

Source: Carried out using SPSS software by the authors of the present paper, based on research data.

Standard Error values between 0.029 and 0.046 can be observed. At the same time, the estimators are significantly different from 0 because each of them registers *p-value* lower than 0.05, the significance threshold allowed for the confidence intervals of the estimators, implicitly at a probability of 95%. This finding is also confirmed by the confidence intervals of the coefficients, which do not change the sign from the lower limit to the upper one, so they do not contain the value 0. The confidence intervals can be observed as follows:

$$ICa_0 : [3.231; 3.371], ICa_1 : [0.023; 0.136], ICa_2 : [0.029; 0.210], ICa_3 : [0.004; 0.159] \quad (3)$$

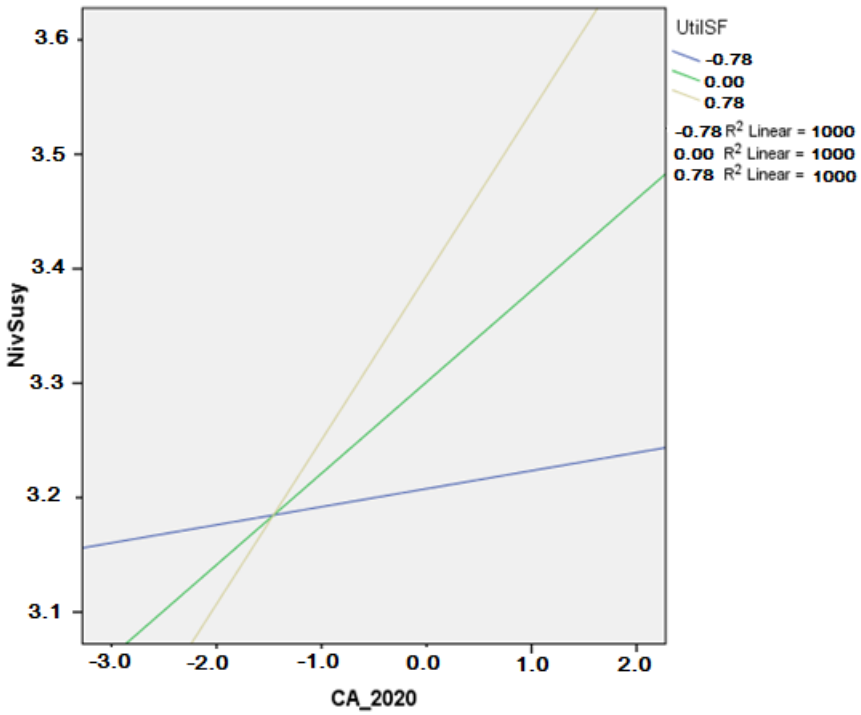

Figure 4. Graphical Representation of the Moderating Effect. Source: Carried out using the SPSS software by the Authors of the present paper, based on research data.

The empirical results in Table 8 are also supported by studies that present the relationship between the analysed terms. The study on sustainable competitiveness in business also includes the interrelationships between the profitability and sustainability of the company [156]. Another article presents the link between performance and sustainable growth [157], while another piece of research addresses the topic of income flows that ensure financial sustainability in eight EU countries, including Romania [158].

To further establish that the effect differs depending on the level reached by the company regarding the use of funding sources, we employed a bootstrapping procedure by quantifying the low-level effect (−1SD), the effect at the mean, and the high level effect (+1SD) [159]. Table 9 presents the coefficient effects of the predictor (level achieved by the company for sustainability) at these values of the moderator (level achieved by the company regarding the use of funding sources).

Table 9. Coefficient Effects of the Level Reached by the Company Regarding the Use of the Funding Sources.

Level Reached by the Company Regarding the Use of Funding Sources	Effect	SE	t	*p*	95%CI—Low	95%CI—Up
−0.780 (−1SD)	0.016	0.049	0.326	0.745	−0.081	0.113
0.000 (Mean)	0.080	0.029	2.787	0.006	0.023	0.136
0.780 (+1SD)	0.143	0.033	4.382	0.000	0.079	0.208

Source: Carried out using the SPSS software by the Authors of the present paper, based on research data.

The effect of the three levels of using funding sources (low, medium, high) is presented in Table 9. As it can be determined, at a low level of using financial sources, the association between turnover and the level of sustainability of the company is weaker, and then, at a medium level of using funding sources, it is stronger, and at a high level of using funding sources, the relationship is the strongest. The statement is supported by the increase in

the coefficient from 0.016 (low use level of funding sources) to 0.143 (high use level of funding sources).

The graphical representation demonstrates that at a lower level of using funding sources, the association between turnover and sustainability level is weaker, and at a high level of using funding sources, the association between the two is stronger. This result is consistent and supports the conclusion from the coefficient effects presented before.

Considering sustainability dimensions, the entrepreneurs must ensure the necessary flexibility in both the pursued architecture and the diversification of funding sources, and if necessary, integrate financial consulting and entrepreneurial education services into their system. Integrating circular economy thinking into financing source planning aims at the sustainable development of the business.

Finally, for the companies to maintain their position on the market in the current context of sustainability, they must identify:

- The areas of interest for thorough basic entrepreneurial and financial knowledge, which will contribute together with other factors to the success of a business;
- The most appropriate development strategies, integrated with the sustainability strategies, for responsible and sustainable growth on the business market;
- The harmonious combination of specific financial tools to achieve the pursued objectives;
- The architecture of a framework and a climate for a sustainable and efficient business, considering harmonious concern for the environment, profitability, and social commitment towards people and the community.

In conclusion, the architecture of the results, presented in the model below suggested by the authors of the present paper, Figure 5, not only provides us with information about how the components of the business process system are connected with sustainability and about the interaction between them, but also offers a general picture of the moderately sustainable business environment with the funding sources that have been used.

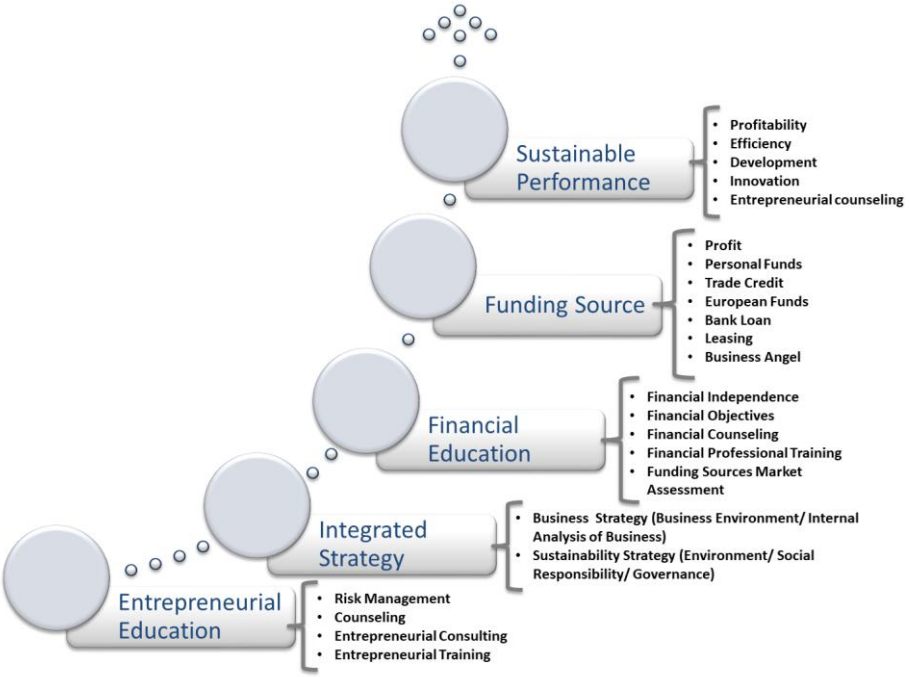

Figure 5. CSFS Model—The Connection between Sustainability, Funding Sources and Performance. Source: Carried out by the Authors of the present paper.

5. Conclusions and Implications

The purpose of this research was to provide pertinent and relevant findings, offering a clearer picture of the entrepreneurs' attitudes, behaviours, and opinions regarding the use of funding sources in their current activities, investments, technological advancements,

and innovations. These aspects were analysed in the context of business competitiveness and sustainability in a dynamically changing market. The contribution of this study lies in correlating and providing an overview of the integration of a wide range of funding sources, because by analysing the literature, it is noted that most studies research and analyse funding sources grouped based on specific criteria or analyse only a single funding source [160], whereas the present research integrates seven types of funding sources.

The conducted study highlighted that the majority of surveyed entrepreneurs intend to primarily use their own funding sources (profits and personal funds) and, ultimately, resort to external sources (bank loans, leasing, and European funds). From the registered results, it is noted that profit reinvestment is the most frequently used funding source, followed by bank credit and leasing, while the least used source are Business Angels.

From the funding sources analysed in the research, the highest level of future use intention is registered for profit reinvestment (with more than half of the respondents), followed by bank loans, leasing, and personal funds.

Related to the concept of sustainable business and sustainability, the study highlighted that, in general, the management of the SMEs considers them important and very important, a fact demonstrated by the result that shows that half of the surveyed companies have defined a sustainability strategy. Moreover, the connection between the existence of a sustainability strategy and the respondents' gender was tested and demonstrated.

This research demonstrates that most entrepreneurs appreciate the importance of funding sources in the transition to a more sustainable future. In this sense, the paper demonstrated the existence of a relationship between the level of sustainability of companies and their turnover, moderated by the use level of funding sources. An important conclusion of the present study consists of developing the CSFS Model that succeeded in presenting the connection between sustainability, funding sources, and performance (confirming, once again, the moderation relationship demonstrated by the regression function).

The study provided a consistent summary of the specialised literature, with one of the implications of the work being to enrich the specialised literature through the model suggested in the study but also to demonstrate the moderation relationship realised in the regression function. The theoretical implications consist of the collaboration of the SMEs with governmental and financial organisations, researchers in the field, or other bodies in order to develop and promote new frameworks and programmes for the implementation of funding solutions suited to the needs of the SMEs. It is concluded that government programmes to support SME lending must be oriented towards fields with high added value, with a high level of technology facilitating the green transition [45].

The comprehensive analysis of the literature also led to a series of practical implications for SME managers regarding funding sources. It was found that integrated strategic thinking, such as the choice of the most suitable funding sources to support practices regarding operational and economic organisational sustainability, risk management regarding the costs associated with financing, combining several internal and external funding sources, and resorting to innovative funding sources, can cause changes in business development.

In order to achieve organisational, operational, and economic sustainability, companies must assess and improve their corporate competencies, evaluate their level of knowledge of different funding sources, innovative financial technologies, and their impact on sustainability. Also, organisations must improve adaptability and flexibility by restructuring existing business models and processes [2]. This involves the use of new strategies and the use of advanced technology to add value and stability to the business, flexibility, and agility in calling on the various funding sources existing at the level of the economy with an impact on environmental and social actions in order to ensure and maintain their performance.

The study put forth practical implications for the national economy as well, since sustainability strategies at the micro level have an effect on economic well-being and the adoption of decisions regarding the recovery and resilience mechanisms so that economies become more sustainable, more resilient, and better prepared for the green transition and the digital one.

Finally, this investigation, correlated with other specialised research, can be useful to both micro- and macroeconomic factors interested in the sustainable development of the SME sector, which is unanimously considered the engine of any country's economy. Consequently, this study contributes to the current state of knowledge regarding the appeal to funding sources that are so necessary for companies.

However, beyond the results obtained, this research also has certain limitations, primarily caused by the fact that the investigated population focused on analysing the Central Region of Romania and only companies using external accounting services. Another limitation of the study refers to the analysis of the seven most well-known and used funding sources, perhaps excluding innovative funding sources from the analysis. At the same time, in future research, large and very large companies can be included; a limitation of the present study is it surveyed only SMEs.

The authors intend to expand the research in the future at the national level, covering all eight regions of development. Future studies could further examine the management of funding sources in the case of companies from other European countries. Moreover, research could also target an in-depth study of the real needs of start-up companies, especially the barriers and negative influences that may affect their opinions. A future study may analyse the opinions of future entrepreneurs, of people who intend to open a business in the immediate future, to be able to observe and compare the possible differences between the opinions of people who have experience in running a business and people who are going to open and manage a business.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are contained within the article.

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Financial and Banking Education of Consumers in the Context of Sustainable Development Society

Nicoleta Andreea Neacșu [1], Carmen Elena Anton [2], Camelia Mirela Baba [2] and Anca Popescu [1,*]

[1] Department of Marketing, Tourism, Services and International Affairs, Transilvania University of Brașov, 500084 Brasov, Romania; andreea.neacsu@unitbv.ro
[2] Department of Finance, Accounting and Economic Theory, Transilvania University of Brașov, 500084 Brasov, Romania; carmen.anton@unitbv.ro (C.E.A.); mirela.baba@unitbv.ro (C.M.B.)
* Correspondence: anca.radbata@unitbv.ro; Tel.: +40-723206550

Abstract: The paper addresses the consumer's behaviour toward banking services, outlining the need to deepen and complete a financial-banking education. The purpose of the study is to identify the opinions of consumers of banking services regarding the collaboration relationship with financial-banking institutions from the perspective of financial education and sustainable development. In this regard, the authors carried out an analysis of the content of loan agreements using: the method of evaluation grids—a specific method of diagnostic analysis supplemented with in-depth interview—a qualitative research method. Our study highlights the role of financial-banking institutions in the sustainable development of social and economic life, marking the need for primary financial education for effective consumer-bank collaboration. The research results reflect the need to develop contractual relationships based on transparency, fairness, and better financial information and education of consumers. The obtained results are useful for decision-makers in banking institutions to develop lending policies according to customer expectations and for authorities to shape various social development policies.

Keywords: financial education; sustainable development; financial-banking market; consumer behaviour; bank loans

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1. Introduction

In the sustainable development of the economy and society in general, financing potential consumers (individuals or companies) by financial institutions is necessary for implementing sustainable development goals [1].

The financial products offered by banks to consumers are varied. However, in the volume of demand, the most significant weight is represented by loans, so the degree of indebtedness of the population in Romania has increased [2].

"Credit institutions have a special role and responsibilities toward direct clients and society as a whole. Banks play an important role as intermediaries between the requesting clients and depositors, contributing, through investments and loans, to the release of financial resources into the effective economy" [3]. In recent decades, the financial sector has sought to contribute positively to sustainable development through innovative products and services [4].

Loans granted to individuals in Romania can take the form of consumer loans (personal loans) and mortgages/real estate investments. Starting with 2020, natural persons in Romania can contract loans to purchase new homes through the "New Home" programme.

The evolution of loans, in euro, granted to the population by the banking sector in Romania between 2017 and 2023 can be seen in Table 1. The statistical data published by the National Bank of Romania [5] show that the level of loans in euros granted by banks to the population in Romania decreased in 2020 and 2023 compared to previous years.

Table 1. Loans granted to households in Romania between 2017 and 2023.

Period	Consumer Loans (Million Euros)	Real Estate Loans (Million Euros)	Loans for Other Purposes (Million Euros)
2017	12,273.7	24,964.6	277.5
2018	10,699.2	22,850.2	245.1
2019	9521.5	21,293.3	225.4
2020	8409.5	19,725.2	250.5
2021	7227.7	17,578.8	245.4
2022	6135.6	15,964.5	343.9
January 2023	6025.2	15,748.8	341.0
February 2023	5958.1	15,631.3	343.2
March 2023	5914.7	15,603.4	344.3
April 2023	5827.0	15,438.6	341.8

Source: Statistical data provided by the National Bank of Romania.

From Table 1 it can be seen that real estate loans and mortgage loans represent the largest share in total loans. Since credit involves the use of liquid funds for current activities (consumer credit) or investments (mortgage credit), it can significantly influence consumption and investments—and implicitly, the sustainable (economic and social) development of households in Romania.

The portfolio of loans related to the population is subject to risks, including the risk given by the impact of periods of crisis (pandemic, war, inflation, etc.) on debtors' ability to pay.

Ensuring a good functioning of the credit market in Romania can be achieved through the Alternative Dispute Resolution Centre in the Banking Domain (CSALB) [6]. Its mission is to provide financial education for consumers of financial services and inform commercial bank employees about the procedures for reconciling disputes that may arise in the contractual relations between consumers and banks [7].

CSALB's communication strategy for 2022 focused on financial education.

Financial education contributes to understanding the terms of the credit agreements and the awareness of possible risks in developing the financing and communication relationship with the financial institution. Financial education has an impact on consumer life and is proving to be a necessity for sustainable economic development. In this regard, the research carried out by Fuzhong Chen et al. [8] provides empirical evidence suggesting that sustainable financial education is positive and contributes to consumer life satisfaction.

Sustainable society and economy result from an assumed behaviour of consumer financial products [9]. Credit institutions in Romania, offering products and banking services following the new ESG policies (environmental, social, and governance policies), are oriented towards actions to raise public awareness of the importance of the concept of sustainability and the usefulness of financing for the development of a sustainable life-style [10]. Financial education and financial literacy play an essential role in the behaviour of individual consumers. Additionally, in compiling the economic knowledge, the education provided by higher education institutions contributes to achieving SDGs (Network-Australia/Pacific 2017 Sustainable Development solutions) [11]. The reports on financial stability published by the BNR (National Bank of Romania) allocate important spaces to the analysis of green financing for the population and small companies. In this context, achieving the objectives of sustainable development, considering the financing granted by banking institutions, requires a certain level of general economic knowledge that consumers should possess.

According to Cwynar A. et al. [12], the level associated with the degree of financial preparation compensated in some places with professional advice in the field of consumers of financial products influences the access to financing and the acceptance of a high degree of indebtedness.

Some studies, such as that made by Pearson and Korankye [13], analyse the relationship between financial education and financial satisfaction, and financial satisfaction influences higher debt levels. The results of the research carried out by Cwynar A. et al. show that financial literacy and financial education programmes are encouraged and explain consumer behaviour in requesting financial advice. They can help increase consumer confidence in the financial market and raise awareness of the role of trust in financial literacy for financial decision-making [12].

Undoubtedly, financial education contributes to the development of good cooperation relations with any financial institution interested in the sustainable economic development of society. Thus, financial education programmes are now being offered at workplaces to educate potential consumers of financial products [14]. The state-of-the-art technology used by most financial institutions requires financial education. The level of general economic and, in particular, financial knowledge gives consumers a boost of confidence in the search for the most appropriate sources of investment. It also helps to find solutions to eliminate financial stress [15]. Financial education is a factor that influences the lifestyle of any potential consumer [16], regardless of gender, with the mention that women are more cautious in making significant investments [17]. The presence of knowledge of financial education is manifested in the process of repayment of loans and, at the same time, in the level of financial stress [18,19].

Actions to achieve the sustainable development goals of society can be implemented through the active involvement of financial institutions not only in lending but also in the transmission of knowledge on minimum financial education so that partnership relations with consumers are beneficial to both parties. Therefore, there is the question of the financial responsibility of banking institutions with an imprint on the well-being of the person and the impact on the development of the economy [20]. The study conducted by Renate Doina Bratu helps establish the awareness, manifestation, and evaluation of the importance of financial responsibility in Romania by focusing on population's savings behaviour. The author concluded that the level of financial responsibility could be higher due to the low level of financial education.

The financial products existing in the financial-banking market provide opportunities for the development of potential consumers by crediting purchases, starting businesses, or developing existing ones.

For businesses in the current world, particularly in the banking sector, studying and comprehending consumer behaviour has become a monumental undertaking because it requires complicated analysis and is challenging to comprehend [21].

The paper aims to determine the coordinates of the collaboration relations between consumers of banking services and financial institutions in the lending process to identify the behaviour of the consumer of banking services and the need for a financial-banking education.

This article contributes to the existing literature, providing a broader view of crediting individuals. The study can impact both banking consumers and the collaborative relationship between them and the financial-banking institution, but also on the banking institution. Through the methodology used and the results obtained, the research carried out can contribute in various ways to:

- awareness of the need for financial and banking education;
- informing and raising awareness of consumers regarding the risks inherent in a bank credit agreement;
- to encourage banking institutions to start financial education policies among consumers in order to raise awareness of the risk they are exposed to, but also to correctly manage the debts they have/register;

- stimulating banking institutions to provide clear and accurate information on contractual terms;
- determining banks in adapting credit policy to meet current economic challenges;
- raising banks' awareness to show more flexibility toward their clients.

A novelty factor of the paper is the harmonization of the two types of research: the method of evaluation grids and the in-depth interview. A sample of 120 credit agreements was analysed using the evaluation grids method to diagnose the contractual relations between consumers and financial institutions. This analysis preceded the qualitative research that was based on the in-depth interview. The main purpose was to identify the banking consumer's behaviour in the process of repayment of loans and the need for the financial education of clients.

The research addresses the behaviour of consumers of bank loans from a social and economic perspective, aiming at several specific objectives: determining the opinions of consumers (individuals) on the banking market in Romania and the need for essential financial and banking preparation; determining the expectations of consumers (individuals) regarding the provision of banking services in the current competitive environment, in an ideal situation; identifying consumer opinion on contractual terms and the benefits of balanced contractual conditions on the banking market; identification of the impact of the banking market on society and sustainable development; and the need for the minimum financial education of the individual consumer.

The results of this paper emphasize the need for basic financial and banking knowledge among consumers. The results can be used by authorities to shape social development policies and by banking institutions to develop credit policies according to customer expectations and the performance pursued.

2. Literature Review

Financial education is crucial in reducing uncertainties and risks associated with investing in risky financial assets. Improving consumers' financial knowledge and literacy helps decrease consumer losses and promote better financial decision-making [22]. According to Wagner and Walstad [23], financial education can assist consumers in making better financial decisions and correcting harmful financial habits, ultimately leading to improved financial well-being for households and to a sustainable development of society.

For a better understanding, the authors structured the study of the literature into two parts:

- the first part considers the connection between financial education and sustainability;
- the second part considers the need for financial education from the perspective of a collaborative relationship between financial institutions and consumers.

2.1. The Relationship between Financial Education and Sustainability

Banks can have a significant impact on both economic growth and sustainable development in general. In the literature, there are numerous studies investigating the relationship between banking sector development and economic growth [24–26] and others focusing on the connection between banking and sustainable development [27–29].

Kumar and Prakash [30] believe that "the adoption of sustainable banking practices by various banking institutions is a powerful engine for achieving sustainable development". Another opinion belongs to Weber [4], who considered how academic research focuses on the impact of the financial sector on society and sustainability due to the financial crisis. The financial crisis has shown that banks strongly influence the economy and society, which bear a great responsibility for sustainable development [31,32].

Sustainability and financial education are linked in several ways. The ability to make informed financial decisions can positively affect the environment and society, both for individuals and organizations. Financial education can support sustainability by encouraging responsible consumption, educated investment choices, financial resource management, and intelligent financial planning.

Financial education is essential in increasing consumer confidence in the choice of banking products and financial institutions with which they are to work. They are also motivated to learn about the financial services that institutions are legally obliged to provide to financial consumers or to contact financial advisors, as they have the basic knowledge for making investment decisions.

Several studies show the need for financial education, especially among people who lack financial literacy [33]. Financial education is a fundamental skill needed for the current dynamic financial world. It is also under the attention of bodies such as the OECD International Network for Financial Education (OECD/INFE). Reports based on interviews and surveys conducted in 2019 and 2020 in OECD member countries (29 countries) provide information on assessing national strategies, approaches, and methodologies of good practice, etc. [34].

Consumer financial education refers to initiatives or courses that help people gain a better understanding of financial goods as well as the knowledge, abilities, and confidence to use them. It is crucial to investigate the connection between financial education and owning risky financial assets to determine if financial education encourages involvement in the financial market.

According to Greenberg and Hershfield [35], consumer financial decision-making is a complex process that requires a lot of time and effort to search for and analyse the information needed for decision-making. Based on Beckker et al.'s [36] findings, it becomes clear that financial education can enhance consumers' understanding and capability to manage finances. However, it does not necessarily guarantee better financial decision-making or outcomes. Therefore, it is crucial to provide financial knowledge, encourage practical application skills, and foster an environment that promotes informed financial decisions.

2.2. The Relationship between Consumers and Financial Institutions and the Need for Financial Education

The importance of financial education has increased over the past two decades as innovation and globalization increase the diversity and complexity of financial services. These developments create new responsibilities for the authorities, which must ensure that the economy and society are adequately prepared to meet the new challenges. Even if Romania is not a member of the OECD (on 15 December 2022, it signed and began the accession process to the OECD), since 2018, the Ministry of National Education, the National Bank of Romania, the Ministry of Public Finance, the Financial Supervisory Authority, and the Romanian Association of Banks have collaborated to develop the National Strategy for Financial Education. In 2018, these institutions concluded a collaboration protocol for implementing joint activities in the field of financial education and elaborating the National Strategy for Financial Education. The document provides an inter-institutional framework through which the five parties carry out joint activities in the field of financial education [37].

Numerous studies focus on consumer education and financial literacy [38–47] and others focus on the relationship between quality of financial services, corporate social responsibility, and consumer satisfaction/loyalty [48–51].

While some studies are looking at the relationship between the competitive environment in the domestic banking sector and the protection of consumer rights and interests [52]; others examine the approach of financial services to consumer protection [53]. Some authors focus on customer attitudes and perceptions toward the banking sector [54–56]. Bennett and Kottasz [54] believe that consumer attitudes have deteriorated much since the financial crisis of 2008.

In the literature, the issue of clauses in bank credit contracts has been approached from a legal perspective [57–59].

In order to understand credit agreements by consumers and a good relationship with financial and banking institutions, a minimum financial education is required. A combination of financial awareness, knowledge, skills, attitudes, and behaviours is referred

to as financial literacy. They are essential to make wise financial decisions, and ultimately, achieve individual financial well-being.

Consumer financial education has been linked to consumers' financial wellness, which is a condition of being financially healthy, content, and worry-free [60].

Consumer financial education refers to initiatives or courses that help people better understand financial goods and the knowledge, abilities, and confidence to use them [61].

Financial literacy is also a significant influence because it has been linked to saving habits and portfolio selection. Financial literacy acquired early in life is positively correlated with an individual's wealth and portfolio allocations in later life, according to Jappelli and Padula [62]. For instance, according to Hilgert et al. [63], maintaining a savings account and having an emergency fund are two examples of good financial habits that are positively connected with financial literacy.

Financial education is required to make wise financial decisions [64] and invest effectively [65], which aids in a person's wealth accumulation. As a result, there may be an impact of financial literacy on financial decision-making [66].

To comprehend the risks associated with investing in goods, one must possess a certain financial literacy level. Thus, the benefits of financial education are reflected in the decrease in financial vulnerability and financial stability and in the choice by users of appropriate financial products and services, which will lead to the management of penalizing interest rates and diversified investments [67]. In order to achieve these goals, financial institutions are investing in the development and education of employees, as well as in the literacy of banking users [68,69]. The lack of communication skills in working with financial institutions means that the transfer of financial knowledge and good practices in the field [70] is restricted.

Some studies [9] show unequivocally that sustainable development is also related to the process of financial education and that financial education contributes to informed decisions and relations with financial institutions in the knowledge and understanding of specific terms. Other studies show that consumers' financial literacy level impacts their sustainable management skills [71]. Effective collaboration between the consumer and financial institutions can only be carried out based on a reasoned knowledge of economic and financial concepts. The importance of consumer relations of banking products with financial institutions offers benefits in the context of their activity [72]. The study mentioned above analyses the types of relationships (deposit, investment, loan accounts), the duration of relationships (age in months), and the depth of relationships (size of balances) with the specification that it deepens the loan relationship through credit cards. The collaboration with banks is complex, involving factors that show the vulnerability of the consumer [73].

Our research analyses the consumer's relationship with financial banking institutions (such as taking out loans) from the perspective of the need for financial education.

3. Materials and Methods

3.1. Context of Research

This paper addresses the issue of the collaboration relationship between the consumer of banking services and the financial-banking institution in the lending process, as well as the need to develop a financial education among the population from a sustainable (social and economic) perspective.

The economic crisis that began in 2008–2009 triggered a collective awakening of consumers, regulators, and banks. Between 2009 and 2012, banks lost—for the moment and at least at the psychological level—the role of discretionary customer relationship manager. At the same time, customers have become more attentive, informed, and selective, forcing banks, with the support of state institutions, to respond to their after-sales requests to a greater extent.

Although "Customer-centric" was the motto of banks for the next few years, care for the customer is still lost immediately after selling banking products and/or services in a

heavy maintenance system. The use of complex and rigid contracts further characterizes the relationship with the bank, especially in the lending area.

However, the progress made is significant. The clarity of important contractual clauses, the regulation and transparency of the calculation of interest rates, the diversity of banking services, and the improvement of communication with the bank are only a few of the progress made.

Consumer credit agreements are regulated in Romania by GEO 52/2016 [74] on credit agreements offered to consumers for immovable property, as well as for amending and supplementing Government Emergency Ordinance no. 50/2010 [75] on consumer credit agreements (Emergency Ordinance No 50/2010 transposed Directive 2008/48/EC [76], as amended and supplemented). Additionally, the republished Law no. 296/2004 [77] on the consumption code has as its object the regulation of the legal relations created between economic operators and consumers regarding the purchase of banking products and services.

European and national legislation, Directive No 93/13/EEC [78] and Law No 193/2000 [79] underline the importance of protecting the consumer as regards his relationship with the financial institution. It was established at the European level that "persons purchasing goods and services should be protected against the abuse of power by the seller or supplier, particularly against adhesion contracts and the abusive exclusion of essential rights in contracts".

The terms set out in credit agreements can often discourage consumption and harm sustainable growth and development. In particular, mortgage-backed credit (where the mortgaged property is the consumer's home), concluded over a long period and involving significant amounts, can substantially impact consumers, with severe social and economic consequences.

The terms in credit agreements that may lead to a problematic relationship with the financial institution refer to management fee; early repayment fee; analysis fee file or credit award; risk fee, especially if insurance has been concluded; the management fee; the term by which the creditor stipulates in his favour the right to variable contractual interest; the term on early maturity onset; the clause under which the lending bank is entitled to assign the claim or credit agreement to another entity, including to companies having as their business the taking-over of claims; and the foreign exchange risk clause for foreign currency loans, whereby the bank assumes no risk as a result of currency fluctuation, the risk being entirely borne by the client.

The consumer of banking services and his behaviour is influenced by transparency of communication, the quality of the relationship between him and the bank (efficient interaction of contact/banking staff with clients), and the financial education he holds. Trust in banking institutions depends on the transparency of contractual terms and the precise information they transmit to their debtors.

Problems faced by banking consumers concerning banks due to a lack of financial education can create difficulties in repayment of loans, discouraging consumption and, implicitly, their mistrust in banking institutions.

Lending based on clear consumer contracts and the formation of primary financial education leads to a positive impact on the sustainable development of society by:

- increase consumption that influences the production and circulation of consumer goods;
- increase the courage to invest;
- increase the standard of living;
- accountability toward the debts contracted by individuals, on which occasion the degree of indebtedness is calculated;
- accountability in spending money;
- strengthening discipline in work, credit consumers, become more motivated and organized in terms of work carried out;
- increase the level of financial education.

Bank loans granted to individuals can have a positive impact on the population if banking institutions show transparency; honest and responsible conduct toward consumers; integrity; receptivity; openness in dealing with customer complaints; availability for financial education, advice, and advice of their clients; and adequate, understandable, and up-to-date information.

Based on these coordinates, the objectives of the research are the following:

O1. Determining the opinions of consumers (individuals) on the banking market in Romania and the need for financial and banking education.
O2. Determining the expectations of consumers (individuals) regarding the provision of banking services in the current competitive environment in an ideal situation.
O3. Identifying consumer opinion on contractual terms and the benefits of balanced contractual conditions on the banking market.
O4. Identification of the impact of the banking market on society and sustainable development and the need for the minimum financial education of the individual consumer.

3.2. Research Methodology

The paper's main objective is to identify the consumer behaviour of banking services in the lending process and determine the need for financial and banking education among clients.

The article uses two types of research: the evaluation grids method and the in-depth interview method. According to the analysis carried out by the evaluation grid method, a diagnosis of the process of carrying out bank loans among individuals was made. The authors also identified contractual relationships with an unbalanced diagnosis (for a small number of contracts).

In order to know the causes that have generated difficulties in the client-banking relationship, qualitative research on the type of in-depth interview was undertaken.

The evaluation grids research is frequently used in diagnosing and positioning a studied phenomenon in a given context.

In this paper, the authors used the method of evaluation grids to analyse the process of carrying out loan contracts concluded by individuals with various financial institutions. These contracts reflect information that is intended to explain the behaviour of consumers of banking products.

In order to establish the diagnosis at the level of the financial and contractual process, these steps were followed: selecting a sample of loan contracts representative for the reflection of the studied phenomenon; establishing the analysis criteria and awarding scores from 1 to 5 assessing the state or trend of contractual relationship; the allocation of coefficients of importance to each criterion according to the position it holds in the analysis grid; the determination of the average score for the general condition of the component ($N_{med} = \sum n_{i \times} p_i$, where n_i is the grade awarded to each component and p_i, the importance score) [80].

Finally, depending on the score set for each contract, a grouping of the way contracts are carried out is established on the following diagnoses:

- consolidated diagnosis if the score is $4 < N_{med} < 5$ characterized by the particularities: the relationships between the parties are well defined, there is transparency, there is predictability, there is the possibility of reconfiguration in case of difficult situations;
- adequate diagnosis with the score $3 < N_{med} < 4$ and the following particularities: the definition of the clauses is viable, and they can be reanalysed, consumers' expectations are properly met, the correct management of the relationship with the consumer;
- balanced diagnosis—$N_{med} \approx 3$ score with the particularities: the consumers trust the bank's employees, they opt for a specific institution even if there are more attractive offers on the market, a certain confidence, social benefits can be obtained or owing to particular situations [81];
- acceptable/tolerable diagnosis—average score in the range $2 < N_{med} < 3$ with the following characteristics: contracting costs are acceptable, rescheduling or refinancing

conditions can be accessed, promoting an attitude of future remodelling of contractual clauses;

- unbalanced diagnosis with a score in the range $1 < N_{med} < 2$ and the following particularities: risky financial conditions, rigid or non-existent risk management practices, reduced transparency, and lack of communication with the consumer.

The method of evaluation grids was chosen for carrying out the content analysis of loan contracts and establishing a diagnosis of the collaboration relationship with emphasis on the process of repayment of loans.

In order to describe the causal relationship between the process of carrying out the loan contracts and the opinions and behaviour of the credit consumer, the analysis was carried out using the semi-directional depth interview method.

The research conducted by the in-depth interview method is qualitative in nature, and it aimed at identifying and analysing the opinions, attitudes, and behaviours of the banking services consumers on the terms of loan contracts concluded with various financial institutions. The procedure used in the research was the semi-structured interview, and the interview guide was used as a tool.

The main objective of this research is to form a clear picture of the consumer's behaviour toward financial services and to identify the need for financial education.

The specific objectives pursued through research were:

- determining consumer opinions on the banking market for individuals and the need for financial and banking education;
- determining the requirements and expectations of individual consumers regarding the provision of banking services in the current competitive environment, in an ideal situation;
- identification of consumers' opinions on contractual terms and the benefits of balanced contractual conditions in the banking market;
- identifying the impact of the banking market on society and sustainable development and the need for the minimum financial education of the individual consumer.

The researched population consists of all adults in Romania who have contractual relations with financial institutions.

The selection of participants in the in-depth interview was based on the snowball or chain sampling method [82].

This sampling method aims to draw into the sample as many possible subjects who have information about the subject under investigation. Regarding this technique, it is not the sample's representativeness that matters but its relevance in relation to the subject approached [83,84]. It is a non-probabilistic sampling technique. As a result, the data cannot be extrapolated to the entire population. Thus, the sample included persons with financial-banking contractual relations in the last five years. Subjects completed a preselection questionnaire to ensure that the proposed objectives were met. Using the sampling technique and the steps mentioned above, the final sample of 240 subjects was established. The structure of the respondents who were part of the sample is presented in Table 2.

For content analysis (by the evaluation grid method), the sample was 120 contracts. From the list of 240 people who constituted the sample for the in-depth interview, the authors selected (by the mechanical step method) 120 people whose credit agreements were analysed by the valuation grid method.

Based on the above topic, the semi-directive in-depth interview [85] was conducted face-to-face between May and September 2022. The interviews were conducted based on the interview guide that went out of the study's purpose and objectives. The authors searched for detailed information on all aspects closely related to the subject under investigation, and each interview was 60–80 min long. The discussions continued until the researchers felt that all the aspects considered had been reached and a thorough understanding of the subject under investigation took place.

Table 2. The sample structure.

	Sample Structure				
Sample (240 respondents)	43.75% male		56.25% female		
Region	Transylvania	Moldovia	Muntenia (including Bucharest)	Dobrogea	
	27.08%	24.17%	34.17%	14.58%	
Sample structure according to age	under 29 years	30–39 years	40–49 years	50–59 years	over 60 years
	5%	25.83%	32.92%	29.58%	6.67%
Education	High school or below	Bachelor's	Master's	Doctorate/Postdoctoral	
	32.92%	40.83%	22.5%	3.75%	

Source: Author's calculation based on collected data.

In designing the interview guide, the technique of climbing the stairs was used [86], and a logical chain of questions was designed to gradually emphasize the subjects' opinions on the investigated subject. From the complex responses of the interviewees, the authors extracted relevant experiences, processes, relationships, and interactions related to the subject under investigation.

The responses were recorded and then stored in electronic files. Subsequently, these files were transcribed, and that information was processed by the technique known as content analysis.

4. Results

The results obtained through the evaluation grids method, analysing the 120 loan agreements concluded by individuals with various financial institutions, reflect information meant to explain the collaboration relationship in the execution of credit agreements. In order to achieve the objectives of the research on consumer behaviour in the relationship of collaboration with financial institutions on loans, the first was to diagnose the situation of the process of repayment of loans made by individual consumers.

After working sessions, the authors identified the essential items determining an excellent contract performance and an ideal collaboration relationship between client–consumer and financial institutions. In order to establish uniform criteria for the analysis of the content of the contracts, the data were codified, so each item was awarded a score according to its importance in the performance of the contract. For example, the item I11 received a score of 0.05, and the total score must be 1. Moreover, out of the 120 contracts analysed, a sample of 30 contracts were selected. These were analysed by authors, and in all cases, the score obtained by the authors was the same.

The preliminary analysis of contract data led to the establishment of an appropriate codification framework covering the relevant aspects of the contract presented in Table 3.

According to the criteria presented in Table 3, the study of the 120 contracts reflects that most of them (a number of 78 contracts meet a score of $N_{med} \approx 3$) fall into the balanced diagnosis. This position outlines the financial institution's orientation to get closer to the client by identifying the needs and desires of consumers in order to achieve a high degree of satisfaction. When it comes to competing, it is essential to prioritize customer satisfaction to retain current customers and attract new ones. This can be achieved by being more efficient and effective in meeting their needs. Support for these results comes from the in-depth interview that argues that the relationship between the client and the bank must be advantageous for both parties. A low percentage (10%) of contracts fall into an appropriate diagnosis with a score between 3 and 4.

On the opposite end, there are several contracts (30 contracts) with a score of 2. The diagnosis reflects an imbalance mainly due to the lack of sound financial education among the consumer of banking services.

Table 3. The criteria analysed/evaluated by authors in credit contracts by the method of evaluation grids.

Criteria	Item	Score
Item 1 (I1) = Transparency	I11 = Transparency in the communication of the calculation method of the interest used by the bank	0.05
	I12 = Transparency regarding the level of margin used by the bank	0.04
	I13 = Transparency in communicating the bank's interest rate change	0.02
	I14 = Transparency on fees charged	0.03
	I15 = Transparency on standard information (repayment schedule)	0.01
Item 2 (I2) = General contractual clauses	I21 = Credit withdrawal	0.05
	I22 = Loan repayment and interest payment	0.08
	I23 = Conditions for rescheduling or refinancing the loan	0.05
	I24 = The analysis of rights and obligations in the contract	0.04
	I25 = Guarantees	0.03
Item 3 (I3) = Specific clauses	I31 = The way the interest rate is calculated	0.08
	I32 = Credit management fees	0.06
	I33 = Other fees	0.05
	I34 = Currency risk clause	0.09
	I35 = The clauses that generated the most disputes	0.07
Item 4 (I4) = Other aspects of the contractual relationship	I41 = Early repayment/ conditions/ commission	0.06
	I42 = Money market indices	0.04
	I43 = Insurance costs	0.03
	I44 = Consequences of non-fulfilment of obligations / delays in payment	0.07
	I45 = Clear and accurate information on risks	0.05
Total score		1

Source: Authors' own research.

In addition to the analysis using the evaluation grids method, the authors turn to the research through the semi-directive in-depth interview that identifies consumers' opinions, behaviours, and attitudes regarding the financial-banking market and financial education and explains the relationship between the repayment of credits and the need for financial education.

Based on the synthesis grid resulting from the preliminary information obtained, the following was performed:

- vertical analysis, by addressing within the same interview how each respondent addressed the topics and subthemes of the in-depth interview;
- horizontal analysis reflects how all respondents address each topic or subtopic. This analysis is essential because it is the foundation of the qualitative study report.

Identifying the qualitative aspects and the corresponding conclusions proved to be the qualitative analysis's most challenging and motivating stage.

Finally, the synthesis grid containing in-depth interviews with the 240 consumers of loans from financial and banking institutions is made, based on which the qualitative research conclusions were formulated.

The vertical analysis of the semi-directive in-depth interviews conducted among the 240 people who have hired loans from financial institutions reflects their views on the conduct of the contractual relations concluded with the lender, debated on each topic.

Topic 1: Opinions on the banking market for individuals and the need for financial and banking education

According to most subjects (63.3%), banking services aim to meet the customer's needs, but the costs of such a relationship are burdensome. The factors that influence achieving a balance and establishing principles of respect in contractual relations are the provision of transparent, honest, quality services.

A small percentage (20%) consider that the market for these services is centralized, rigid, and lacking the possibility of negotiations. It also considers that the activity of providing financial and banking services involves the recording of high costs with the staff employed by the institution, which influences the costs of accessing credits. Along with these costs, at the institutional level, there are also costs with IT resources necessary to build an information system.

The subjects interviewed appreciate the importance and role of financial and banking services for the sustainable development of social life as undeniable but difficult to access for most consumers, primarily due to high costs. Their development and organization by highly qualified authorized persons in the field accentuate their importance and inspire confidence.

The majority (68.3%) agree on the following aspects: the banking market is organized, dominated by competition, and influenced by the central policy of the financial institution.

In addition, the majority (61.7%) of those interviewed agree that the cost–quality ratio of services provided is the fundamental factor influencing the supply and demand of financial and banking services, the consumers assessing the quality of the service they make use of against the service they expected to receive.

Last but not least, the lack of minimum financial education of most banking customers is mentioned, as well as the empathy of the service provider who comes into direct contact with it and who should adapt the offer to the consumer's needs. Most of the respondents consider that better financial education is needed for consumers. Thus, the institution must maintain sight of the fact that its staff must be motivated, appreciated, and stimulated to present the offer to the institution.

The research results on respondents' opinions on banking services for individuals are summarized in Table 4.

Table 4. Summarized answers corresponding to topic 1 from qualitative research.

Topic	Summarized Answers
Opinions on the banking market for individuals and the need for financial and banking education	• 63.3% consider that banking services aim at meeting the needs of the customer, but the costs are high; • 20% say that the banking market is centralized, rigid, lacking the possibility of negotiations; • 100% consider that financial and banking services play an essential role in the sustainable development of social life.
Solutions for the proper functioning of the banking market	• 86.67% of the subjects propose grouping the offered banking products on income levels; • most respondents (85.7%) see a problem in poor financial preparation of banking customers and propose a better financial education for the population.

Source: Authors' own research.

Topic 2: Requirements and expectations of individual consumers regarding the provision of banking services in the current competitive environment in an ideal situation

A share of 36.7% of respondents considers that quality services result from a professional accumulation of studies based on previous experience. Additionally, the integrated computerization of financial services and the rapid communication with the customer contribute to providing quality services. In this context, access to the resources and knowledge necessary to use such communication channels is questioned.

Other subjects (40%) consider that the client expects more empathy from the employees of the financial institution, patience, and understanding that convey confidence in the integrity and objectivity of the banking profession.

There are subjects dissatisfied with the contractual relationship between them and the financial-banking institution (20%) regarding the method of calculations and transmission of the interest rate. The respondents' complaints impacted the excellent cooperation with the financial institution, and in extreme cases, they turned to the courts.

All these aspects influence the degree of satisfaction in collaboration with financial and banking institutions, which differ from period to period, from client to client. The respondents' opinion advocates long-term, close relationships of close collaboration that have as traits common feelings, events, and feelings. They are also aware of the need for basic financial education and are willing to participate in financial knowledge activities for the benefit of all.

From the survey carried out according to the age of respondents, it is noted that age is an essential factor in taking the risk of making certain investments, which is why consumers are willing to allocate some of the time available to participate in financial education courses. There are also secondary factors that can affect the adoption of financial decisions, such as monthly income, financial education, personality, etc. Thus, respondents aged 20 to 25 generally do not have a financial education basis, do not invest too much, and do not resort to bank loans. People between the ages of 30 and 40 generally have set goals and have a higher income that allows them to make investments and use them as sources of financing on bank loans. Depending on the financial education held, they are honest and loyal consumers of financial institutions. The third category of potential consumers of banking services is those older than 40 with clearly defined financial goals, with a financially organized life. These people show caution but a great openness in the development of investment appetite and financial education. The solution for changing this behaviour in relation to investments would be to allocate time to educate themselves financially both by themselves and by participating in seminars organized by financial and banking institutions.

The following are summarized answers that reveal the most critical aspects related to the requirements and expectations of individual consumers regarding the provision of banking services in the current competitive environment in an ideal situation (Table 5).

Table 5. Summarized answers corresponding to topic 2 from qualitative research.

Topic	Summarized Answers
Requirements and expectations of individual consumers regarding the provision of banking services in the current competitive environment in an ideal situation	• 36.7% of respondents consider that quality banking services are influenced by the previous experience of employees;
	• 50.4% of respondents consider that the digitalization of financial services and rapid communication influence the quality of the banking service.
The expectations that the respondents have from the banking institution employees	• 40% of subjects expect empathy and understanding; • 30.8% of respondents expect professionalism; • 29.2% of respondents expect compliance with contractual relationships.
Taking risks based on age	• subjects aged 20–25 years do not invest much; they are reserved; • subjects aged 30–40 years have fixed goals and resort to moderate investments; • respondents over the age of 40 have great openness to investment and financial education; they have a financially organized life.

Source: Authors' own research.

Topic 3: Consumer views on contract terms and the benefits of balanced contractual conditions in the banking market

Taking into account the specifics of the activity, the correct promotion of the provider–beneficiary relations is overshadowed by the cumbersome communication with the financial-banking institution on the performance of specific services. The majority of respondents

(48.3%) consider that professionals in the field enjoy their privileged status only by providing services that meet specific criteria that justify public trust.

Regarding the degree of satisfaction in this collaboration relationship, a part of the subjects surveyed (36.7%) consider that it can be achieved when the importance and role of the consumer in the performance of these services are recognized. The cooperation relations toward the financial institution strives for are permanent, long-lasting one based on closeness, understanding, and harmony.

According to the respondents, for the financial institution, one of the objectives pursued in carrying out the activity should be the permanent concern for the transmission of financial information in a form accessible to the understanding of any consumer, analysis, and discussion of contractual relationships.

It is also recalled, in this context, that the market for financial and banking services is complex and challenging to understand without minimal financial preparation and the current use of new technologies.

For an ideal relationship, more time should be given to the consumer in explaining the contract terms, the risks that may occur during the relationship, and all the costs involved.

A summary of the responses obtained on the topic of contractual clauses and the benefits of balanced contractual conditions on the banking market is given in Table 6.

Table 6. Summarized answers corresponding to topic 3 from qualitative research.

Topic	Summarized Answers
Problems of banking institutions in relations with consumers (individuals)	• lack of transparency (77.5%);
	• financial institutions enjoy privileged status (48.3%); • recognition of the importance and role of the consumer in the banking market (36.7%).
Solutions to establish balanced contractual conditions	• cultivating long-term relationships characterized by mutual respect and permanent counselling (58.75%); • formation of essential financial preparation of clients (72.92%).

Source: Authors' own research.

Topic 4: The impact of the banking market on society and sustainable development and the need for the minimum financial education of the individual consumer

The banking sector contributes to the economic development of society by favourably influencing social development in a fair business relationship with the client.

Some subjects (58.3%) agree that pursuing social, economic, and environmental objectives could lead to meeting future needs in a sustainable society. Financial institutions should therefore aim, in addition to performance, at providing quality and easily accessible services to the general public and at the economic growth through which they can lead to increased social development.

Respondents (78.3%) consider that financial institutions can support consumers by conducting financial and banking education courses.

It is also appreciated that only close, long-term, empathetic collaboration can lead to a transfer of interest for these actions.

The financial and banking sector has the potential to support, along with increasing individual performance, problems of meeting social needs, including education, health, and social protection.

Financial institutions have implemented credit policies with an important social role, with an impact on preserving the environment and improving the quality of life.

The most significant responses of respondents regarding the impact of the banking market on society and sustainable development are highlighted in Table 7.

Table 7. Summarized answers corresponding to topic 4 from qualitative research.

Topic	Summarized Answers
Actions that can lead to sustainable development	• the development by financial institutions of activities that bring value and participate in the saving of resources; • technology, process digitalization, and innovation of the FinTech System; • the judicious consumption of resources is a responsible and efficient way of thinking; • financing by banking institutions of projects of social, environmental, and humanitarian interest; • implementation of credit policies with a social role, with an impact on preserving the environment and improving the quality of life.

Source: Authors' own research.

The quantitative data, collected based on the synthesis grid, led only to qualitative assessments. These quantitative data take into account the opinions expressed by each respondent concerning each topic, and can hint at, on the whole, the importance given to them.

An important observation that can be made regarding the information provided by most of the interviewees is that, as far as the contractual relations between the financial-banking institution and the borrower in an ideal situation are concerned, their requirements and expectations are multiple and at a high level to achieve the satisfaction of a well-performed service. Obtaining an overview of the approaches taken by the interviewed respondents in relation to the topics to be interviewed can be done precisely based on quantitative data in the synthesis grid that highlights, in essence, the interest or importance given to them. Table 8 reflects, in percentages, the share of each topic in the total interventions of the respondents.

Table 8. The share of each topic in the total interventions of the respondent.

Topic Addressed	Share from Total Interventions (%)
Topic 1: Opinions on the banking market for individuals and the need for financial and banking education	24.84
Topic 2: Requirements and expectations of individual consumers regarding the provision of banking services in the current competitive environment in an ideal situation	26.25
Topic 3: Consumer views on contract terms and the benefits of balanced contractual conditions in the banking market	24.96
Topic 4: The impact of the banking market on society and sustainable development and the need for the minimum financial education of the individual consumer	23.95
Total	100

Source: Authors' own research.

Taking into account the quantitative data mentioned above, we can outline, at the level of the interviewed respondents, significant qualitative aspects, namely:

- on the one hand, in their interventions, the respondents paid more attention to creating a better framework for contractual relations, of an ideal framework where financial-banking services can be provided given the development of the banking market and the competitive environment in Romania on sustainable bases. This aspect reflects the desire to improve contractual relations for the benefit of the parties involved and for sustainable economic development as a whole;
- on the other hand, it is possible to observe the respondents' focus on outlining some principles of sustainability starting from the ideal consumer-banking institution relationship (advantages and disadvantages), so that a valid promotion of consumer-financial banking institution relations takes place;

- finally, we notice the approach of all topics with relatively immediate interventions, which indicates the interviewees' interest and willingness to participate in improving the framework of contractual relations with banking institutions.

Following the analysis of the data obtained from the two research types, the authors outline an essential guide to being consulted by consumers before purchasing a bank loan (Figure 1).

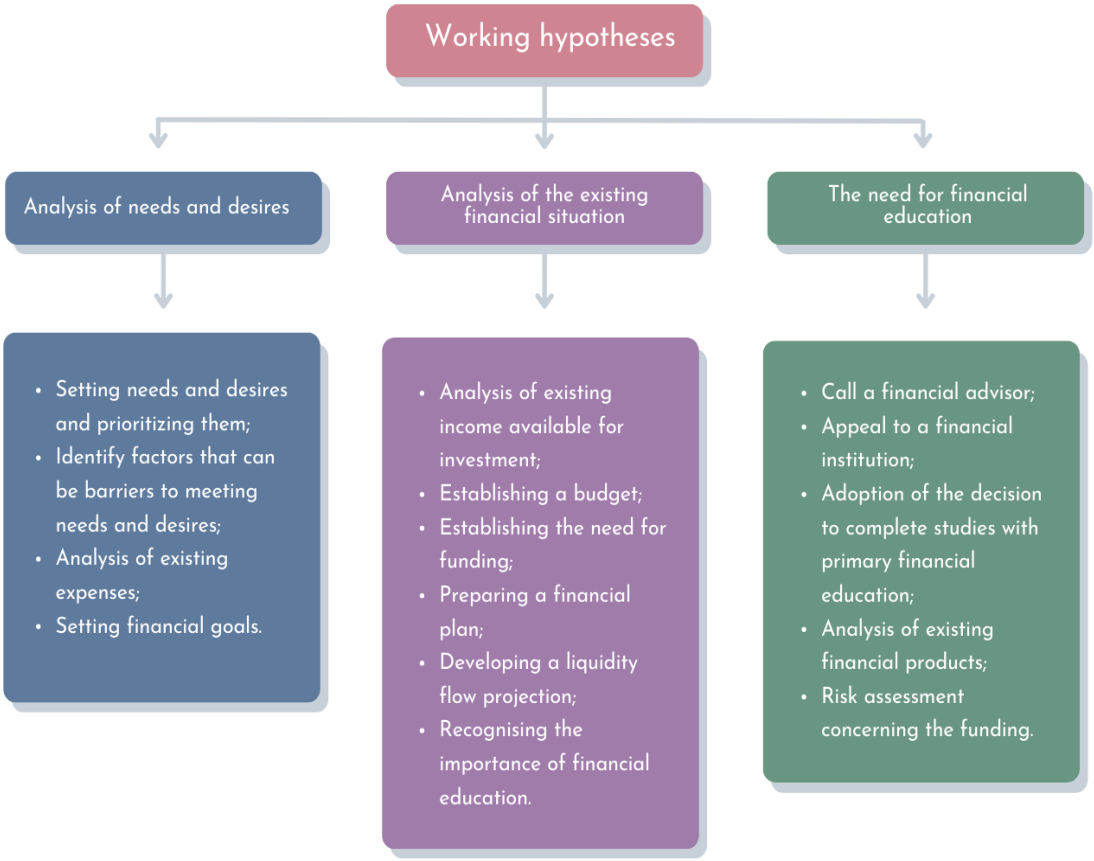

Figure 1. Framework basic guide for consumers. Source: Authors' own research.

Table 9 outlines the cause-and-effect relationship for the most relevant aspects identified by the authors following the two types of research carried out.

Table 9. Cause and effect relationship for the most relevant aspects of research.

Cause	Effect
Lack of financial and banking education programmes	Discouraging the consumption of bank loans due to misunderstanding of the financial-banking system
A high degree of technology	Reluctance to use new technologies
Use of specific technical terms	It induces the consumer a sense of insecurity over the contracted loan
Inefficient interaction between bank staff and credit consumers	Altering the consumer's economic behaviour; Harm the economic interests of consumers

Source: Authors' own research.

Therefore, minimum financial education contributes to hiring and carrying out bank loans with more confidence in a balanced process of the contractual relationship.

5. Conclusions

Overall, the economic crisis has resulted in significant setbacks in almost all countries. As a result, available resources have been substantially reduced for all sectors, including the financial and banking industry [87]. In the current context, financial institutions focus on modern technologies, diversifying the products and services offered. Thus, through services such as internet banking, mobile banking, and home banking, he focuses on the virtual client by providing them with facilities for accessing financial information. Diversifying and developing financial markets have led to a specialization of banks and available products.

This paper identifies the root cause of loan and loan repayment syncope in a low level of financial literacy. The results of this paper resonate with other previous studies that support and reinforce the idea that the level of financial literacy is low due to a low level of financial responsibility [20]. Thus, the research conducted revealed such aspects as lack of general financial and economic knowledge, reluctance to access new banking products (traditional ones occupying the primary place in use), susceptibility in the client–employee–bank relationship, little confidence in the information communicated by the financial institution, the need to seek financial advice, the need for minimum financial and easy to access training options, etc. Most participants in the study accessed products such as personal loans (a situation confirmed by analysing loan agreements using the evaluation grids).

The appearance of the "Ordinance 50/2010 [75] on consumer credit agreements", approved by Law 288/2010 [88], brought into Romania provisions on the rights and obligations of the parties regarding consumer credit agreements. Only the reluctance of the clients and the lack of financial education, but also the lack of sufficient information (despite the efforts of the bodies empowered to make available the facilities offered by the normative act) constituted barriers to the conclusion of the addenda to the ongoing contracts.

A report published by the World Bank [89] shows that Romania's position is last in the European Union depending on the use of financial intermediation services (with a percentage of 22% of the number of adults). The report shows the need for advice and the adaptation of the offer to the simplicity of the client's knowledge.

Banks (banking products and services) currently respond to a reasonable level of customer expectation and are already regular service providers and, even more, social partners in everyday life. The relationship between banks and clients, from the perspective of loans, was also studied by Saengchote and Samphantharak [90].

The need for primary financial education is also set out in Mahmood-ur-Rahman's [91] study examining the impact of financial education on banking and non-banking financial services. Educated consumers use various electronic payment methods, payment through specialized platforms, payment by mobile phone, etc.

In synthesis, based on the research carried out, the following can be outlined according to the research objectives:

- respondents want a better framework for conducting contractual relations taking into account the development of the banking market and the competitive environment on a sustainable basis;
- outlining some principles of sustainability starting from the ideal consumer-banking institution relationship (advantages and disadvantages) to take place a valid promotion of consumer-financial banking institution relations;
- respondents appreciate the importance of primary financial education to help them understand specific contractual terms, calculation of interest, costs involved in financing through loans, etc.;
- awareness of increasing the level of financial responsibility by increasing the level of financial education;
- we notice the approach of the subjects regarding the importance of appealing to the services of a financial consultant or financial-banking institutions;

- finally, recognizing and appreciating the role of financial-banking institutions in supporting the sustainable development of social and economic life and the need for primary financial education for efficient consumer-bank collaboration.

Financial-banking institutions can consider the research results to meet the client's knowledge needs in guiding him to choose the best investment option, advising on money management, and purchasing services. The direction of action to be followed would be to identify essential consumer demands to meet them and strike a balance between satisfaction and performance of the institution from a sustainable perspective for both parties. It is essential to build specialized work teams in various fields, taking into account the work of customers, which would lead to a better understanding of them and the problems in their work. In the work strategy, an important role should be played by communication with the consumer, explaining the advantages of each service, determining the increase of the client's familiarity with the complexity of the financial process, and sustainable economic thinking.

The financial sustainability of the bank client and its ability to repay contracted loans was affected by a financial, economic, or social crisis, as was the crisis generated by COVID-19. Consumer financial and banking education can be shaped by the strategies and policies promoted by banking entities. Banks play an essential role in the recovery and financing of the economy in general and individuals in particular. In this sense, banks can adapt their lending policies and strategies according to the financial and financial requirements of the consumption of banking services, and they can rethink the lending process according to the user's profile.

A future research direction could be studying the credit process for legal entities and its impact on sustainable development.

Finally, the authors propose a guide for micro-enterprises to be considered by them when they want to access credit. Figure 2 shows the outline of this guide.

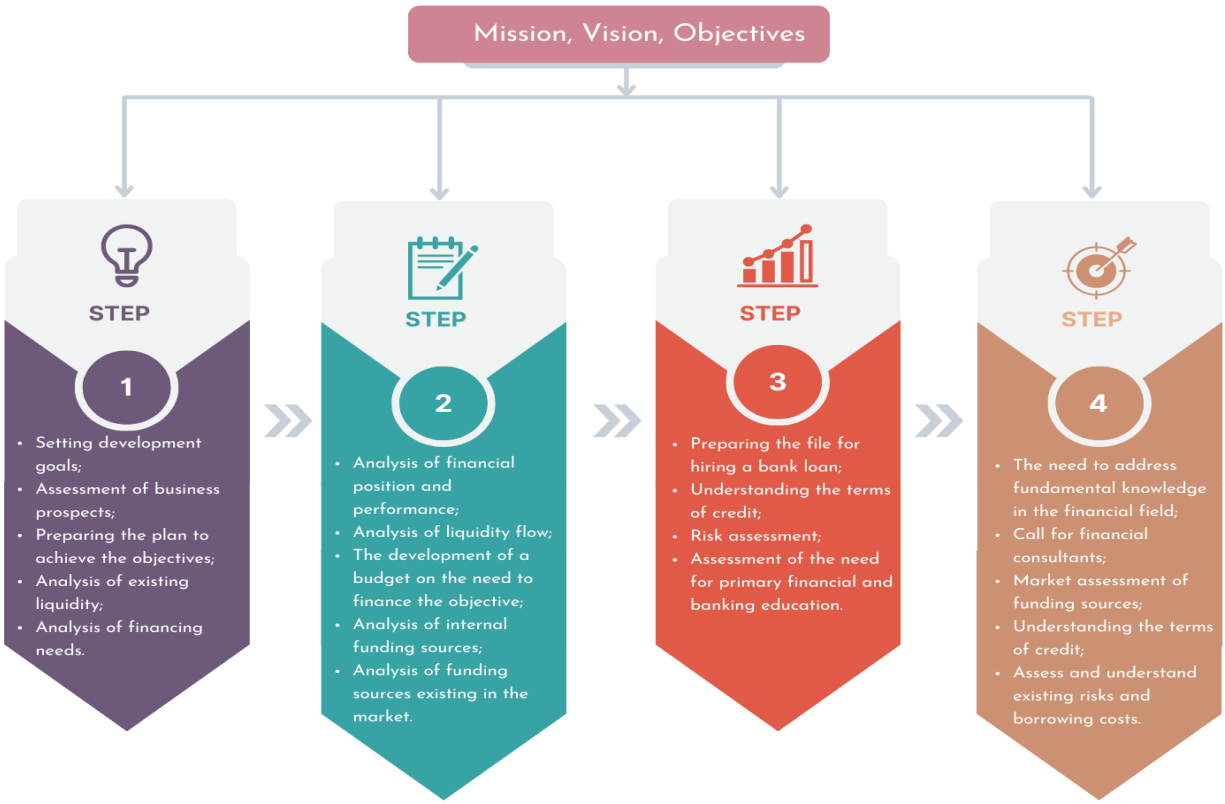

Figure 2. Framework basic guide for micro-enterprises. Source: Authors' own research.

The limit of the research carried out in this paper is given by the fact that a random sampling could not be performed, so the sample validation cannot be achieved from a statistical point of view, not allowing extrapolation of the results to the entire population investigated. However, this does not mean that this research is less valuable. They are topical and are of real benefit to authorities and decision-makers in banking institutions.

Through the topical issues presented and analysed, the authors want to highlight the importance of consumer financial education and the existence of a correct relationship between the financial institution and the consumer for a sustainable society.

Last but not least, the innovative nature of the study provides another perspective on the impact of the financial market on the sustainable development of a society. The financial market is the area where people have the slightest knowledge, and in general, investments are based on government securities, bonds, shares, etc. The relationship with financial and banking institutions is specific and requires the development of financial education with information on the risk–benefit ratio. In these circumstances, financial education becomes necessary and valuable for many consumers of financial and banking services.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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10 EXPLAINING THE EU REGIONAL ECONOMIC GROWTH THROUGH REGIONAL- AND COUNTRY-LEVEL ACHIEVEMENTS IN EDUCATION

Monica RĂILEANU SZELES[1],
Carmen ANTON[2],
Mirela BABA[3],
Steliana BUSUIOCEANU[4],
Adriana LITRĂ[5],
Titus SUCIU[6]

Abstract

This paper uses the methodological framework of multilevel mixed-effects models to shed light on the importance played by regional and country-level factors for the regional economic growth within the European Union (EU). In particular, factors in the area of education and Internet utilization are considered. Gradually, variance components models, random intercept models and random slope coefficient models are tested, and finally the random slope coefficient model is found to best fit our hierarchical dataset. The results indicate that at country level lower proportions of early school leavers, as well as higher expenditure on education and R&D, enhance regional growth. At regional level, higher achievements in education and higher rates of Internet usage are both associated with higher regional economic growth. The impact of education and Internet variables on the regional economic growth is generally found to be different across the New Member States and the Old Member States.

Keywords: regional economic growth, EU, education, ICT
JEL Classification: O12, O47

[1] *Transylvania University of Brasov and Institute for Economic Forecasting, E-mail: monica.szeles@unitbv.ro.*
[2] *Transylvania University of Brasov, E-mail: carmen.anton@unitbv.ro.*
[3] *Transylvania University of Brasov, E-mail: mirela.baba@unitbv.ro.*
[4] *Transylvania University of Brasov, E-mail: steliana.busuioceanu@unitbv.ro.*
[5] *Transylvania University of Brasov, E-mail: adraiana.litra@unitbv.ro.*
[6] *Transylvania University of Brasov, E-mail: titus.suciu@unitbv.ro.*

1. Introduction

Economic growth plays a crucial role in the EU Agenda for growth and jobs, being at the core of the Europe 2020 Strategy, which particularly emphasizes the smart, sustainable and inclusive growth. Recently, the European Commission has recognized that the European regions had to become more competitive by innovation, digital transformation and automation, to successfully compete with the most advanced economies and regions in the process of globalization. However, the Commission is aware of the differences among the European regions with regard to technological advance and innovation, as reflected, for instance, by the implementation of the Smart Specialization Strategies (RIS3). In the view of all EU initiatives and funds aimed to encourage broad-based innovation (*e.g.,* Lagging Regions Initiatives, RIS3, Horizon 2020, Stairway to Excellence, etc.), the regional policies must provide support for the development of innovation capacities in the less advanced EU regions, in accordance with the regional specific environment and conditions.

Education is generally acknowledged as a fundamental factor of economic growth. According to the Europe 2020 Agenda, it helps employability and it reduces poverty. In addition, R&D/innovation/technology might improve the EU competitiveness, and in the long term it can diminish the structural weaknesses in the EU economy.

Lately, providing people with ICT (Information and Communication Technologies) skills has become a new challenge for all the educational systems, because it represents the main requirement for the development of the ICT sector. Technology is the key of the global innovation-driven economic growth (Sharafat and Lehr, 2017), and at the same time the main factor of sustainable development, as stated by the 17 Sustainable Development Goals advanced by the 2030 Agenda for Sustainable Development. However, education and investment in R&D (Research & Development) can substantially enhance the impact of ICT on economic growth.

There is a substantial body of literature analyzing the dynamics, causes, implications and policies related to the regional economic growth within the EU, but most of them are either cross-country studies or country case studies. When analyzing the determinants, most papers are based on the regional drivers, and only very few ones discuss the contribution of both regional- and country-level factors to the EU regional economic growth. This paper aims to light up this issue, by considering the influence of both regional- and country-level factors in the areas of education and ICT on the EU regional growth. The empirical analysis uses hierarchical data (regions nested into countries) running from 2001 to 2017. Additionally, the paper also examines: (1) whether the impact of education and ICT on regional growth is different across the New Member States (NMS) and the Old Member States (OMS), and (2) the robustness of results under several specifications of the mixed-effects models used here.

The paper is structured into four sections. The first section is Introduction, the second section summarizes the most relevant contributions to the literature, the third section presents the methodology and data, and the last section concludes and formulates policy recommendations.

2. Literature Review

The relationship between the human capital and economic growth has been widely debated in the literature (*e.g.,* Schultz, 1961; Rosen, 1976; Romer, 1986 Lucas, 1988; Mulligan and Sala-i-Martin, 1993; Barro and Sala-i-Martin, 1995), most papers finding a positive effect of

human capital on growth, especially on long term. Education has been widely acknowledged as a factor of growth, but different mechanisms have been found to explain this causality. For instance, increasing the workforce's ability to finalize the work tasks faster, facilitating the transfer of knowledge and increasing the creativity are the channels through which education may influence the productivity of any country (World Economic Forum, 2016).

Increasing the expenditure on education and the expenditure on R&D, increasing the quality of school and educational programs, and discouraging the early school leavers are only a few examples of policy measures that might lead to better educational attainments at all levels. However, the empirical results are broad and diverse. There is a mixed and inconclusive literature about the effect of education expenditure on economic growth. Barro and Sala-i-Martin (1995) and Baldacci *et al*. (2008) find a positive relationship between them, while Devarajan *et al*. (1996), Landau (1986), Levine and Renelt (1992), and Keller (2006) find no significant relationship. Hanushek (2013) underlines the importance of the cognitive skills of population and of the school quality for improvements in long term growth, especially for the developing countries. He argues that while improving in terms of school attainment the developing countries have not improved in quality terms, so that closing the gaps with the developed countries still remains an unsolved issue.

The positive impact of ICT on economic growth has been widely analyzed in the literature (Edquist & Henrekson, 2004; Hanclova *et al*., 2015; Falk & Biag, 2015), but mixed results were found when studying the differences among the countries. One body of literature argues that the less developed countries can reach higher growth rates through ICT (Steinmuller, 2001), while other papers find that investment in ICT should be undertaken by the upper middle income countries where higher marginal returns are anticipated (Dimelis and Papaioannou, 2009; Hanclova *et al*., 2015). Recent evidence indicates that the developing and the emerging countries do not benefit more from investment in ICT than the developed countries (Niebel, 2018).

In line with one of the research questions investigated in this paper, Dimelis and Papaioannou (2009) show that the higher impact of ICT on economic growth in the developed countries is due to the advantages of higher learning and experience levels. Public policies targeting higher investment in ICT should therefore increase the human capital stock by supporting higher education (King *et al*., 1994). Choi and Hoon Yi (2017) find that the effect of Internet use on economic growth is enhanced by an increase in the R&D expenditure.

A series of studies confirm the positive implications of Internet usage on economic growth. Using a time series data for South Africa running from 1991 to 2013, Salahuddina and Gow (2016) find a positive and significant long-run relationship among Internet usage, financial development, trade openness and economic growth, as well as a causal link between Internet usage and economic growth. Billon *et al.* (2017) indicate that the positive impact of Internet usage on economic growth depends on the educational inequality in both developing and developed countries, so that the public policies should consider the educational distribution in order to speed up the mechanism through which the Internet use boosts economic growth.

The ICT has allowed the development of E-commerce over time, based on real and increased productivity. This proves the worth of ICTs and unravels the "productivity paradox" (OECD, 1999). E-commerce is perceived not only as a form of trade digitalization, but also as an accelerator of progress across all the 17 Sustainable Development Goals advanced by the 2030 Agenda for Sustainable Development.

Despite all the benefits induced by the expansion of E-commerce, as often highlighted by international institutions (*e.g.,* OECD, 1999, 2017; UN, 2015; UNCTAD, 2016), the E-commerce poses a number of challenges, such as the inequitable distribution of payback. To maximize the benefits of E-commerce in the society, the governments must design policy measures to increase the number of users. This equally involves measures in the area of education and of Internet infrastructure. Engaging more people in education, including more people in lifelong learning programs, as well as discouraging early school leavers enhance the abilities and skills to purchase goods on line. Improving the Internet infrastructure, especially in the rural and disadvantaged areas, facilitates more companies and persons to engage in E-commerce. As underlined by OECD (2017), the lack of access to the Internet represents in fact the main barrier against the expansion of E-commerce.

To harness the potential of E-commerce for economic development and to stimulate governments to actively engage in enabling more people and companies to benefit from E-commerce, the international institutions publish not only regular reports on E-commerce, but also indicators of progress (*e.g.,* UNCTAD B2C E-commerce Index 2016, UNCTAD, 2016). Finally, the initiatives undertaken by governments and international institutions toward supporting the development of E-commerce were empirically found to generate a positive impact on economic development, as shown by Anvari and Norouzi (2016).

The skills development has often been claimed as a main source of digital divide, with negative consequences on E-commerce as well. A more inclusive and better education may provide more people with the necessary skills to engage in E-commerce (OECD, 2017).

To sum up, the scientific literature, as well as the international institutions, generally agrees upon the positive role of education and E-commerce in stimulating the economic growth. Moreover, the positive role played by ICT and E-commerce is found to be significantly enhanced by the education and public expenditure on R&D. However, there is modest empirical evidence on how the regional growth or regional development is enhanced by a mix of regional-national policy measures in the area of education and ICT.

Sterlacchini (2008) examines the relationship between education and economic growth at the EU regional level, and finds that the share of adult population with tertiary education and the intensity of R&D expenditures are the most effective determinants of economic growth during the period 1995–2002. Another regional approach is undertaken by Vincente and Lopez (2011), who assess the regional digital divide across and within the EU countries. Based on Eurostat cross-sectional data, they find large disparities the EU in terms of ICT adoption and use.

However, to our knowledge there is no study analyzing the impact of regional- and country-level factors of education and Internet use/ICT on the EU regional economic growth. A multilevel analysis based on a hierarchical design of data would improve the knowledge on the mechanisms that contribute to the increase in regional economic growth within the EU.

3. Methodology and Data

Data

The empirical analysis uses Eurostat panel data running from 2001 to 2017, aggregated at regional level, as well as at country level. All the 28 EU countries are included in the analysis. According to the NUTS 2016 classification, the 281 NUTS2 statistical regions of the EU group together basic regions for the application of regional policies. The selection of

variables included in this study firstly depends on data availability from Eurostat and, secondly, is based on theoretical grounds.

The dependent variable is the regional economic growth (NUTS2 variable), while the explanatory variables are socio-economic and demographic variables aggregated either at regional level (NUTS2), or at country level:

- At regional level: primary educational attainments (abbr. "Education 0_2"), secondary educational attainments (abbr. "Education 0_2"), tertiary educational attainments (abbr. "Tertiary education"), E-commerce usage (abbr. "E-commerce at regional level"), proportion of population who never used the Internet (abbr. "Internet use - never"), fertility rate (abbr. "Fertility"), human resources employed in the technology sector, (abbr. "HR_tech"), Internet usage (used to create the dummy variable "Internet intensity")..
- At country level: E-commerce usage (abbr. "E-commerce at country level"), expenditure on R&D (abbr. "GERD"), early school leavers (abbr. "Early leavers"), lifelong learning, and economic growth (abbr. "GDP growth").

Method

To address the hierarchical structure of our data, in the empirical section of the paper we use multilevel mixed-effects models (also known as hierarchical models). The multilevel data structure includes time repeated observations at Level 1, nested into regions at Level 2, and regions nested into countries at Level 3. In contrast with the linear models, the multilevel models accommodate a mix of fixed effects and random effects, also being known as mixed-effects models.

The first step of our multilevel methodology consists of estimating the correlations among the observations within clusters with the interclass correlation coefficient (ICC), because this helps deciding about the appropriateness of such kind of models. The ICC is measured as the ratio of the between-cluster variance to the total variance, and it explains the proportion of the total variance that can be attributed to clustering. If the ICC is near zero, it means that there is a very low clustering of data, and in this case linear models should be used instead of multilevel ones. The ICC can be measured at each level of the clustering structure.

In our study, the country level ICC is the correlation between two years, *t* and *t'*, for the same country, *j*, but for different regions, *i* and *i'*.

$$\rho_v = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_u^2 + \sigma_e^2} \tag{1}$$

The region level ICC is the correlation between two years, *t* and *t'*, for the same region and the same country.

$$\rho_u = \frac{\sigma_v^2 + \sigma_u^2}{\sigma_v^2 + \sigma_u^2 + \sigma_e^2} \tag{2}$$

where, σ_v^2 is the variance between countries and σ_u^2 the variance within countries.

In a multilevel setting, the choice of the most appropriate model is not arbitrary. In fact, the most appropriate model is not the most complex one, but the one that best describes the set of working data. In order to find it, the simplest model (also called the "null model" in the multilevel methodology) should be gradually improved with random effects and covariates. After each multilevel model, a likelihood ratio test (LR test) should be used to find out whether "the more complex" model fits the data better than the simpler one. The variance

components model, the random intercept model and the random slope coefficient model are therefore tested step by step, without and with covariates, from the simplest to the most complex model. The design of empirical section, as well as the methodology, follows Răileanu Szeles (2018).

In order to examine the null hypothesis that there are no higher level effects, the three-level model is compared to the single-level model. This way, we can prove the usefulness of the hierarchical analysis.

The single-level model is presented below:

$$y_{tij} = \gamma_{000} + e_{tij} \tag{3}$$

where: e_{tij} (residual) is the time-specific deviation from region's predicted outcome and γ_{000} (fixed intercept) is the "grand" mean.

Next, the null hypothesis that there is no country effect is tested by comparing the three-level model to the two-level repeated observations-within-regions. The two-level model is presented as model (4):

$$y_{tij} = \gamma_{000} + u_{0ij} + e_{tij} \tag{4}$$

where: u_{0ij} (region-level random intercept) is the region-specific deviation from the country's predicted outcome.

In the third step, we test the null hypothesis that there are no region effects by comparing the three-level model to the two-level repeated observations-within-countries model. This specification is presented as model (5):

$$y_{tij} = \gamma_{000} + v_{00j} + e_{tij} \tag{5}$$

where: v_{00j} (country-level random intercept) is the country-specific deviation from the fixed intercept.

In the models above, the random effects and residuals are assumed to be independent one from another, and normally distributed with zero means and constant variances.

In case that the three-level model is found to best fit the data, the empirical design starts from the three-level variance-components model (also called the "empty" or "null" three-level model). By adding Level1, Level2 and/ or Level3 explanatory variables, the null model becomes a three-level random-intercept model with covariates. When relaxing the hypothesis of constant slopes across higher levels, the model becomes a three-level random slope (coefficient) model.

The three-level variance components model can be written as below:

$$y_{tij} = \gamma_{000} + v_{00j} + u_{0ij} + e_{tij} \tag{6}$$

The three-level random slope coefficient model can be further decomposed into Level 1, Level 2 and Level 3:

$$y_{tij} = (\gamma_{000} + v_{00j} + u_{0ij}) + (\gamma_{100} + v_{10j} + u_{1ij})x_{tij} + e_{tij} \tag{7}$$

Level 1:
$$y_{tij} = \beta_{0ij} + \beta_{1ij} x_{tij} + e_{tij} \tag{8}$$

Level 2:
$$\beta_{0ij} = \delta_{00j} + u_{0ij} \tag{9}$$

$$\beta_{1ij} = \delta_{10j} + u_{1ij} \tag{10}$$

Level3: $$\delta_{00j} = \gamma_{000} + v_{00j} \quad (11)$$

$$\delta_{10j} = \gamma_{100} + v_{10j} \quad (12)$$

In all equations above, subscript *t* denotes time (at Level 1), subscript *i* denotes region (at Level 2), and subscript *j* denotes country (at Level 3).

4. Empirical Analysis

The methodological design of our study includes a descriptive analysis in the first part, based on the calculation of interclass correlation coefficients, and a set of multilevel models, running from the simplest to the most complex one, in the second part of this section.

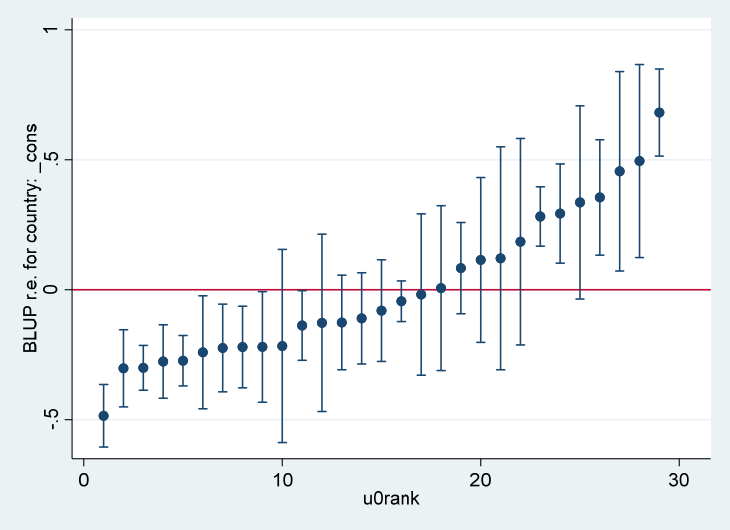
The overall mean of the economic growth rates from 2001 to 2017 across the EU regions is -3.29%, the between-country (Level 2) variance in growth rates is estimated at 9.50%, while the within-country between-regions (Level 1) variance is 57.83%. These result in a total variance of 67.33%. The variance partition coefficient is 9.50/67.33, meaning that 14.11% of the variance in the regional economic growth can be attributed to differences among countries.

In addition, when comparing the null multilevel model (the variance-component model) with a null single-level model we find that there is clear evidence of province effects on the regional economic growth within the EU, so that the multilevel models describe data better than the linear ones.

One way in which we may examine the significance of country effects is by a caterpillar plot (Figure 1), which shows the country-level residuals (empirical Bayes predictions) and the associated standard errors.

Figure 1

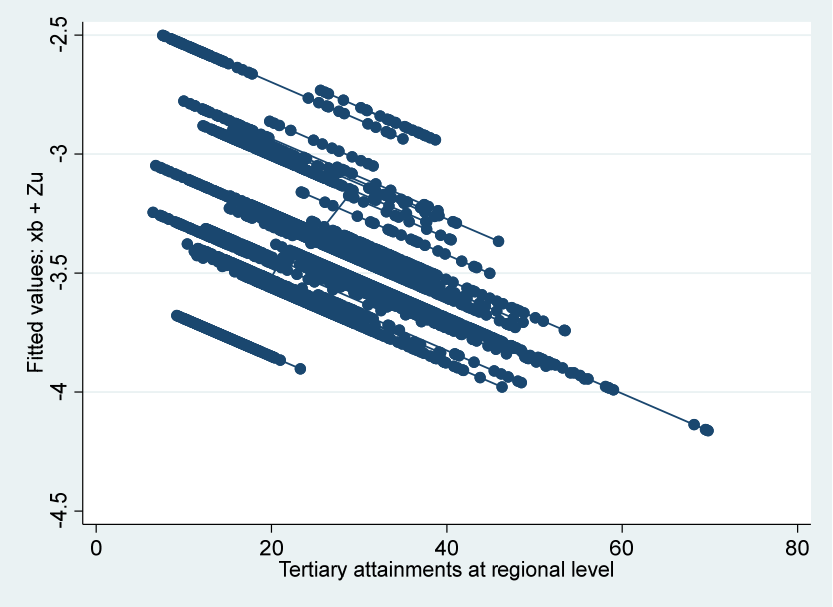
Examining the Country Effects at the EU Level by Caterpillar Plot



The first model that will be tested and analyzed is the random intercept model, which assumes different intercepts but the same slopes across countries, as shown in Figure 2. To keep the model simple at this step, the EU regional economic growth is explained as depending only on the regional tertiary attainments.

Figure 2

Random Intercept Model, Regional Growth-Tertiary Educational Attainments



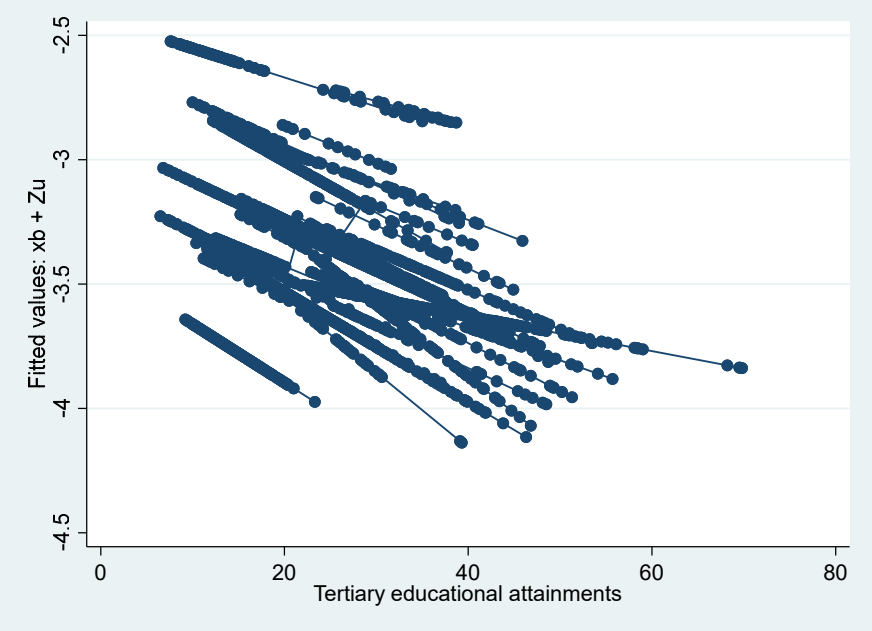
In the next step, we test whether the effect of holding tertiary educational attainments varies across countries by applying the log likelihood test (LR test). The null hypothesis for this test is that the two additional parameters (intercept and slope variance) are simultaneously equal to zero. Applied to our data, the test indicates that the effect of the tertiary education attainments significantly differs among the countries, so that it is worth dropping the assumption of equal slopes, as presumed at the previous step.

The negative covariance (-0.001) means that countries with a high intercept tend to have a flatter-than-average slope. Similarly, countries with a low slope tend to have experienced a much higher increase in the tertiary educational attainments (above-average slope).

The random slope model we have fitted implies that the between-country variance in regional economic growth is a function of tertiary educational attainments; that is, the amount of between-country variance differs along with the tertiary educational attainments.

Figure 3

Plot of the Predicted Country Lines
Between-country Variance, as a Function of Tertiary Educational Attainments



A key motivation for using multilevel modeling is, however, to assess the effects of Level2 explanatory variables on Level1 outcomes and the extent to which they can explain the Level2 variance.

The design of our empirical approach can be described as follows. First, the regional economic growth is explained through regional and country characteristics in the area of education, by random slope coefficient models (Table 1), which all consider random slopes for the tertiary educational attainments variable. In Tab. 2, different variances are assumed for the Internet intensive- and non-intensive EU regions, and in case that "Internet Intensity" is confirmed to be a significant driver of regional growth, then a set of other variables in the area of Internet usage is introduced, as to comparatively examine the impact of education- and health- related variables on EU regional growth (Tab.3). In Tab.1 and Tab.3, separate models are built for the groups of NMS and OMS.

In table 1, at the EU level (model 1.1), only education-related variables are included into the model, while for the NMS and the OMS (models 1.2 and 1.3) additional variables are also considered. The results indicate important differences especially between the NMS and the OMS with regard to the impact that both the regional- and country-level variables have on regional economic growth. Only models 1.2 and 1.3 are explained, because model 1.1 is reported only for reference.

At country level, a higher proportion of early school leavers from education is found to hamper regional economic growth in both OMS and NMS, which is in line with the literature which does not only acknowledge this relationship (e.g. Harmon et al, 2003; Sianesi and van Reenen, 2003; Krueger and Lindahl, 2001), but also places the problem of early school

leaving at the core of the EU education policy (Gillies and Mifsud, 2016).. The most important determinant of regional economic growth is the country-level expenditure on education, in both NMS and OMS, while the country-level economic growth is found to be associated with an increase in the regional economic growth only in NMS.

Only in OMS, higher educational attainments in education (at all primary, secondary and tertiary levels) are found to be positively associated with regional economic growth. These findings are according to our expectations, as the effect of education on economic growth has been widely debated and acknowledged in the literature (e.g. Barro and Sala-i-Martin, 1995). The relationship between economic growth and education has also been approached from the perspective of the quality of education and the related differences in the NMS and OMS countries, (Duguleană and Duguleană, 2011).

The regional fertility rate represents a powerful and significant determinant of regional growth in both NMS and OMS in the sense that a higher feritility rate discourages regional growth. Unemployment is found to carry negative significant effects on regional growth only in OMS, because in NMS the large shadow economy swallows a significant proportion of unemployed (especially long term unemployed). A higher proportion of people employed in the technology sector encourages regional growth in OMS, while discouraging it in NMS. This is because in OMS the technology companies are largely widespread across regions, and in NMS they are rather concentrated in certain regions (Borsi and Metiu, 2015; Drumea, 2015).

Table 1

Impact of Education on Regional Growth (Random Slope Coefficient Model)

Variables	EU (Model 1.1)	NMS (Model 1.2)	OMS (Model 1.3)
Country level			
GDP growth Lag1	0.0015*** (0.0004)	0.0035*** (0.0007)	0.00036 (0.0004)
Early leavers Lag1	-	-0.0037*** (0.0010)	-0.0010* (0.0004)
Educ. Expend. Lag1	0.0261*** (0.0037)	0.016** (0.0078)	0.030*** (0.0040)
Unemployment	-	0.0087 (0.0078)	-0.0023*** (0.0009)
Region level			
HR_tech Lag1	-	-0.0045** (0.0024)	0.0016* (0.0008)
Primary education	0.0018** (0.0009)	-0.0017 (0.0019)	0.0036*** (0.0010)
Secondary education	0.0018** (0.0009)	-0.0017 (0.0016)	0.0035*** (0.0010)
Tertiary Education Lag1	0.0012 (0.0009)	-0.0010 (0.0018)	0.0028*** (0.0010)
Fertility	-0.0819*** (0.0098)	-0.07*** (0.01)	-0.07*** (0.01)

Notes. (1) Random slope coefficient models, random slope: tertiary educational attainments; (2) Level1: year; Level2: region; Level3: country; (3) Standard errors are reported in brackets; (4) *** p<0.01, ** p<0.05, * p<0.1.

In Table 2, we introduce one additional variable at the regional level, called “Internet intensity, which is created as a dummy variable. It takes the value 1 for regions with percentages of Internet usage higher than the EU average and 0 otherwise.

In contrast with the previous model specification, in Tab.2 we assume different variances for the Internet intensive regions and non-intensive regions. Given that at this step of our empirical analysis we only test the significance of Internet intensity as a driver of regional

growth in the framework of multilevel analysis, only one model for the whole group of EU countries is reported.

Table 2

Impact of Education and ICT on Regional Growth (Random Slope Coefficient Model)

Variables	Random slope coefficient (Model 2)
Country level	
GDP growth Lag1	0.0013*** (0.0004)
Early leavers Lag1	-0.0006 (0.0006)
Educ. Expend. Lag1	0.0256*** (0.0037)
Unemployment	0.0011 (0.0008)
Region level	
HR_tech Lag1	0.0004 (0.0009)
Primary education	0.0020** (0.0009)
Secondary education	0.0020** (0.0009)
Tertiary education Lag1	0.0014* (0.0008)
Fertility	-0.0829*** (0.0097)
Internet intensity	0.0174*** (0.0045)

Notes. (1) Random slope coefficient model, random slope: tertiary educational attainments; (2) Level 1: year; Level2: region; Level3: country; (3) Standard errors are reported in brackets; (4) *** p<0.01, ** p<0.05, * p<0.1.

When introducing different Level 1 variance for Internet intensive and non-Internet intensive regions, most explanatory variables at country- and regional level in the area of education carry significant positive effects on regional growth. Moreover, the intensity of regions with regard to the Internet usage slightly amplifies the positive effects of all education variables. The internet intensity itself has a much important impact on regional growth compared with the education attainments in education (at all primary, secondary and tertiary levels). Overall, the results reported in Table 2 suggest that increasing the rate of Internet usage at the EU regional level results in positive direct and indirect effects on regional growth.

The regional level fertility rate, and the expenditure on education are found to be the main drivers of regional growth, which is in line with the literature (e.g. Raileanu Szeles, 2018), In addition, EU regions that are intensive in Internet usage are significantly associated with a higher regional growth.

As compared to Table 1 and Table 2, in Table 3 additional variables in the area of Internet utilization are used to explain the EU regional economic growth. The estimates are separately reported for the NMS and the OMS to unveil significant differences between the two groups of countries. This time, a random slope is assumed for the variable “Poor regions”. This variable was built as a dichotomous variable, which takes value 0 for the regions that belong to the richest 50% of regions in terms of GDP per capita and 1 otherwise. We decided to relax the assumption of constant slopes for this variable because we do not only expect, but it was also confirmed by the LR test that poorer and richer regions have different patterns with regard to the impact that variables in the area of education and Internet utilization have on the regional growth.

Table 3

Impact of Education and ICT on Regional Economic Growth

Explanatory variables	NMS (Model 3.1)	OMS (Model 3.2)
Country level		
GDP growth	-0.0004 (0.0044)	0.0025*** (0.0007)
Early leavers Lag1	-0.0025* (0.0015)	0.00005 (0.0005)
GERD country Lag1	-0.0394*** (0.0092)	-0.0030 (0.0035)
E-commerce Lag1	-0.0009 (0.0011)	-0.0006*** (0.0002)
Region level		
GDP growth Lag1	-0.2430*** (0.00847)	0.1002** (0.0552)
Primary education Lag1	0.0063*** (0.0021)	0.0012 (0.0010)
Secondary education Lag1	0.0041** (0.0019)	0.0010 (0.0010)
Tertiary education	0.0031** (0.0015)	0.0009 (0.0010)
E-commerce (regional level) Lag1	-0.0003 (0.0008)	0.0004 (0.0003)
GERD region	0.0141** (0.0073)	0.0010 (0.0014)
Internet banking Lag1	0.0014*** (0.0003)	-0.00005 (0.0002)

Notes. (1) Random slope coefficient models, random slope: Poor regions; (2) Level 1: year; Level2: region; Level3: country; (3) Standard errors are reported in brackets; (4) *** p<0.01, ** p<0.05, * p<0.1.

Most explanatory variables are introduced in models (3.1) and (3.2) by their lags, alongside with the lag value of the dependent variable. Given that the OMS are exposed to the digital divide at a lesser extent than the NMS, the usage of the Internet has not anymore in their case a significant effect on regional growth. In turn, the GDP growth at country level has a significant and positive effect on regional growth only in OMS, where regions tend to be more similar and convergent in terms of their economic growth.

In the NMS, at regional level, better achievements in education (all, primary, secondary and tertiary education), higher public expenditure on R&D, as well as a wider usage of Internet banking are found to enhance regional growth. The positive impact of the Internet banking is in line with previous findings on the benefits induced by the broader use of ICT technologies (Drumea, 2015).

At the country level, the expenditure on R&D (model 3.1) and the E-commerce (model 3.2) have a negative impact on regional growth. Even though the negative effect of E-commerce on regional growth in both NMS and OMS could be surprinsing, this finding is not new in the literature (D'Costa, 2005; Răileanu Szeles, 2018). The explanation could be that a progress in this regard at country level is too broad and often localized only in the most developed regions, so that the effect is finally negative on regional growth.

5. Discussion and Conclusions

The paper attempts to identify and analyze by a multilevel analysis the regional- and country-level determinants of regional economic growth in the EU, with a focus on education and ICT. Finding what mix of regional and national policy measures could enhance regional economic growth within the EU would be useful for the EU regional policy and for the national governments, too. Different model specifications are successively tested to reveal not only

the effect of different regional and national policy measures, but to also to unveil the likely differences between the NMS and the OMS.

There is a restrained set of empirical findings that are robust to all model specifications and all country groups. A lower proportion of early leavers from education, a higher economic growth rate, as well as higher public expenditure on R&D and education are the country level policy measures that stimulate regional growth under most empirical models.

In general, the impact of regional level variables on regional growth is different across models and groups of countries. In the area of education, the tertiary educational achievements are a significant stimulus for regional growth only in the NMS, while the positive influence of the primary and secondary educational achievements is significant only in the NMS and only when determinants in the ICT area are also included in the model. These results suggest that better educational achievements matter for a higher regional growth only in the NMS, while in the OMS they carry no significant effect.

At regional level, employing more people in the technology sector stimulates regional growth, but only in the OMS. This finding should be correlated with the higher technological development of the OMS as compared to the NMS during the reference period of time (Borsi and Metiu, 2015).

In the area of education, the primary, secondary and tertiary educational achievements, when being significant, they generate positive effects for regional growth in both NMS and OMS, being therefore an important regional driver of regional growth.

As also found in other studies (Raileanu Szeles, 2018), the fertility rate is correlated with regional economic growth, in the sense that a lower fertility rate stimulate regional economic growth in both NMS and OMS.

Surprisingly, higher expenditure on R&D and higher usages of E-commerce, when both being aggregated at country level, discourage regional economic growth in NMS and OMS. However, at regional level, higher usage of Internet banking, higher Internet usages, as well as higher regional expenditure on R&D enhance regional economic growth. This finding not only underlines the positive impact of ICT on economic growth, as confirmed by other studies (Hanclova et al., 2015; Falk & Biag, 2015), but also suggests the importance of regional policy measures, compared to the national level ones, for the stimulation of regional growth.

In comparison with the existing strand of literature on this topic, the novelty of the paper consists of examining both regional and national factors of the EU regional economic growth in the areas of education and ICT, by using a hierarchical model with several specifications, and a time span of 17 years.

The conclusion is that only a mix of regional-national policy measures in education/ ICT could accelerate regional economic growth in the EU. A group of multilevel models with time occasions nested in regions and regions nested in countries revealed the impact of the two types of policy measures. When looking back over the last 17 years, we find out that important discrepancies still exist between NMS and OMS, and this also reflects in the impact of policy measures on the regional growth. Discouraging early leavers from education, increasing expenditure on R&D and enhancing the ICT development help boosting regional growth in both NMS and OMS, but increasing regional educational attainments and the Internet usage are effective only in NMS, while extending the technology sector is more effective in OMS.

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Gender Parity within the Gender—Sustainability Paradigm: A Case Study on Management Structures of the Romanian Academia

Cristina Drumea [1,*], Bogdan Băcanu [1], Carmen Elena Anton [1], Adriana Veronica Litra [1], Steliana Busuioceanu [1] and Alexandra Doroș [2]

[1] Transilvania University of Brasov, Faculty of Economic Sciences and Business Administration, 500036 Brasov, Romania; b.bacanu@unitbv.ro (B.B.); carmen.anton@unitbv.ro (C.E.A.); adriana.litra@unitbv.ro (A.V.L.); steliana.busuioceanu@unitbv.ro (S.B.)

[2] Dragan European University of Lugoj, Faculty of Economic Sciences, 305500 Lugoj, Romania; alexandra2doros@yahoo.com

* Correspondence: cristina.drumea@unitbv.ro; Tel.: +40-723-248-000

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Abstract: Our study proposes a Romanian national perspective of the gender–sustainability paradigm in higher education under the Sustainable Development Goal 5 (SDG5) approach. The starting point is the interlinkage of the two concepts, gender parity and sustainability, depicted on a fundamental societal domain. Data collection was completed following a census approach, resulting in staffing data on 47 Romanian state-owned universities. Data collected envisaged the tenure teaching staff, divided into two gender groups; the count was focused on executive roles and collective managerial elected bodies for the 2015–2019 mandate. The gender situation was analyzed quantitatively by the number of teaching staff, their gender structure, and their representation in the executive functions and collective decision-making bodies. We calculated gender indexes and used statistical correlation coefficients to explain the relations between the different categories of personnel and their influence on establishing the management structures. The results of the gender configuration analysis were further associated with the latest national meta-ranking of Romanian universities. Our findings show that Romanian universities demonstrate sustainability under SDG5 through their institutional capacity to use either feminine majorities or a statistically detected pro-female voting propensity in order to construct optimally gendered management structures through vote only.

Keywords: gender parity; higher education; sustainable development; UN SDGs

1. Introduction

We start our research on the premise that there is a direct connection between the two notions: Sustainable development and gender equality (we use the definition of the concept as per the European Institute for Gender Equality, EIGE [1]). This connection has been confirmed by numerous studies that prove women play a positive role in maintaining and ensuring the sustainable development of the society and is also based on a new political approach that has been adopted worldwide since 1987, when the concept officially came into existence, becoming quasi axiomatic. Nowadays, the proponents of this approach are international organizations, governments, and public figures.

The 1987 approach, presented by its author Gro Harlem Brundtland, Prime Minister of Norway and President of the World Commission on Environment and Development (WCED) at the time, defined for the first time the concept of sustainable development in the report "Our Common Future" [2]. Based on this definition, the sustainable development index [3] was later introduced, grouping 21 indicators into eight categories under three pillars. The aforementioned approach claims that the three

pillars of sustainable development—economic, environmental, and social—are "relevant to discussions of gender equality" [4]. An increasing number of studies [5–10] also show that gender inequality generates costs that have a negative social impact and lead to environmental degradation. To verify these results, which are intuited based upon the existing political approach to the new social behavior, further research is required. As policy-makers already have established agendas to reduce what was defined as the "gender gap" (definition in [1]), an understanding of the state of matters could serve as a foundation for their success; moreover, such comprehension would serve to calibrate the efforts to achieve the objectives laid out in these agendas.

Of the three pillars, the social one, which refers to human well-being with an emphasis on educational opportunities and gender equality, is acknowledged as the most politically sensitive and, as a consequence, is the most difficult to address and manage.

Our study, guided by the ideas of the United Nations 2030 Agenda for Sustainable Development [11], is focused on analyzing gender aspects of a significant societal domain to promote evolved social behaviors, namely public universities. The geographical area of this study is Romania, which ensures a coherent framework of the economic, social, legal, and cultural context that public universities operate in. Moreover, the social status of persons associated with this professional area is highly regarded by the society; this fact offers a significant signal as to the social positioning of women in this field.

We begin our study by investigating the current state of gender parity (definition in [1]), as a first step towards gender equality of the academic staff in the Romanian universities, as well as understanding the configuration of its management structure. We assess whether there are any gender imbalances by analyzing data on the accession of women to executive positions, either via electoral processes or via direct appointment (en-suite of these electoral processes) for the last four-year mandate (2015–2019).

Based on the analysis of the collected data, our paper pursues two objectives: (1) We explore the formation and dissemination of executive power through the hierarchical pyramid, and (2) we identify the correlation between the gender structure of the staff and the propension to replicate this structure into senior management positions through electoral and direct appointment processes.

The research phases are as follows: (a) We identified all the legal elements that may influence the gender parity and are likely to generate a discriminatory approach in the academic staff structure. At the same time, we depicted the electoral mechanism that leads to the formation of collective management bodies and tenured senior management positions in universities; (b) we examined the gender ratio of the management structures resulting from a direct vote by the academic staff. The research included a quantitative analysis of the voter-voted relationship focusing on gender; (c) we completed the research on executive structures resulting from appointing, as opposed to election, with the same emphasis on gender; (d) we summarized the results by the category of executives (elected or appointed) using index correlations; and (e) we concluded on the gender positioning of the Romanian academia in relation to a sustainable approach under the United Nations' Sustainable Development Goal 5 (SDG5).

This study contributes to the existing literature in several ways. Firstly, we carried out a quantitative research on the gender parity positioning of the academic staff in Romanian universities and mapped the mechanisms of power as well as the setup of collective decision-making bodies (senate and faculty council). The starting point is a voting system involving an almost egalitarian feminine electorate and a legislative context that contains neither discriminatory nor gender-based regulations.

Secondly, we conducted an analysis of the way in which women de facto elect structures based on direct vote, with no interference of glass ceiling [12] circumstances.

Thirdly, we revealed through data correlation the reaction of senior managers to the staff's gender signals; it is a reaction reflected in the way the direct appointments of executives are made (data can be found in Section 4). We also discuss whether the introduction of gender quotas in the Romanian academia would possibly limit unsustainable gender-biased behaviors, given that similar initiatives in other European countries have generated mixed outcomes.

2. Sustainability and Gender: Literature Review

The sustainability—gender dyad has constantly influenced the development agenda since 1990. However, the transformation of gender-related goals into the Sustainable Development Goals (SDGs) and the creation of a plan that focuses on gender equality were achieved only after 2015, when the United Nations adopted the 17 SDGs, organized in 169 indicators for the main dimensions related with the sustainable development of one specific country [13]. This process was decisively marked by a political component, as part of the social pillar of the Brundtland domain triad set in 1987 [2].

Understanding the positioning of the gender approach as one of the determinant elements of sustainable development requires a brief review of the concepts in question. This analysis should also explain the political perspective that arises and leads to the establishment of certain objectives dictated by the behavioral model towards the distribution of power in society.

The basic reasoning that generates this approach is that sustainable development is based on the complete use of human resources, which implicitly means the maximum use of the planet's population of women.

It is noteworthy that the concept of sustainability was followed by that of sustainable development, and then by that of the politics of sustainable development, which finally involved the gender topic. As such, gender parity was introduced into the public agenda as a target of the 2030 Agenda for Sustainable Development. Many writings explain the evolution of sustainability and sustainable development in terms of concepts and practice. Of these, the works [14–16] for the first, respectively [17], and for the second category are most often quoted according to the citation indexes. The part devoted to the material aspects is usually predominant, while political and social aspects are not sufficiently addressed to explain the current state of matters.

The "materiality" of the discussion on sustainable development is marked by the initial association of the concept of sustainability with the management of forestry and agricultural production in Europe since the 17th and 18th centuries. These turned into the theoretical source for the ecological movement of the 1960s, including its related writings. The evolution of the ideas correlated to long-term development, which continued in 1972 with the classic report of the Rome Club [18].

For the gender–sustainability relationship, the framework adopted by Scoones [8] reveals itself as a bridge that partially explains the origin of the connection between politics and sustainable development.

The first part of this framework emphasizes the technical side elaborated by the economic theory focused on resource scarcity. Numerous economists, including Malthus and Marx, have discussed the imbalances related to economic growth and suggested a political solution. Within this economic approach, the evolution of ideas marks the concern for maintaining development within the boundaries of the biophysical and social balance [19] while understanding the geographically demarcated natural and social systems [20]. Even though concerns for important sectors, such as water, energy, and food, have begun to interconnect, political awareness as a determining factor has evolved from a relatively non-binding approach [21] to a clear political perspective. Political ecology, theorized in numerous papers [22], for example, has become a coherent trend of analysis with a clear political structure. It is worth noting a shift from the political analysis of the materiality of resources to an analysis that includes people in the category of resources, discussing a politics of people, which equally involves the politics of knowledge [23].

The entire process previously depicted, marked by political will and related actions in the governance of states and the management of international institutions, especially of those that gravitate around the United Nations (UN) system, has brought about the redefinition of benchmarks for the general discussion of resource scarcity. Essentially, it has been noted that all these primary benchmarks and their definitions, as well as the analytical benchmarks and the rest of the associated theories, are based on already configured frameworks by political criteria in the collective mind or general perception of the society.

The synthetic idea is that resources are "built" [24] as opposed to "given". Scoones also points out that, "In this view, scarcity is not a fixed feature related to the amount of a commodity and its price in a

global market but has to be understood politically in relation to historically specific patterns and forces of production, distribution, and consumption. Resources are always constructed; they are generated through social and political processes and produced by people in different places" [8].

The partial conclusion of this turning point in the discussion about the long-term material balances of the planet is that their analysis is influenced by a political context. More specifically, scarcity is essentially a problem of interpersonal relations, hence a political problem [25].

If the balance of resources is defined and managed politically because this equilibrium is defined by the relations between people, then all the categories and concepts related to population segmentation become relevant. Analysis in this field must include a concrete contextual definition at a given time [26], starting with geographical positioning, then the clarification of the cultural environment, and finally the identification of all structural characteristics of the population involved. By elaborating on a part of these structural elements, we can assert that "class, gender, age, ethnicity, and inherited histories of location in a globalized world all become relevant in understanding scarcity in context" [8]. Bringing into discussion the ideas and concepts related to ethics, morals, and social justice [27] is a logical step towards obtaining a socially desirable state that should encompass the desired material progress and equilibrium.

Once a step in the direction of establishing social justice has been taken, the social pillar acquires a pivotal position in the management of societal resources by virtue of rights derived from the ideas of social justice [28].

The social perspective is also preserved in terms of resource distribution, which is done according to an arrangement primarily marked by social considerations before observing any technical or economic criteria [29]. Also, the social perspective should translate into a new way of seeking and promoting technical innovation and new technologies. [30]. Consequently, the innovations and technologies that are part of the chosen social approach will largely be selected [31].

From this perspective, we find that in real life, the options for social and material development are influenced by the existing cultural context, as well as by the direction in which the current social culture is evolving. A series of transnational social movements with global trends [32], which impose cultural characteristics that have a positive impact in relation to sustainable development, are identified and discussed [29,33,34] The associated concept is citizen-led transformation, which induces a multitude of interaction forms, within the private and the public sector, by which community-generated initiatives are promoted [35,36].

Within these transformations, the structural characteristics of the population are reconsidered and re-valued. A significant position in this category of characteristics is held by gender. Starting from the community level and/or from the level of public institutions, which play a decisive role in supporting new development approaches, the gender structure is analyzed and molded as an implementation tool under the new paradigm of societal development. As such, allowing the aforementioned binding elements to step back into the background, the sustainability–gender connection becomes significant, especially as political direction of the next decade according to the 2030 Agenda [37].

As for the case of other structural characteristics of a population in a given geographical area—usually a state or a community of states with a similar set of foundations—the basic political idea is to accept that particular characteristic and to act towards its positive reflection in the political and social behavior. Acceptance means eliminating any form of negative discrimination while positive reflection is proportionate representation; the 2030 associated objective is gender equality.

The political objectives evolving from the sustainability–gender relationship have been justified not only based on ideas of social justice but also on the results of studies focusing on the impact of women in relation to the environment, primarily through natural resource management [38] or the economy at large [39]. More specifically, this impact on the economy is discussed by Goldin [39] through the prism of the gender gap.

As for the parity objective, it is desired that the gender gap [40] fades as a sign of the establishment of a fair society and as a prerequisite to the optimal use of human resources at the societal level for those

structures, preferably increasingly numerous, where the gender parity objective has been factored in and related policies are being implemented.

It is also worth noting that, in practice, as a sign of the application of the gender policy, various programs that aim at achieving gender equality in order to build a more equitable global society have surpassed the pre-findings from studies dedicated to the sustainability–gender linkage. The UN system, the World Bank, the European Institute for Gender Equality, and other international organizations actively support and implement internal programs that aim at achieving gender parity.

The consistency and intensity of this approach, essentially political in nature, is justified more thoroughly by studies on the social pillar and mainly on women's political behavior. These studies have created the theoretical basis for the gender gap approach, first in politics and then in economics. Subsequently, the same material has contributed to guiding discussions on the necessity for global gender equality as a sine qua non condition for sustainability.

2.1. Gender Parity as a Political Tool for Sustainability

The reconfiguration of the social structures as a consequence of the adoption by the UN of the 17 Sustainable Development Goals [37], especially SDG5 on gender equality, has been materialized in plans and actions. The latter are aimed at facilitating women's access to executive positions, namely decision-making positions, particularly in public organizations. This entails removing formal and informal barriers, as the "glass ceiling" [12,41], and encouraging what could be considered "positive" discrimination. Public organizations have been given priority in the implementation of these actions because of their strict regulatory context and their major social impact.

In the logic of the programmatic consolidation of the social pillar, the first to be targeted by gender policies are the institutions most plainly impacted by the principle of representation, ensuing from voting. They include parliament-like institutions at the state level, as well as council-type institutions at the local level.

At a later stage, the plans for gender objective SDG5 are customized for different sectors of activity and different types of institutions. However, we see that the concern for public organizations with social impact is maintained. The latter includes the education sector, with a special role for universities. An increasing number of countries show a preoccupation in shaping the gender structure within universities as a necessary step for building social equity.

Understanding the factual status of the universities and the perspective envisaged for them regarding that matter translates into studying the political "coverage" around them. The latter would designate how women are involved in modern political systems, including the way parity objectives in these systems are put into practice via political willpower.

Although famous women have left their mark in world history for several thousand years from positions of executive power, women's voting rights have only been instituted over the last 130 years. The first country to grant women the right to vote was New Zealand in 1893, whereas the United States did so only in 1920. Among European countries, the United Kingdom granted women the right to vote in 1918, followed by Germany, the Netherlands, Poland, and Austria in 1920. France did the same, but in 1944, Japan in 1947, Greece in 1952, Switzerland in 1971, and Portugal in 1976. In Romania, universal suffrage was introduced in 1938, but it has only been operational since 1948.

Despite the existence of universal suffrage, the representation of women in parliaments and other political bodies resulting from the electoral process was disproportionate, with high deviations compared to the proportion of voters. In many countries, the first women parliamentarians appeared before the introduction of the universal vote; nevertheless, even if the proportion of women has grown steadily, it is still considered unsatisfactory. These gender inequalities, first in the political system and second in other social systems, undermine the quality of deliberation, representation, and legitimacy in the democratic process [42].

The analysis of underrepresentation of women in institutions resulting from a universal vote shows that the political behavior of women differs from that of men [43] in relation to many criteria,

such as voting involvement [44], non-electoral participation [45], and the understanding of the political process related to voting [46]. It has been found that knowledge depends on the available resources that can be personally allocated by the voter, which disadvantages women [47].

In summary, it can be inferred that, starting from an initial difference as to the resources available—a difference generated by a historical context—women are disadvantaged in terms of involvement in voting-based political processes. This fact, judged within the paradigm presented above, has a negative effect on the legitimacy of their decisions and finally on the sustainable development of the society.

Considering that the process of achieving gender parity is unsatisfactory, in the last two decades, a sharper reforming political approach has been crystallized. In the EU, this approach is explained in a note [48] issued by the European Parliament: "Given the slow speed by which the number of women in politics has been growing, there have been increased calls for more efficient methods to address the problem of women's under-representation and reach a gender balance in political institutions. Electoral gender quotas represent one such mechanism . . . ". In the same document is also shown that "legislated quotas are implemented in 8 (eight) countries and party quotas in 14 (additional) countries" and that "some gender quotas have resulted in major leaps in women's representation, while others had led to almost no change. In general, the note reveals a mixed picture in Europe when it comes to women's representation" [48]. Legislated quotas are considered to have had a significant impact in Slovenia, Portugal, and France. Finland has over 40% female representation in politics without a quota usage; in a similar situation, we find Sweden, which uses party quotas though. The same note [48] clarifies that, "Legal quotas and party quotas may target any of the three stages in the candidate selection process: aspirants, candidates and elected representatives".

Currently, more than 130 countries use this system [49]. Given the way it is imposed, the interest in its origins and forms of implementation, especially its effects, becomes natural [50]. The effects of the introduction of gender quotas seem to incur more complicated effects than just increasing the number of elected women [51]. The results are studied in terms of the way in which women's careers are affected, starting with the recruitment stage [52], which requires discussing access to professions and organizations that have traditionally been dominated by men.

On the other hand, changes in women's participatory behavior have been studied, both at the level of involvement and at the decision-making level, after being assigned a representation mandate. Studies conducted in Latin America, where the introduction of gender quotas in politics has been extremely abrupt, show that the participation of women in electoral processes has not undergone significant changes [53]. Similar findings related to women's interest in voting-related issues or campaigns have also been reached in a set of other states [42].

As for the effects of this political approach, in our study, the impact on universities is of interest. Relevant publications elucidate the success in obtaining gender parity in Austria [54] and Sweden [55]. We will further discuss in the next section these countries' approach related to academia.

A partial conclusion would be that the enrolment of an institution in sustainable development trendsetters can be achieved by addressing *all* the hierarchical stages that could be affected by the gender gap. Effort must be focused not only on changing the general cultural background and the specific context of the institution but also on the overall operational process. It starts with the recruitment stage and ends with how the top executives are selected.

2.2. Targeting Gender Parity in Academia Worldwide

The reform of universities in the direction of decreasing the gender gap in order to achieve gender parity materialized in different forms in numerous countries, where special laws that promote gender equality in academia dictate a concrete approach [56,57]. However, underrepresentation remains a problem in research and academia. In Europe, women account for 46% of Ph.D. graduates, 37% of associate professors, and a mere 20% of full professors [58]. Studies point to a multitude of reasons for the underrepresentation, but, in our opinion, a starting point consists in the predominantly male structure of selection committees and evaluation panels. Consequently, "a number of countries

have introduced quotas requiring the presence of at least 40% of women (and men) in all scientific committees" [59]. Finland, for example, introduced academic gender quotas in 1995. Spain adopted academic gender quotas in 2007 [60], and in 2014, France introduced gender quotas for all scientific communities [61].

The case of Austrian academia is considered to be a success of gender quotas usage. Austrian quota regulation came into effect in 2009, meaning that initially at least 40% of the members of university bodies must be women, and at least 50%, after 2015. Wroblewsky explains: "Law formulates sanctions for failure to comply. In the event that a university body does not meet the required quota for female members . . . the body is deemed to be incorrectly constituted, cannot make decisions, and must be reconstituted" [54].

Another successful approach in obtaining gender parity is the Swedish academia, where Peterson [55] elucidates that the gender equality in the universities' management has been addressed with a gender mix policy. Mentioning a Swedish study [62], Peterson underlines the fact that: "The relatively high proportion of female vice-chancellors in Sweden is probably a result of political pressure in the form of goals and policies. In Sweden, vice-chancellors at government funded higher education institutions are appointed by the government for a six-year period, a quite unusual process compared with other countries" [55].

Other relevant studies addressing gender equality in academia have described national depictions of the matter using a comparative approach. A British–German comparison [63] regarding the vice-rectors' situation in these countries pinpoint that "women are in significant minority in senior academic positions". Another study [64], which aligns in comparison Turkish and New Zealand universities, discusses organizational barriers. However, both studies focus on the top management positions, without a discussion about elected collective bodies.

What is striking are the cases where even sharp legislative constraints are considered insufficient to obtain targeted quantitative representation. Therefore, in order to attain the desired parity, acts of positive discrimination are resorted to.

Australia presents a range of interesting examples related to gender equality policies, without explicitly using quotas. An interesting case [65] has generated polemics in academia, when the Australian government promoted an "Affirmative Action (Equal Employment Opportunity for Women) Act" in 1986 (replaced by "Equal Opportunity for Women in the Workplace Act 1999") and went towards modelling universities' management using action plans that stated clear objectives in order to attain gender parity and gender equality [66]. Although it enacted the universal vote for women in 1902 and has had gender equality legislation in place for three decades now, in 2014, women constituted only 44% of the academic staff and held 31% of senior positions [66], while in 2018, only 27% of full professors and 32% of vice-rectors in public universities were women. When it comes to science, technology, engineering, and mathematics (STEM institutions), women's academic employment in these disciplines at the senior level is particularly low at 17%, according to an Australian study [67].

Even in Europe there is significant political pressure for shaping some university fields by gender quotas. Carlos Moedas, the EU commissioner for Research, Science, and Innovation from 2014 to present, calls for gender quotas in university management [68]. He also states that European Parliament institutions should introduce "allocations for female academics at some point". In favor of this intervention, Moedas brings up arguments based on individual cases of famous women and on studies [55,69], referring to negative developments in certain fields considered "fashionable" and essential for sustainable development. Additionally, summarizing theories related to negative developments, when a position is labelled "feminine", it does not necessarily mean that the women who occupy it are empowered but instead that the position has devalued in status and power as per [70,71].

As for the criteria for representation in political institutions, the legal obligations in place are accompanied by overall pressure for actions towards reaching gender parity. For example, in [63], the authors describe the governmental mechanism used to obtain the desired figures in universities:

"Higher education leadership in Germany is strongly influenced by state policies and because German higher education institutions still receive about 80% of their budget from the state the responsible Ministry can exert a certain amount of direct pressure". On the one hand, the tendency to use studies to demonstrate that this particular approach is moral and economically efficient is emphasized; on the other hand, even without proving indubitably positive effects, the number of gender regulations is on the rise. Their coverage area spreads from the public to the private sector; in other words, the type of representation quota imposed in public universities, for example, is then to be found on the boards of some private companies. A failure to comply with these quotas prompts penalties from the state.

The current situation regarding women's representation shows the most positive cases in the Western democracies, but even here, gender gaps are still to be found [40]. Leading democracies, such as the USA, Germany, and France, face consistent gender gaps in practice and unimpeded approaches are still dominant, even though gender regulations continue to rise. More important is, in our opinion, the observation that gender parity could be rapidly implemented in practice from the top to bottom level in the case of academic management structures, via ministerial or legislative actions. However, that may regrettably affect the exercise of a democratic vote of the entire teaching staff, with unpredictable consequences.

We note that from the point of view of the 2030 Agenda for Sustainable Development, as much as the universities play a core role in society, they represent an area of secondary interest, being slightly overtaken by other institutions with immediate political impact. However, universities represent an area where both electoral-type political models and knowledge-based hierarchical models coexist. Consequently, in Sections 3 and 4, we observe and assess the ratio of women in higher education accessing executive positions via electoral processes in Romanian universities. For our study, benchmarks are then utilized: Both vertically, within the structures of the society, and horizontally, between Romania and other countries.

3. Data Collection and Methods

The gender situation (M/F balance) in the Romanian universities was analyzed in terms of the quantitative aspects reflected by the number of teaching staff, their gender structure, and their representation in the executive functions and collective decision-making bodies, namely the senate and the faculty councils. These positions are granted as the result of electoral processes.

We also considered the staff appointed to executive functions (vice-rector, dean, and vice-dean) and studied the correlation between the two ways of accessing such functions, in terms of gender.

The assessment was based on data collected between February and July 2019. We describe the current situation resulting from elections in the Romanian universities held under the stipulations of the Education Law No. 1/2011. This vote took place in the interval 2015–2016 and its results are valid for the current mandate (2015–2019) with slight adjustments reflected in partial elections caused by local circumstances, which affected a limited number of positions. The voters are the teachers and the elected representatives of the students; auxiliary non-tenured teaching staff and technical-administrative staff do not have voting rights for the academic executive structures.

The quantitative database was formed by counting the number of members in significant units and at particular levels in the organizational hierarchy of the university: Rectorate, faculties, and departments. The same counting was completed for senate and faculty councils. We considered two genders and everyone's affiliation thereto was determined based on their first name. We collected the data published on the universities' websites under the stipulations of a law sustaining transparency in state-owned organizations. We obtained further clarification from relevant staff during phone interviews. Since our research covered more than 22,000 teaching staff, any incongruencies that may have appeared on the figures published on the universities' websites fall under the statistical thresholds' risks.

In order to collect quantitative data, we chose a census approach, meaning that we processed all data on Romanian state-owned universities (except military academies), without sampling. Hence, we

conducted in-depth research, leading to the formation of a complete quantitative gender picture of every university organizational chart in the designated area.

This group comprised 47 universities that meet the current Romanian quality standards, i.e., that are accredited to function in the Romanian higher education system (data shown in Appendix A).

The 47 universities were clustered in our study into six broad groups based on their profile, which reflects the general accepted partitioning by function:

1. Comprehensive (non-specialized) universities—17 units;
2. Humanities (social sciences, law, business) universities—6 units;
3. Polytechnic universities—6 units;
4. Universities of agronomy, forestry, and veterinary medicine—4 units;
5. Medical universities—5 units; and
6. Universities of arts—9 units.

This assemblage was used in order to facilitate comparisons between entities with close characteristics imposed by their profile, marked by an individual history determined by social and/or organizational needs. We note that the universities that belong to the "comprehensive" group contain faculties that are included in all the other five categories but are not differentiated as a specialized university (Table 1).

Table 1. Data collection per staff functions and university groups.

University Categories	Students	Teaching Staff		Rector (R)	Vice-Rector (VR)		Senators (S)		Dean (D)		Vice-Dean (VD)		Faculty Council (FC) Member		Department Director (DD)	
	Total	Total	Female (F)	Male (M)	Total	(F)	Total	(F)	Total	(F)	Total	(F)	Total	(F)	Total	(F)
Total	450,431	22,431	11,116	44	201	77	1939	722	350	113	711	317	4916	2114	927	380
Comprehensive	152,200	6702	3440	16	71	35	721	307	150	51	245	113	1761	848	316	146
Humanities	132,400	5191	2681	6	37	11	356	121	82	22	195	89	1208	510	226	92
Polytechnics	85,631	3975	1462	6	29	7	322	83	57	8	154	48	1050	306	161	35
Agronomy	27,650	1155	618	4	19	3	109	33	22	7	56	36	281	131	58	23
Medicine	39,700	4041	2323	5	26	11	220	90	18	13	47	26	398	206	94	45
Art	10,450	1367	592	7	19	10	211	88	21	12	14	5	218	113	72	39
F/Total (%)	x	x	49.56	x	x	38.31	x	37.24	x	32.29	x	44.59	x	43.00	x	40.99

Data was collected with the aim of dividing the tenure teaching staff (as defined by L1/2011 with subsequent amendments) into two gender groups. The study focused on the category of main executive roles (rector, vice-rectors, deans, vice-deans, and department directors) as well as the category of collective managerial-elected bodies (senate and faculty councils). Doctoral schools were not included due to the non-voting status of the doctorate candidates.

Based on the figures obtained from the census, we calculated a series of gender shares, for each university, as a ratio of the number of women to the total number of one defined organizational category of teaching staff, i.e., faculty council members, senators, or deans. The ratios have the general format $\frac{x}{y}$, where x is the number of women and y is the total staff for each organizational category with significance in our study, as defined below.

The significant organizational categories were all the teaching staff (labelled with the acronym G); the direct elected executives and collective bodies: Rectors (acronym R), department directors (acronym DD), respectively senate members (acronym S), and faculty council members (acronym FC); as well as appointed executives: Vice-rectors (acronym VR), deans (acronym D), and vice-deans (acronym VD).

Although, initially, an attempt was made to operate with the same type of indicators that international organizations operate with (that is, a ratio of women to men in a defined category), for Romanian universities, the number of mathematically inoperable situations (null denominators or indeterminate ratios) excluded this option.

In order to reflect the gender structure of an organizational category of personnel according to the management position they occupy, i.e., senate member, vice-rector, vice dean etc., we used a gender index (Ix) that represents the unweighted average of the women's share in each of the mentioned substructures. We calculated this average for each of the six groups of universities, using the formula:

$$Ix(achr) = \frac{\sum_i^n (x/y)_i}{n}, \quad (1)$$

where:

- (achr) is replaced by the acronym of every category, i.e., G for general or DD for department directors;
- $\frac{x}{y}$ is the ratio of women for each of the categories identified by the acronym; and
- n is the number of universities considered in every group (n = 47 for all the universities, and n takes values of 17, 6, 6, 4, 5, and 9, respectively, for the six groups stated above (see Table 1).

In order to statistically highlight a series of correlations, we further calculated the average, median, and standard deviations for all the $\frac{x}{y}$ ratios envisaged in relation to the executive and decision-making functions, for the total of the 47 universities, and for each of the 6 groups. We subsequently used the correlation coefficients (Pearson) to explain how the links between the different categories of personnel (G, S, FC, DD, etc.) influence the process of establishing the management structures. The coefficients were calculated for pairs of indexes belonging to the same group of universities. The results are shown in Appendix D.

From the appendices, we selected in the tables (Tables 2–8) only the correlations that were causally relevant, in relation to the characteristics of the electoral process. Supplementary data is, however, presented in full via the appendices.

Table 2. Data on Department Director index (IxDD) correlated with the General index (IxG) per total and per groups of universities.

	IxG	DD	DDf	IxDD	Correl $\frac{x}{y}$G → $\frac{x}{y}$DD	Pro M(+)/F(−)
All categories	0.492	927	380	0.447	0.384	0.045
Comprehensive	0.514	316	146	0.483	0.524	0.031
Humanities	0.509	226	92	0.416	0.238	0.093
Polytechnics	0.382	154	34	0.203	−0.894	0.179
Agronomy	0.521	65	24	0.378	0.925	0.143
Medicine	0.571	94	45	0.487	0.221	0.084
Arts	0.454	72	39	0.574	0.254	−0.120

Note. The acronyms used are: Department Director female (DDf); the correlation of the share of women in the total staff with the share of women in the total DD (Correl $\frac{x}{y}$G → $\frac{x}{y}$DD); ProM(+)/F(−) is the difference between the indexes IxG and IxDD.

Table 3. Data on IxS correlated with IxG per total and per groups of universities.

	IxG	S	Sf	IxS	Correl $\frac{x}{y}$G → $\frac{x}{y}$S	ProM(+)/F(−)
All Categories	0.492	1939	722	0.390	0.568	0.102
Comprehensive	0.514	721	307	0.444	0.327	0.070
Humanities	0.509	356	121	0.358	0.303	0.151
Polytechnics	0.382	322	83	0.255	−0.220	0.127
Agronomy	0.521	109	33	0.293	0.585	0.228
Medicine	0.571	220	90	0.416	−0.581	0.155
Arts	0.454	211	88	0.427	0.943	0.027

Table 4. Data on IxFC correlated with IxG per total and per groups of universities.

	IxG	FC	FCf	IxFC	Correl $\frac{x}{y}$G → $\frac{x}{y}$FC	ProM(+)/F(−)
All categories	0.492	4916	2114	0.468	0.681	0.024
Comprehensive	0.514	1761	848	0.488	0.568	0.026
Humanities	0.509	1208	510	0.458	0.532	0.051
Polytechnics	0.382	1050	306	0.298	0.490	0.084
Agronomy	0.521	281	131	0.440	0.918	0.081
Medicine	0.571	398	206	0.552	−0.534	0.019
Arts	0.454	218	113	0.528	0.938	−0.074

Table 5. Data on IxVR correlated with IxS per total and per groups of universities.

	IxS	VR	VRf	IxVR	Correl $\frac{x}{y}$S → $\frac{x}{y}$VR	ProM(+)/F(−)
All categories	0.390	201	77	0.413	0.331	−0.023
Comprehensive	0.444	71	35	0.525	0.013	−0.081
Humanities	0.358	37	11	0.325	0.430	0.033
Polytechnics	0.255	29	7	0.228	0.679	0.027
Agronomy	0.293	19	3	0.167	−0.088	0.126
Medicine	0.416	26	11	0.397	0.761	0.019
Arts	0.427	19	10	0.500	−0.018	−0.073

Table 6. Data on IxD correlated with IxFC per total and per groups of universities.

	IxFC	D	Df	IxD	Correl $\frac{x}{y}$FC →$\frac{x}{y}$D	ProM(+)/F(−)
All categories	0.468	350	113	0.409	0.530	0.059
Comprehensive	0.488	150	51	0.362	−0.198	0.126
Humanities	0.458	82	22	0.352	0.885	0.106
Polytechnics	0.298	57	8	0.112	0.172	0.186
Agronomy	0.440	22	7	0.338	−0.876	0.102
Medicine	0.552	18	13	0.717	0.499	−0.165
Arts	0.528	21	12	0.593	0.533	−0.065

Table 7. Data on IxVD correlated with IxFC per total and per groups of universities.

1st Correlation	IxFC	VD	VDf	IxVD	Correl $\frac{x}{y}$FC →$\frac{x}{y}$VD	ProM(+)/F(−)
All categories	0.468	711	317	0.474	0.282	−0.006
Comprehensive	0.488	245	113	0.541	0.304	−0.053
Humanities	0.458	195	89	0.443	0.509	0.015
Polytechnics	0.298	154	48	0.342	0.592	−0.044
Agronomy	0.440	56	36	0.602	0.918	−0.162
Medicine	0.552	47	26	0.512	0.829	0.040
Arts	0.528	14	5	0.474	x	0.054

Table 8. Data on IxVD correlated with IxD per total and per groups of universities.

2nd Correlation	IxD	VD	VDf	IxVD	Correl $\frac{x}{y}$D →$\frac{x}{y}$VD	ProM(+)/F(−)
All categories	0.409	711	317	0.474	−0.133	−0.065
Comprehensive	0.362	245	113	0.541	−0.203	−0.179
Humanities	0.352	195	89	0.443	0.139	−0.091
Polytechnics	0.112	154	48	0.342	−0.212	−0.230
Agronomy	0.338	56	36	0.602	−0.615	−0.264
Medicine	0.717	47	26	0.512	−0.510	0.205
Arts	0.593	14	5	0.474	x	0.119

The values for the correlation coefficient are shown in column 6 of each table, using the notation Correl $\frac{x}{y}$A→ $\frac{x}{y}$B (where A and B are the categories of teachers mentioned above: G, S, FC, DD etc.).

Apart from the correlation coefficient, for the relevant causalities, we calculated the difference between the indexes of the observed *cause-factor* and *results* of the electoral process or the process of appointing the executives. For example, in the senate configuration (S), the essential cause-factor is the configuration of the general staff structure (G), so the difference will be calculated between the general index (IxG) and the specific index for the senate (IxS); this difference is symbolized with "ProM (+)/F(−)" and has a meaning in the pro-feminine or pro-masculine inclination of the vote results. The arithmetical sign plus (+) indicates a pro-male result, while the minus (−) shows a pro-female result of the process. The difference illustrates the behavioral predisposition of the voters and of the decision makers, in the case of the appointed executives. The assessments we made regarding the gender preference of the teaching staff are associated with the "cross vote" reasoning. Essentially, this goes as follows: If we take a statistical population divided into two categories A and B, each bearing a share ratio of x and y (where x is larger than y and x + y = 100%), and after the vote to elect representatives, the result presents a structure x1 and y1, where x1 + y1 = 100% and x is higher than x1 (as a percentage), then it means that those in category A voted B, in a higher proportion than the other way around.

As already stated, after calculating all the indexes noted Ix, for each category of personnel and group of universities, we correlated them using the Pearson coefficients. We used the results to statistically sustain the causal links identified through the qualitative analysis of both the electoral issued positions (R, DD, S, FC) and of the appointed positions (VR, D, and VD).

The results of the analysis of the gender configurations were further associated with the ranking of the Romanian universities. We compared this ranking with a gender positioning system designed by us for the main categories of our study, as previously defined. This gender positioning system relays on the gender configuration of the teaching staff and the gender configuration of the senate, as the main rule-makers, as well as the gender configuration of the department directors, as the main operational managers.

The study of the mentioned configurations involved an analysis of the economic and legal context in correlation to the management of the personnel in Romanian universities. Elements of an economic nature, such as salaries or other similar conditions, which could induce a gender imbalance, were sought. This line of investigation showed that in 2019, there was no legal element that could favor the emergence of an income gap between teachers due to the gender factor. Teachers' regular income (resulting from the basic didactic standard hours) is regulated by a unique payroll law (L153/2017), which stipulates fixed rates for salaries, depending on seniority and didactic grade, and/or on the executive position held in the case of *elected* executives (rector and department director) and *appointed* executives (by elected direct supervisors, that is, vice-rectors, deans, and vice-deans).

Also, by law, there are no discriminatory elements that we could identify as to the access to women in universities as students or as teachers. In the same demarche of a contextual characterization and in order to draw a clearer picture of the gender positioning of the Romanian universities, we noted that the She Figures Report 2018 [72] offers the following data:

1. Romania has a glass ceiling index of 1.04 in 2016 (1st in the European Union, while the EU28 median index was 1.64); and
2. Romania has the highest proportion of women in academic staff for grades A and B out of 34 states (EU28 plus six more: Bosnia and Herzegovina, Iceland, Israel, Norway, Switzerland, and Turkey).

These elements show that for the female voters, there was no impediment in electing the solution considered the best, given the fact that the vote was equal and undisclosed, and for the aspiring candidates, there is no formal conditionality related to academic hierarchy or seniority. Consequently, in Romania, we found no propensity for discussions about gender quota regulations in either the executive or collective decision-making bodies, nor in scientific structures for the academic settings.

We note as well that the context analysis did not identify elements, formal (law, rules, and regulations) or informal (i.e., glass ceiling) that would impact, positively or negatively, the gender representation in Romanian universities. Therefore, a preliminary conclusion of this introductory context analysis would be that there are no elements of a legal nature that should induce gender discrimination in generating power configurations for the Romanian public universities. No case of universities that have formally adopted gender discriminatory elements was identified in our research, nor those having any informal elements operating as a glass ceiling have been acknowledged. We also note that the legal provisions of the Education Law No. 1/2011 may be slightly altered by regulatory elements specific to each university, a possibility stipulated by the aforesaid law, on the condition that these elements are kept and must function within the existing legal framework.

4. Research Results

4.1. Findings on the Gender Incidence in the Management Structures Resulting from Direct Voting (Rector, Department Directors, Senate Members, Faculty Council Members)

4.1.1. Gender Propensity in Electing the Rector (R)

Before noting the results of the direct voting scheme for each university structure, by category, and the aggregate of all public universities in Romania, we observe that the general ratio of women is approximately half of the total number of teachers (49.6%). By group, a higher proportion is attained by comprehensive, humanities, agronomic, and medical universities (these groups constitute 32 out of the 47 universities), as shown in Table 1 and Appendix A. Otherwise, the number of universities with a feminine majority of the teaching staff is 26 out of 47 universities (55.3%).

The direct and undisclosed character of the vote is considered the most democratic and constitutes the procedure used in the election of the rector. For the supreme executive position in universities, the election is preceded by a referendum, while an alternative procedure—the election of the rector by contest—can also be opted for. In the 2015–2016 elections, which set the current mandate in the Romanian academia, only one (one) university opted for the contest method of selecting a rector; the remaining 46 universities used the direct vote. This gives a clear indication as far as the preferred rector selection procedure goes.

All the tenured teachers, as well as the student representatives who are members of the faculty councils and senate, participate in the direct election of the rector. We estimate (based on the legal provisions of the construction of senates and faculty councils, where students represent 25% of the members) that the number of students voting for the rector each time embodies 5–10% of the total number of voters, depending on the administrative partition of each university, by faculties. These student representatives ensue themselves from a voting process, where only students participate. No gender-related element that would alter the secret character of the vote could be identified.

Election rules regarding representativeness are controversial as principle in many universities' charters that we studied and compared. The rules of staff's representation in different collective bodies are decided upon by each university. It is interesting to emphasize that all universities in our census grant *only* teaching staff voting rights for the election of managers (heads of departments and rectors) and executive structures (councils and senates). The technical/administrative staff and the auxiliary teaching staff are excluded. To compare, until 2011, the previous education law stipulated that the rector should be elected only by the senators, who were elected themselves out of and by the members of the faculty councils.

In Romania, as of August 2019, out of 47 rectors, only 3 are women, or 6.4% of the total. Until 2017, there were 4 women rectors, or 8.5%, but one of them was removed due to faulty management, a decision sustained by a court verdict in 2019. In comparison, the EUA (European University Association) results show that in the 47 member countries, 12% of all rectors are women. According to EU data [72], in countriessuch as Italy, Turkey, and Czech Republic, for the same indicatorwe found smaller percentages than Romania's.

From the collected data, we note that, out of the 44 Romanian universities that have male rectors, 24 universities (54.5% of the total of 44) hold a women majority of voters. From the three remaining universities, one university has a men majority; the others present a women majority. The situation is depicted in Figure 1.

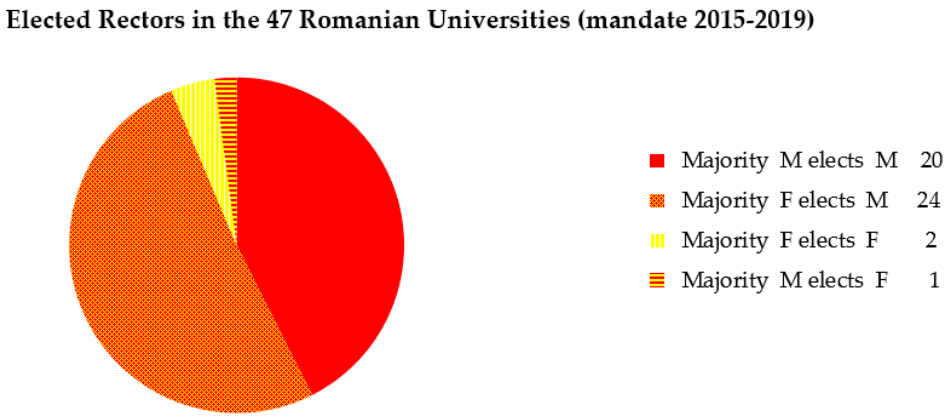

Figure 1. Gender propension for the elected rectors in the 47 Romanian universities (mandate 2015–2019).

The results regarding the rector's election offer an extremely unfavorable gender image, which contrasts with the elements mentioned in [72], with the values of type "F/Total (%)" in Table 1, as well as with the calculated indexes of type: general index (IxG), faculty council index (IxFC), and department directors index (IxDD). Considering the phases of the electoral process for which the European Parliament proposes gender quotas [48], we investigated the possible elements that may have blocked the access of women to the candidacy for rector, the transformation of a possible intention into candidacy, or the free vote. Consequently, we affirm that we did not identify statistically relevant elements that would explain the results, given the positive gender situation regarding the academic grades A and B and the structural barriers [72]. The legal elements and related electoral university regulations promote the free option and the exercise of a democratic vote for all teaching staff. However, it is obvious that further future research is needed to explain these results.

4.1.2. Gender Propensity in Electing the Department Directors (DD).

The department directors are elected by direct and secret vote as well, but with the participation of the teaching staff only. In the case of these executives, problems related to the application of the principle of representativeness are non-existent. It can be considered that, by the nature of the department's structure and its reduced size, the election of a person is completely transparent and enjoys full representativeness within this structure.

On the other hand, in Romanian universities, the position of the department director is significant because, according to Education Law No. 1/2011, the holder has a decisive role in the management of the department's financial and human resources. The status of the directors' position is given by the voters' unmediated connection with the current decisions of the individual whom they have chosen as the direct manager. Given this type of direct interaction, the vote expresses both the merit-based option and the gender attitude.

Taking this entire context into consideration, the gender situation of heads of departments is shown in the annexed tables (Appendix A for absolute values, Appendices B and C for the gender ratios for each university and per group of universities, and Appendix D for statistical values and correlations across groups of universities).

Based on the collected data, Table 2 was extracted in reference to the relevant data for the department directors (DDs). Their (gender) distribution into the groups of universities defined above is as follows:

We have calculated the index for the department director (DD) category, IxDD, with the abbreviations formed as previously explained and further detailed below.

- IxDD $= \frac{\sum_i^n (DDf/DD)_i}{n}$ as the average of the (DDf) women department directors' share in the total department directors (DD), calculated for each university, where n has the value specific for each

group of universities: n = 47 (for all) and n = 17, 6, 6, 4, 5, and 9, respectively, for the six groups stated above.

- IxG = $\frac{\sum_i^n (Gf/G)_i}{n}$ as the average of women teachers' (Gf) share in the total teaching staff (G), calculated for each university, where n has the specific value for each group of universities, as defined.
- Correl $\frac{x}{y}$G → $\frac{x}{y}$DD for every group of universities is the correlation of the share of women in the total staff with the share of women (DDf) in the total DD, where the shares were calculated for each university.
- DD is the (absolute) number of department directors (in Table 1, the number is for every group of universities).
- DDf is the number of women as department directors (in Table 1, the number is for every group of universities).
- ProM(+)/F(−) is the difference between the two indexes (IxG and IxDD), the structure G being considered as a causal factor of the election result.

All further abbreviations are formed similarly, as well as correlations by function/group/category.

From the data in Table 2, we observe that the specific IxDD indexes have somewhat lower values than the general IxG indexes. For all universities, IxG = 0.492 and IxDD = 0.447, which leads us to affirm, using the statistical interpretation of these averages, that the gender DD footprint is very close to the G gender image. From that, we can assert that the female majorities have a slight pro-male inclination when voting for this position. In fact, the female majorities dissolve as representation at the department directors' level, except for the group of arts universities, where women are a minority reflected as a majority for this position.

As the value of the correlation coefficient (penultimate column) is generally low, we conclude, in conjunction with the differences shown in the last column, that an attitude that might be interpreted as being gender biased for this type of vote cannot be statistically sustained. A poor correlation means that in a group, a women majority did not consider it useful to take advantage of this gender status by voting, and each university elected an internal structure without indubitable connection with its general gender structure.

We note two exceptions: The agronomy and polytechnics university groups, which show a high positive and high negative correlation coefficient, respectively. The negative correlation infers that a gender configuration favorable to women has elected their worst representation, meaning that a large majority generates the highest pro-male difference. On the other hand, the high positive coefficient shows that the election results follow a similar pattern of representation of the basic gender structure of the voters. In other words, the proportion of female department directors follows that of the voters.

4.1.3. Gender Propensity in Electing the Senators (S)

According to the education law, the senate is the supreme decision-making body of a university. Theoretically, the senate can control the activity of the executives and, in extremis, can remove the rector in a number of situations (the decision must then be validated by the ministry of education).

Teaching senators represent a maximum 75% of the number of senators and they are elected by direct and secret vote from among all the university teachers. Each university decides on the numerical size of its own senate. The law stipulates that the senators' election process must respect the principle of representativeness for each component entity of the university. Considering these elements, it would be expected that the gender representation in senates should follow the gender structure of the university. However, in Romania, this logical link between the general structure and senates' structure is influenced by the (poor) quality of the senates' current activity, which possibly diminishes the importance of their role in the voters' perception. This fact is marked by a lower participation rate in the vote for senate members compared to that for the faculty executives.

The senators elect a president of the senate from among its members who are teachers. S/he can have an influential role, insofar as s/he can generate legal regulations and/or promote the decisions of the board of directors through their vote. Usually, given the fact that many senators are executives appointed by the rector, the senate is a regulatory body de facto subordinated to the rector. This caveat on the power distribution is independent of the gender factor; for our case study, of the 47 senate presidents, 6 are women, which is 12.8% of the total, with an associated gender ratio (Sf/S) of 37.2% for all universities, meaning 722 women senators in 1939 senators. Only 3 women presidents of senate were elected by women majorities, notwithstanding that women have held majorities in 11 senates.

The results of the latest elections (held in Romania between 2015 and 2016 for the current four-year mandate) for university senates are synthesized in Table 3, keeping the same method for grouping universities and the notations as detailed above.

The data in Table 3 synthesizes for the senator category a generalized feminine underrepresentation for all groups of universities and in total. The differences between the general-type indexes and those of the senate show the highest deviations in the agronomy, medicine, and humanities groups, despite the fact that IxGs illustrates feminine majorities. The art universities present very small differences.

The value of the correlation coefficient between IxG and IxS, is closer to 1 for the arts and closer to 0 for the humanities. The negative values for polytechnics and medical universities show that the overall balance is by far more unfavorable for women as the women's share is more consistent. Additionally, when IxG displays values higher than 0.5 and surpasses IxS, it means that the women's voting option was guided by other criteria and not necessarily by gender.

Our interpretation given to the overall process is that the principle of merit in conjunction with the perception related to the role of senators prevails in regard to the gender option.

On the other hand, analyzing the situation of the general gender balance vs. that of the senate for all universities in absolute terms, we find that out of the 47 universities, women represent the majority in 26 universities: 12 comprehensive universities, all 5 medical universities, and 3 out of 4 agronomy universities, but no polytechnics. In the senate, we find the same majority in only 11 universities, out of which 7 are comprehensive, 1 is medical, and 3 are arts (which have small senates of 8 to 12 people, so are less statistically significant). If, for all universities, IxG = 0.492 and IxS = 0.3907, we can conclude that the gender gap is sufficiently significant to bring up questions about a better tool to lessen it, but also about the quality of the senate's activity.

4.1.4. Gender Propensity in Electing the Faculty Councils (FC) Members

Regarding the faculty councils (FC) and their gender balance, it is worth noting that the role of this body has been practically diminished de facto by the inclusion of the dean, vice-deans, and department directors along with other directly elected members. Nevertheless, the impact of their decisions on the voters is clearer and more direct than in the case of senators. This generates the assumption that the vote for faculty councils generates a greater voter interest in comparison to the senate elections.

From the point of view of the general gender balance, the structures of the faculty councils would in many universities be altered by the participation, due to internal rules, of appointed managers, such as deans, and of elected executives, such as department directors, instead of (only) those directly elected for these bodies. The election results for faculty councils for the same most recent mandate are synthesized in Table 4.

From the data in Table 4, we immediately note that, although women are slightly underrepresented in councils (in relation to the general gender situation), the negative deviations are smaller than in the case of the senates. They actually halve, thus faithfully observing as a trend the overall structure. In the case of the art universities, there is even a pro-female reversal of the general gender balance.

The correlation between IxG and IxFC in Table 4 shows values close to 1 for two groups of universities, but also values close to or higher than 0.5 for the rest of the groups. A gender interpretation that we can give in respect to the election results in the case of the faculty councils is that

their gender structure quite closely reflects the gender composition of each university group, with minor differences.

4.2. Findings on the Gender Incidence in the Appointed Executive University Positions (Vice-Rectors, Deans, Vice-Deans)

Except for the rector and department director, the other executives are selected solely by their direct supervisors, with a relative distortion that will be further detailed in the case of the dean. More specifically, vice-rectors are selected by the rector and vice-deans by the dean based on a system that does not formally reflect the views or options of the voting staff and students. Nevertheless, we detect informal components that reflect the opinion of the subordinate group structures, segmentation that also involves the gender component.

4.2.1. Gender Propensity in Appointing the Vice-Rectors (VRs)

The appointment of vice-rectors reflects the rector's strategy and completes the public image of the rectorate. The team of vice-rectors is sometimes used, formally or informally, in the rector's election campaign, by being already nominated in order to transmit a certain image of the future executive structure to the voting staff. It can be inferred that the rector selects the gender structure of vice-rectors in accordance with the observed gender signals of the organization, thus trying to closely replicate the voting preference demonstrated for the senate. We remember that in the previous education law, the vice-rectors were elected by the senate members only. Thus, the members of the senate could have directly supported a pro-feminine policy, should it have been considered that this is the leading line manifested via the vice-rector's structure.

The number of vice-rectors is established by each university and announced in its charter. There is no gender quota element and there has not been any consistent discussion in the public space on this topic. There are 201 vice-rectors in the 47 universities.

Although the average is 4.27 vice-rectors per university, this number fluctuates mainly with the size of the university but not necessarily in a direct proportion. We note that even for the large universities, the executive models for vice-rectors are extremely diverse. For example, Poli (polytechnics) Bucharest, which ranks third in terms of teachers and students (after U ClujN and the U Bucharest), functions with only four vice-rectors, while U ClujN has nine vice-rectors, and the U Bucharest has eight vice-rectors. Thus, the provisions of university charters regarding the number of vice-rectors are adapted to local conditions and are not establish by a general formula.

Of the 201 vice-rectors, 77 are women (38.3%). Table 5 presents the synthetic situation in correlation with the election of senators, which is the most relevant type of correlation in regard to the informal signals explained above.

By comparing all types of indexes for the defined university groups, we note that the gender index of vice-rectors is relatively close (in fact, the closest) to the gender index of senators. The fact shows that the rectors have complied de facto with the signal given by their direct voters, although there is no formal mechanism that induces this proclivity.

Unlike the differences given in Tables 3 and 4 (final columns), those from Table 5 generally present slightly lower values for all the groups, which brings us to conclude that the rectors have a clearer affirmative attitude and action than the feminine electorate of the universities. The conclusion is all the more obvious if the structure of vice-rectors is compared to that of rectors; in 11 universities, female vice-rectors make the majority of total vice-rectors appointed, and in 8 universities, there is gender parity for this position. The indexes of medical universities and polytechnics show corrective actions taken by some rectors in the universities of the two categories, as the general gender structure is less favorable to women in comparison to the selected vice-rectors. In the case of vice-rectors, the agronomy universities (with the highest indexes difference) position themselves as "sexist" based, paradoxically, on the most consistent feminine majority of the teaching staff (53.5%).

Methodologically, the correlation for data on vice-rectors (IxVR) is made in connection with the senators' ratios (IxS), the senate being considered as a significant structure. We chose not to correlate it with the general structure of the teaching staff (IxG), because the senate and its structure are already established by a vote that orientates the gender trend. For all universities, IxS = 0.390 and IxVR = 0.413, thus we conclude that, on average, the rectors appoint the vice-rectors using the gender "image" of the senate.

4.2.2. Gender Propensity in Appointing the Deans (Ds)

The selection of the dean involves the rector's decision, "democratized" by a so-called public contest. The candidates approved of by the faculty council—constituted as explained above—submit applications for the dean position. In the end, the rector selects the most suitable candidate from the list approved by the faculty council. Theoretically, the faculty council could bar the candidacy of a person disliked by its members by not granting notification. Under this same policy of limiting the rectors' option, a "mock candidate" practice was observed: The faculty council would approve of one valid candidate and a number of invalid candidates that are, consequently, ineligible according to the rector. Yet, given the configuration of power, it is obvious that the choice of dean depends solely on the rector's decision.

Given the way they are selected, the gender factor plays a more pronounced role in the case of the deans in the logic of the context. On the one hand, it reflects the pro-feminine attitude of the rectors, which was revealed when analyzing the selection of vice-rectors, and on the other hand, the faculty councils are expected to reflect the gender structure of the faculty.

Keeping in mind this mechanism and the pro-feminine attitude of the rectors, the most relevant reference point for the configuration of deans is the configuration of the faculty councils. We then correlated the indexes of the two positions (deans and faculty councils, per groups of universities). The data is synthesized in Table 6.

We note that for the deans, the gender balance indicates differences in favor of men more prominently than in the case of the faculty councils' structures, which themselves show the same tendency in relation to the general balance. Given the fact that these councils also include department directors, and they reflect (as detected) a gender tendency, it can be concluded that these councils, like in the rector's elections (93.6% men), prefer male options. The fact is further reflected in the negative values of the correlation coefficients for polytechnics and comprehensive universities, suggesting that female voters on faculty councils manifest a male preference in voting.

Methodologically, the correlation for data on the deans (Ds) is made with the faculty councils' ratios (IxFC); the reason for choosing this correlation factor is that the faculty council (FC) validates the candidacies for the dean position, while it contains a pre-formatting of the opinion of the faculty council (FC) members already selected from and representing the general staff structure.

For a more detailed examination of the women's voting preference, the primary database of the study was accessed in its most exhaustive levels, with a focus on the comprehensive universities, as the largest group of universities in our study. It was revealed that out of the 151 faculties counted for in this group, 72 have a feminine preponderance of teachers, while of these, 36 faculties have male deans. Of the faculties with a male teacher majority, for five faculties, female deans have been appointed.

The same type of preference for male deans was also observed in the case of humanities universities after a similar data detailing.

For the medical universities, the preponderance of female deans may be explained by the greater proportion of female teachers in the faculties. The faculties of pharmacy, dentistry, and nursing have a significant female preponderance, and the executive structures are formed accordingly. It is to be noted that that feminine predominance in these professional fields does not fall under the stereotyped distribution of women towards "caring" activities and duties, but it is rather linked to an articulate option of women for a professional field of activity, which in Romania, nowadays, is very dynamic, well positioned, and rewarded.

For all universities, IxFC = 0.468 and IxD = 0.409, so we note a negative gender trend similarly found in the case of IxG−xS correlation, but of a smaller amplitude. The specific procedure for appointing the deans, combining the filtering of candidates by the faculty council, and the selection of the appointed person by the rector, can be a cause that should be further investigated.

4.2.3. Gender Propensity in Appointing the Vice-Deans (VDs)

The university charter and election regulations establish the role of the vice-deans, their numbers, and other procedural aspects. The vice-deans are appointed by the deans. The dean does not actually have to justify his option and does not need the approval of any collective body. Therefore, the rational choice would mean performance orientation, including observing the informal conditions related to the gender issue.

The informal conditioning can materialize in two ways: Firstly, in the influence that the faculty council's image (meaning gender structure) will have in establishing the dean's option, and secondly, in the fact that the dean, like the rector, would support a corrective action meant to counterbalance a possible pro-male attitude of the FC members.

For the vice-dean (VD) ratios, two correlations were made: With the faculty council ratios (Table 7) and with the deans' ratios (Table 8), since the deans appoint the vice-deans and follow the pre-formed faculty council representatives' opinion, as explained before.

From the comparison of the indexes for vice-deans (IxVD) with those of the mentioned two executives' categories, we note that the smallest differences are associated with the indexes for the faculty councils (IxFC). The situation is synthesized in Table 7, where we see that the gender structure of vice-deans very closely reflects the structure of the faculty councils.

In the case of the arts group, four universities out of the nine are quite small in size, entailing that the position of vice-dean is not used as an executive layer. Therefore, although IxVD can be calculated, averaging for five universities, the correlation coefficient would present a distortion that would question its significance for the study. It is the reason why the correlation is non-numerically represented in Tables 7 and 8.

Thus, the deans significantly comply with informal gender signals and support affirmative actions, beyond any formal framework or gender quotas being imposed. The correlation coefficients are significant for three groups of universities, and the negative differences in the last column show that the gender balance is more feminine in the case of vice-deans than in the case of faculty councils, which is to say that deans amplify in their appointing options of the vice-deans an affirmative action based on gender signals.

The comparison between the gender structure of deans and that of vice-deans is given in Table 8. Although the correlation coefficients (above) do not show high values, it is noteworthy that the negative values in the last column suggest a tendency to counterbalance gender-wise the results from the deans' appointment. More importantly, the proportion of female vice-deans is higher than that of deans in all groups of universities, except for the medicine and arts, where the female deans already represent a consistent female majority.

Without involving the "queen bee syndrome" [73], we note that this behavior of the deans reflects a model of understanding the role of women in Romanian universities, in a similar approach of the one manifested by the rectors.

4.3. General Correlations and their Interpretation

As already specified, we completed the correlation analysis between the calculated indexes (columns 2 and 5 of Tables 2–8) using the Pearson coefficient. The causal relationships, direct and indirect, established by the nature of forming the structures analyzed in Tables 2–8, are emphasized with * in the Table 9 (which presents all the values of the respective coefficients, including for the positions which do not present a causal link).

Table 9. Correlation analysis between specific indexes.

Ix	General (G)	Vice-Rector (VR)	Senate (S)	Dean (D)	Vice-Dean (VD)	Faculty Council (FC)	Department Director (DD)
G	X	0.198	0.521 *	0.659	0.76	0.763 *	0.561 *
VR	-	X	0.935 *	0.539	0.091	0.654	0.777
S	-	-	X	0.739	0.357	0.867 **	0.91 **
D	-	-	-	X	0.422 *	0.929 *	0.834
VD	-	-	-	-	X	0.599 *	0.518
FC	-	-	-	-	-	X	0.949 **
DD	-	-	-	-	-	-	X

Notes: * marks the correlation coefficients from Tables 2–8, showing causal relationships, direct and indirect, associated with the election process, and ** marks the coefficients associated with the direct voting, that is, the staff (G) elects senators (S), faculty councils members (FC) and department directors (DD) and these values are similar because they show the analogous behavior of the mass of voters G.

We notice a series of values close to 1 for VR and S correlations, as well as for D and FC. Both show that the "image" of the senate and the faculty council were decisive in the rector's choice for vice-rectors and deans.

Similarly, we can interpret the way in which the gender structure of VD is formed. The values 0.422 and 0.599 show that the deans tend to achieve a gender balance of the D-VD situation, respectively, to reflect the gender structure of the FC with a pro-feminine attitude, when appointing these executives.

The values on the first line show that after the direct vote, a significant part of the universities prefer to put in place decision-making structures that do not reflect the general gender structure. The higher value in the case of FC shows, though, that these councils are influenced by the general gender "image", which seems to be a clearer factor of the voting option.

The values marked with ** (in Table 9), which are close to 1, show that the voting mode of teaching staff in a university is similar for the senate (S), faculty council (FC), and department director (DD). Although vote-wise there is no direct link between the S, CF, and DD, a certain behavioral uniformity is noticeable and that is why such large values of the correlation coefficients emerge.

Finally, we resume with a few observations related to the values resulting from the intermediate statistical process that led to the realization of Tables 2–8. From the analyzed data, it can be stated that:

(a) The differences between the indexes of the various categories between which there is a causal, direct, or indirect connection (generated by the rules of the electoral process, which results in a gender structure) give a clearer picture of the situation of the general gender approach of the academic staff in comparison to the correlation coefficients.

(b) The distinct situations revealed, especially the high differences found in the last column of each Tables 2–8, can be explained by the specific context associated with an electoral situation, without us having noticed an abnormal gender approach. It is the case of the male predominance of the vice-rectors (VRs) from Polytechnics Bucharest or the case of the pro-male difference found between the general female share (51%) and the female share in the senate (16%) at the University of Agronomy Bucharest. These are statistical anomalies that are generated by situations that do not reflect a formal or informal discouragement regarding the selection of feminine candidates.

4.4. The Gender Balance in Correlation with the Rank of Romanian Universities

In 2016, the Romanian Ministry of Education set up a group of experts to realize a meta-ranking [74] of the national universities. This group used a methodology based on the integration of nine international existing rankings. According to their methodology, the 2018 ranking encompassed 26 Romanian universities, for which ratings higher than 0 were calculated and thus occupied positions from 1 to 8. The universities in this ranking are listed in Table 10 in the order of the occupied position (column 2).

Table 10. Correlation between national universities' meta-ranking and gender ratio ranking.

University	Rank	G Ratio	Rank G	G-S Ratio	Rank G-S	G-DD Ratio	Rank G-DD
U ClujN	1	0.505	14	0.215	20	0.080	8
U Bucharest	2	0.560	9	0.196	17	0.127	16
Poli Bucharest	2	0.368	24	0.198	18	0.124	15
U Iasi	3	0.403	21	0.158	14	0.163	20
Med ClujN	4	0.638	1	0.218	21	0.038	7
U Timișoara	5	0.526	12	0.074	7	0.086	10
Poli Iasi	5	0.352	25	−0.018	4	0.127	17
Med Bucharest	5	0.585	3	0.227	23	0.085	9
Med Iasi	5	0.501	16	−0.074	1	−0.055	3
U Brașov	6	0.503	15	0.150	13	0.236	24
ASE Bucharest	6	0.574	4	0.255	25	0.241	25
Poli ClujN	6	0.383	23	0.037	5	0.171	22
Poli Timisoara	6	0.334	26	0.099	8	0.096	12
U Craiova	7	0.458	20	0.105	9	0.094	11
U Constanța	7	0.565	7	0.047	6	−0.060	2
U Sibiu	7	0.500	17	0.198	19	0.167	21
U Oradea	7	0.479	19	−0.021	3	−0.001	5
Agro ClujN	7	0.511	13	0.351	26	0.111	14
U Galati	8	0.561	8	0.130	11	0.106	13
U Ploiesti	8	0.529	11	0.195	16	−0.055	4
U Suceava	8	0.490	18	−0.029	2	−0.153	1
U TgMures	8	0.566	6	0.145	12	0.036	6
Constr Bucharest	8	0.400	22	0.228	24	0.242	26
Agro Buc	8	0.599	2	0.130	10	0.132	18
Med Craiova	8	0.559	10	0.226	22	0.209	23
Med Timisoara	8	0.574	5	0.179	15	0.145	19

As a continuation of this approach, we proceeded to construct a ranking of the same universities on the basis of the general gender ratios (Gf/G), as well as the differences between general gender ratios (Gf/G) and the ratios obtained for the senate (Sf/S) and the department directors (DDf/DD), following the direct elections that involved all teaching staff. Our gender ranking started with the most pro-feminine situation. For the ratio Gf/G, the position 1 is assigned to the university with the highest overall female ratio (in our study, this is Med ClujN, with a general ratio of 0.638).

For the differences of representation in the senate (Sf/S) and department directors (DDf/DD), position 1 was awarded for the smallest difference that shows a pro-feminine attitude. According to our data, for the difference between Gf/G and Sf/S, position 1 is occupied by Med Iasi (ratio for Sf/S is 0.074 higher as compared to the general ratio Gf/G), and for the difference between Gf/G and DDf/DD, the position 1 is occupied by the U Suceava (ratio for DDf/DD is higher by 0.153 than the general ratio Gf/G). Table 10 includes our gender ranking for all 26 universities comprised in the national meta-ranking.

Finally, the calculation of the Spearman coefficients that associate the position of a national top university to our ranking given by different gender differences showed the values:

S = −0.198 for the general gender ratio, Gf/G.

S = −0.064 for the difference between the general gender ratio, Gf/G, and that of the senate, Sf/S.

S = −0.022 for the difference between the general gender ratio, Gf/G, and that of the department directors, DDf/DD.

The values demonstrate a weak linkage between the general ranking and the one associated with the gender parity. The values are close to zero for the gender representation differences calculated by us for Gf/G, Sf/S, and DDf/DD. As in 18 out of the 26 universities (see column 3 of Table 10), women represent a majority in the teaching staff, they play a direct and decisive role in establishing the gender differences that give the senate configuration and the department directors' structure in the ranked universities.

Two of the universities that appear in Table 10 (U ClujN and U Bucharest) are also ranked in the top 1000 worldwide (top 801–1000) according to the QS World University ranking established for 2020. What is interesting to point out is that while both present strong women majorities, they have similar and relatively small gender ratios for S and DD positions (see Appendix B), with high deviations from the general gender ratio, G, as compared to the other universities in our census.

5. Conclusions

The results of our study on how the electoral process in Romanian universities influences the gender balance associated with the executive power mechanisms and those of the collective decision-making bodies should be put in the context of the facts conferred by the She Figures Report 2018 [72] for Romanian academia.

In view of this comparison, we emphasize the fact that our study fully covers the public university system, with all the tenured teachers being counted, while the mentioned report only covers approximately 8% of university staff, namely 1737 persons reckoned in 2016 [72] (p. 132). In addition, our study generated a more accurate separation of the personnel into distinct categories of functions in liaison to the electoral process (two categories of boards, i.e., senate and faculty council, and five types of executives, i.e., rector, vice-rector, dean, vice-dean, and department director), while the She report refers only to two generic categories: "Boards" and "heads".

Our final conclusions synthesize the main aspects, predominantly qualitative, from both the partial conclusions accompanying each table in Section 4 and the data contained in Appendixs A– D.

As such, in 2019, 2 groups of universities out of the existing 6 and comprising 21 of the 47 universities have feminine majorities of academic staff, with an overall gender ratio of 0.982 (corresponding to the index IxG of 0.496 in the study). The most pro-feminine group of universities as general structure G is that of the medical universities (which ensures the easiest placement on the labor market and the highest average income in Romania), with a general gender ratio of 1.352.

The rectors' gender ratio gives the first signal related to the voting behavior of the teaching staff in general, and of women in particular. Of the 47 rectors, 44 are male (gender ratio for rector is 0.07), of which 24 are elected by feminine majorities. This ratio can be considered extremely negative and its causes should be studied in a separate in-depth study. The positive related aspect is that the empowerment of the universities' teaching staff to elect the rector without government interference, legalized only in 2011, did not generate inopportune actions. For the category of directly elected positions, namely, department directors, senators, and faculty council members, the department directors are the ones who have the most consistent operational connection; the information that orients the vote is the most complete and transparent given the proximity of the voter-voted tandem. Per category of universities, the polytechnics have a small but predictable subunit index, while the agronomy universities offer, surprisingly, the most "sexist" differences, despite the female majority of the staff.

In the case of senates, for all the groups of universities, the gender index has worsened compared to the previous category and in relation to the general share of women (IxG), with one exception in the case of the art universities. Again, the agronomic universities surprise us with the highest index difference, followed by the humanities.

In the case of the faculty councils, for four university groups and overall, a relatively small decrease of the feminine representation can be recorded, as in the case of the senates, but smaller than the latter. For two groups, the art and medicine universities, the index shows a feminine predominance. In the latter case, the value of the gender index is due to men voters who elected women.

Therefore, we retain that for the positions and structures resulting from direct voting, the indexes show values over which the feminine option was decisive. This prevalence emerged into the balance change in favor of male candidates—the case of the rectors being prominent—but also in finding mostly male-predominant indexes for the elected executive positions. However, the values of the indexes for senators and councilors are maintained in the immediate vicinity of the general index of the staff (as per the values shown in the last column marked with "Pro M(+)/F(−)" in Tables 2–8).

For the appointed executive positions that are associated with the decision of their direct hierarchical manager—vice-rector, dean, and vice-dean—our findings show a general support for pro-feminine positioning, without explicit affirmative actions being taken. Of the three positions, the clearest cases are those of the vice-rectors and vice-deans.

The rectors, in the mentioned structure, opted for teams that, in general terms, faithfully reflect the vote structure for senate members; in other words, the gender indexes of vice-rectors are similar to the gender indexes of senate members. With lower values than the general indexes, they still accurately reflect the feminine electorate option.

In the case of the deans, although the rector has a decisive role, the specific index reflects the gender index of the faculty councils, but with differences unfavorable to women. It is worth noting that here too the result is influenced by the configuration given by the department directors. The influence modality is complex and remains to be studied disjointedly.

For the vice-deans, the results are in line with the expectations in the sense that they closely reflect the structure of the faculty councils, with the smallest differences compared to the rest of the indexes. Overall, the situation of the vice-deans replicates gender signals at the faculty level, instrumented by the deans, with even clearer accents than the similar propensity of the rectors when appointing vice-rectors.

We conclude that for the indexes measured for all significant executive positions and collective bodies, the feminine influence is consistent, even when the balance is not dictated by absolute or relative majorities of women. The final power structure and the associated female option seem to have been guided by considerations other than those related to a potential demarche aimed at gender assertion.

Looking at the indexes (rounded percent values) for the group of all 47 universities, that is: IxG = 49%, after direct vote IxDD = 45%, IxFC = 47%, and IxS = 39%, and appointed functions as IxVR = 41%, IxD = 41%, and IxVD = 47%, we believe that their positive gender significance comes from the following reasons: (1) Six of the seven values (except IxS) are above the 40% threshold (a minimum benchmark for gender representation in countries with legal gender quotas), (2) very small differences between IxG and IxDD or IxFC indicate a mirroring of the general gender structure at the executive level and decision bodies with direct impact on the voters, and (3) values close to zero for the differences IxS - IxVR and IxFC-IxVD designate compliance of the rector and dean with the signals transmitted by the voting options expressed for the senate and the faculty councils. At the same time, we consider that the IxS and IxD values can be seen as elements with a negative gender significance, to be improved in the near future. The causes of these negative deviations of IxS and IxD should be addressed in further detailed studies. Technically speaking—that is, from the point of view of the statistical interpretation of the ratios and differences calculated on the census data—we conclude that the current management configuration is the result of a process in which women played a significant role, given the general gender structure (IxG = 49.2%) and a women's majority in 26 of the 47 universities. The respective process, which includes election-type selection as well as assignment to functions, is a democratic one; throughout our analysis, we did not identify any gender discriminatory aspects under the category of direct discrimination [75]. Indirect discriminatory aspects were not taken into consideration and we note it as a limitation of our study. The differences of representation vis-à-vis the general structure, which can be interpreted arithmetically as being gender unfavorable, are the result of a gender-free voting option, probably guided by the principle of merit, which seems to be equally supported by female and male majority configurations.

From a practical point of view, the study suggests that taking affirmative actions in Romanian universities must be thought of very carefully in order to avoid intervening in a situation when the voting option of the female component would be affected, as well as the pro-feminine trends in

recruiting new academic staff (as per the She Figures report 2018). The arguments are given both by Romania's general positioning in the mentioned report [72] and by the operational aspects that would result from imposing a gender quota system.

The limits of our study are generated by its quantitative approach itself, which is the consequence of objectives related to gender parity in the sense of the SDG 5. Focusing on the numerical aspects associated with a census implicitly neglects several qualitative aspects. These could include the "queen bee" syndrome, for which several manifestation signs are visible, in particular for the appointed positions. Another important qualitative aspect to be studied would be the psychological motivation that causes women not to apply for these positions, although there are no formal elements that may hinder their commitment.

We also did not consider the effect of the gender concentration, which is manifest in certain faculties, such as the feminine majority in the medical and language faculties, or outliers that we found in certain universities in connection to their size: Very large (with 1300–1500 staff) or very small ones (with 100–200 staff). Similarly, we were able to identify particular forms of interpretation by each university of the principle of representativeness. In other words, the effect of an excessive gender concentration in a segment of a university may have a negative gender effect at the representative level, which no longer reflects the overall gender balance.

If we consider sustainability as being materialized in gender parity, meaning optimal usage of human resources, then our study showed that Romanian universities are placed in a beneficial situation, marked by the existence of a feminine majority of staff in 26 out of 47 universities and the value of indexes Ix (shown above), but in an extremely "sexist" position marked by the proportion of female rectors. This beneficial situation must be corroborated with the positive trends of Romania, as the She report [72] shows in that area, as well as with the special position related to the non-existence of gender-negative phenomena, such as the glass ceiling.

For the way gender parity is reflected in collective bodies and head executives, beyond the numerical materialization of the vote determined by a female majority in the ways revealed above, sustainability must be interpreted, in our opinion, as the freedom of these majorities to choose what they consider best as success formula for the respective organization in the specific conditions of a given HR configuration.

We conclude that our study on the Romanian academia demonstrates their sustainability through their institutional capacity to use the female majorities and the pro-female propensity (all the way from the recruitment of the teaching positions A throughout the appointed executive positions), in order to concoct the best formula for management structures through a vote that is free of gender quotas or governmental interference.

Therefore, we consider that the principle of merit, with its multiple facets, prevails in all types of elections as a determinant of the voting option and, for the timeframe covered by our study, excludes an additional search for discriminatory gender elements that would influence the election results.

Finally, it should be considered that in our study, women's presence in senior academic grades A and B [72] and executive positions with a direct and unmediated impact on staff showed options that are probably better documented and targeted than any suggestion associated with affirmative actions supported by gender quotas or similar tools. In fact, it can be inferred that the merit principle, which seems to have primarily guided the voting options for the collected data, brings up a pro-feminine inclination of the voting options, or at least a fair gender representation in most cases. This is even more valuable in the absence of gender allocations in Romanian academia, showing a natural inclination of the voting structures towards meritorious candidates, without gender limitation or bias.

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Appendix A

Table A1. Data collection (census) on Romanian universities' staffing.

University	Students	Teaching Staff		Rector	Vice-Rector		Senators		Dean		Vice-Dean		FC Member		Department Director	
	Total	Total	(F)	(M)	T	F	T	F	T	F	T	F	T	F	T	F
U Galati	11,750	656	368	1	4	2	65	28	14	3	21	12	151	83	33	15
U Craiova	17,600	847	388	1	6	1	68	24	12	3	31	9	147	51	33	12
U Constanta	14,200	481	272	1	5	3	54	28	16	8	23	8	220	129	16	10
U Pitesti	9450	428	239	1	4	0	40	23	6	0	8	7	98	53	17	9
U Ploiesti	7400	280	148	1	4	2	39	13	5	3	11	5	119	56	12	7
U Suceava	7700	341	167	1	4	1	27	14	10	4	15	7	92	43	14	9
U Petrosani	3250	147	63	1	3	1	30	10	3	2	6	3	56	25	8	2
U Sibiu	14,150	628	314	1	4	2	63	19	9	5	23	9	132	55	21	7
U Tg Jiu	2900	132	70	1	4	2	21	11	4	1	2	0	41	21	8	6
U Resita	1600	73	39	1	1	1	18	8	3	1	3	3	33	19	4	2
U Tg Mures	8600	511	289	1	8	4	69	29	6	3	9	6	78	34	17	9
U Tirgoviste	5850	266	134	1	4	3	36	14	10	2	9	5	82	43	20	10
U Brasov	18,900	668	336	1	5	4	68	24	18	4	48	17	179	77	30	8
U Arad	5700	209	105	0	3	1	28	13	9	3	3	3	76	35	9	3
U Alba Iulia	4500	165	76	1	2	2	16	9	5	3	2	1	34	18	10	5
U Oradea	14,150	700	335	1	5	2	56	28	15	5	20	10	171	78	48	23
U Bacau	4900	170	97	1	5	4	23	12	5	1	11	8	52	28	16	9
ASE Bucharest	22,000	770	442	1	6	2	72	23	12	5	35	19	148	85	21	7
U Bucharest	31,000	1395	781	1	8	1	88	32	19	5	54	27	346	156	60	26
U ClujN	35,600	1444	729	1	9	2	76	22	21	2	49	20	315	112	87	37
U Timisoara	14,550	637	335	1	5	3	42	19	11	5	27	12	123	55	25	11
SNSPA Bucharest	5800	161	78	1	3	1	25	12	4	3	5	2	54	33	8	5
U Iasi	23,050	784	316	1	6	2	53	13	15	2	25	9	222	69	25	6
Poli Bucharest	28,931	1343	494	1	4	0	94	16	15	4	65	22	372	106	41	10
Poli Iasi	13,600	682	240	1	6	3	46	17	11	2	35	7	206	60	40	9

Table A1. *Cont.*

University	Students	Teaching Staff		Rector	Vice-Rector		Senators		Dean		Vice-Dean		FC Member		Department Director	
	Total	Total	(F)	(M)	T	F	T	F	T	F	T	F	T	F	T	F
Poli ClujN	24,800	875	335	1	7	2	81	28	12	1	23	8	243	71	33	7
Poli Timisoara	12,450	644	215	1	5	0	51	12	10	0	13	3	120	32	21	5
Constr Bucharest	5850	325	130	1	4	1	29	5	7	1	16	7	79	28	19	3
Marina Constanta	1400	106	48	1	3	1	21	5	2	0	2	1	30	9	7	1
Agro Bucharest	12,450	379	227	1	6	1	32	15	7	2	20	15	84	45	15	7
Agro ClujN	5850	311	159	1	6	1	25	4	5	2	15	10	71	32	15	6
Agro Iasi	4600	178	78	1	4	0	21	6	4	2	8	3	45	11	10	2
Agro Timisoara	4750	287	154	1	3	1	31	8	6	1	13	8	81	43	18	8
Med Craiova	4300	415	232	1	4	1	30	10	4	2	6	3	57	31	20	7
Med Bucharest	11,600	1510	884	1	6	3	81	29	4	3	17	11	158	63	24	12
Med ClujN	7100	720	459	1	5	1	31	13	3	2	10	7	61	35	20	12
Med Timisoara	7100	669	384	1	5	1	38	15	3	2	7	3	54	29	21	9
Med Iasi	9600	727	364	1	6	5	40	23	4	4	7	2	68	48	9	5
Arhit Bucharest	2900	256	121	1	3	1	27	12	3	1	4	2	52	29	9	7
Arts ClujN	950	170	56	1	3	1	29	9	2	0	2	1	25	7	10	4
Arte Iasi	1500	173	85	0	3	2	24	10	3	3	4	2	34	18	7	3
Music Bucharest	900	117	58	0	3	2	30	15	2	2	2	0	36	18	6	3
EFS Bucharest	1500	80	38	1	1	1	15	5	2	2	0	0	13	7	5	4
Arts Tg Mures	400	66	37	1	1	0	12	7	2	2	0	0	12	9	4	4
Arts Bucharest	1500	189	85	1	1	0	45	22	3	0	0	0	46	25	14	8
Theater Bucharest	800	193	34	1	2	1	20	2	2	0	2	0	0	0	10	4
Music ClujN	1000	123	78	1	2	2	9	6	2	2	0	0	0	0	7	2
Total	**450,431**	**22,431**	**11,116**	**44**	**201**	**77**	**1939**	**722**	**350**	**113**	**711**	**317**	**4916**	**2114**	**927**	**380**

Appendix B

Table A2. Gender ratio per universities and functions.

University	All Teaching Staff		General	VR	S	D	VD	FC	DD
	Total	(F)	Ratio (F/Total)						
U Galati	656	368	0.561	0.500	0.431	0.214	0.571	0.550	0.455
U Craiova	847	388	0.458	0.167	0.353	0.250	0.290	0.347	0.364
U Constanta	481	272	0.565	0.600	0.519	0.500	0.348	0.586	0.625
U Pitesti	428	239	0.558	0	0.575	0	0.875	0.541	0.529
U Ploiesti	280	148	0.529	0.500	0.333	0.600	0.455	0.471	0.583
U Suceava	341	167	0.490	0.250	0.519	0.400	0.467	0.467	0.643
U Petrosani	147	63	0.429	0.333	0.333	0.667	0.500	0.446	0.250
U Sibiu	628	314	0.500	0.500	0.302	0.556	0.391	0.417	0.333
U Tg Jiu	132	70	0.530	0.500	0.524	0.250	0	0.512	0.750
U Resita	73	39	0.534	1	0.444	0.333	1	0.576	0.500
U Tg Mures	511	289	0.566	0.500	0.420	0.500	0.667	0.436	0.529
U Tirgoviste	266	134	0.504	0.750	0.389	0.200	0.556	0.524	0.500
U Brasov	668	336	0.503	0.800	0.353	0.222	0.354	0.430	0.267
U Arad	209	105	0.502	0.333	0.464	0.333	1	0.461	0.333
U Alba Iulia	165	76	0.461	1.000	0.563	0.600	0.500	0.529	0.500
U Oradea	700	335	0.479	0.400	0.500	0.333	0.500	0.456	0.479
U Bacau	170	97	0.571	0.800	0.522	0.200	0.727	0.538	0.563
ASE Bucharest	770	442	0.574	0.333	0.319	0.417	0.543	0.574	0.333
U Bucharest	1395	781	0.560	0.125	0.364	0.263	0.500	0.451	0.433
U ClujN	1444	729	0.505	0.222	0.289	0.095	0.408	0.356	0.425
U Timisoara	637	335	0.526	0.600	0.452	0.455	0.444	0.447	0.440
SNSPA Bucharest	161	78	0.484	0.333	0.480	0.750	0.400	0.611	0.625
U Iasi	784	316	0.403	0.333	0.245	0.133	0.360	0.311	0.240
Poli Bucharest	1343	494	0.368	0	0.170	0.267	0.338	0.285	0.244
Poli Iasi	682	240	0.352	0.500	0.370	0.182	0.200	0.291	0.225

Table A2. *Cont.*

University	All Teaching Staff		General	VR	S	D	VD	FC	DD
	Total	(F)	Ratio (F/Total)						
Poli ClujN	875	335	0.383	0.286	0.346	0.083	0.348	0.292	0.212
Poli Timisoara	644	215	0.334	0.000	0.235	0.000	0.231	0.267	0.238
Constr Bucharest	325	130	0.400	0.250	0.172	0.143	0.438	0.354	0.158
Marina Constanta	106	48	0.453	0.333	0.238	0.000	0.500	0.300	0.143
Agro Bucharest	379	227	0.599	0.167	0.469	0.286	0.750	0.536	0.467
Agro ClujN	311	159	0.511	0.167	0.160	0.400	0.667	0.451	0.400
Agro Iasi	178	78	0.438	0.000	0.286	0.500	0.375	0.244	0.200
Agro Timisoara	287	154	0.537	0.333	0.258	0.167	0.615	0.531	0.444
Med Craiova	415	232	0.559	0.250	0.333	0.500	0.500	0.544	0.350
Med Bucharest	1510	884	0.585	0.500	0.358	0.750	0.647	0.399	0.500
Med ClujN	720	459	0.638	0.200	0.419	0.667	0.700	0.574	0.600
Med Timisoara	669	384	0.574	0.200	0.395	0.667	0.429	0.537	0.429
Med Iasi	727	364	0.501	0.833	0.575	1	0.286	0.706	0.556
Arhit Bucharest	256	121	0.473	0.333	0.444	0.333	0.500	0.558	0.778
Arts ClujN	170	56	0.329	0.333	0.310	0	0.500	0.280	0.400
Arte Iasi	173	85	0.491	0.667	0.417	1	0.500	0.529	0.429
Music Bucharest	117	58	0.496	0.667	0.500	1	0	0.500	0.500
EFS Bucharest	80	38	0.475	1	0.333	1	x	0.538	0.800
Arts Tg Mures	66	37	0.561	0	0.583	1	x	0.750	1
Arts Bucharest	189	85	0.450	0	0.489	0	x	0.543	0.571
Theater Bucharest	193	34	0.176	0.500	0.100	0	0	x	0.400
Music ClujN	123	78	0.634	1	0.667	1	x	x	0.286

Appendix C

Table A3. Average F/T gender ratios per groups of universities.

	General (G)	Vice-Rector (VR)	Senat (S)	Dean (D)	Vice-Dean (VD)	Faculty Council (FC)	Department Director (DD)
All categories	0.492	0.413	0.390	0.409	0.474	0.468	0.447
Comprehensive	0.514	0.525	0.444	0.362	0.541	0.488	0.483
Humanities	0.509	0.325	0.358	0.352	0.443	0.458	0.416
Polytechnics	0.382	0.228	0.255	0.112	0.342	0.298	0.203
Agronomy	0.521	0.167	0.293	0.338	0.602	0.440	0.378
Medicine	0.571	0.397	0.416	0.717	0.512	0.552	0.487
Arts	0.454	0.500	0.427	0.593	0.474	0.528	0.574

Appendix D

Table A4. Gender ratio correlations.

General	**Teach**	**General**	**VR**	**S**	**D**	**VD**	**FC**	**DD**
Average	477	0.492	0.413	0.390	0.409	0.474	0.468	0.447
Median	341	0.502	0.333	0.389	0.333	0.500	0.471	0.440
StDev	376	0.086	0.284	0.124	0.306	0.218	0.115	0.177
Teaching staff	X	0.058	−0.277	−0.254	−0.171	−0.136	−0.330	−0.258
General	-	X	0.153	0.568	0.432	0.435	0.681	0.384
Vice-Rector (VR)	-	-	X	0.331	0.387	0.021	0.290	0.141
Senat (S)	-	-	-	X	0.425	0.110	0.681	0.552
Dean (D)	-	-	-	-	X	−0.133	0.530	0.391
Vice-Dean (VD)	-	-	-	-	-	X	0.282	0.099
Faculty Council (FC)	-	-	-	-	-	-	X	−0.258
DepDirector (DD)	-	-	-	-	-	-	-	X
Comprehensive	**Teach**	**General**	**VR**	**S**	**D**	**VD**	**FC**	**DD**
Average	394	0.514	0.525	0.444	0.362	0.541	0.488	0.483
Median	341	0.504	0.500	0.444	0.333	0.500	0.471	0.500
StDev	233	0.041	0.269	0.085	0.177	0.249	0.062	0.133
Teaching staff	x	−0.031	−0.373	−0.308	−0.190	−0.300	−0.519	−0.327
General	-	x	0.115	0.327	−0.387	0.252	0.568	0.524
Vice-Rector (VR)	-	-	x	0.013	0.188	0.055	0.430	0.058
Senat (S)	-	-	-	x	−0.338	0.190	0.605	0.623
Dean (D)	-	-	-	-	x	−0.203	−0.198	−0.126
Vice-Dean (VD)	-	-	-	-	-	x	0.304	−0.207
Faculty Council (FC)	-	-	-	-	-	-	x	0.532
DepDirector (DD)	-	-	-	-	-	-	-	x
Humanities	**Teach**	**General**	**VR**	**S**	**D**	**VD**	**FC**	**DD**
Average	865	0.509	0.325	0.358	0.352	0.443	0.458	0.416
Median	777	0.515	0.333	0.342	0.340	0.426	0.449	0.429
StDev	443	0.056	0.145	0.084	0.222	0.062	0.107	0.117
Teaching staff	x	0.270	−0.610	−0.585	−0.827	0.225	−0.586	−0.372
General	-	x	−0.115	0.303	0.213	0.926	0.532	0.238
Vice-Rector (VR)	-	-	x	0.430	0.385	−0.141	0.107	0.017
Senat (S)	-	-	-	x	0.869	0.099	0.675	0.847
Dean (D)	-	-	-	-	x	0.139	0.885	0.737
Vice-Dean (VD)	-	-	-	-	-	x	0.509	−0.044
Faculty Council (FC)	-	-	-	-	-	-	x	0.621
DepDirector (DD)	-	-	-	-	-	-	-	x
Polytechnics	**Teach**	**General**	**VR**	**S**	**D**	**VD**	**FC**	**DD**
Average	663	0.382	0.228	0.255	0.112	0.342	0.298	0.203
Median	663	0.375	0.268	0.237	0.113	0.343	0.292	0.219
StDev	394	0.038	0.179	0.077	0.096	0.105	0.027	0.039
Teaching staff	x	−0.604	−0.470	0.008	0.678	−0.489	−0.465	0.848

Table A4. *Cont.*

Polytechnics	**Teach**	**General**	**VR**	**S**	**D**	**VD**	**FC**	**DD**
General	-	x	0.339	−0.220	−0.285	0.935	0.490	−0.894
Vice-Rector (VR)	-	-	x	0.679	−0.034	0.058	0.322	−0.433
Senat (S)	-	-	-	x	−0.138	−0.486	−0.338	0.217
Dean (D)	-	-	-	-	x	−0.212	0.172	0.400
Vice-Dean (VD)	-	-	-	-	-	x	0.592	−0.849
Faculty Council (FC)	-	-	-	-	-	-	x	−0.709
	-	-	-	-	-	-	-	x
Agronomy	**Teach**	**General**	**VR**	**S**	**D**	**VD**	**FC**	**DD**
Average	289	0.521	0.167	0.293	0.338	0.602	0.440	0.378
Median	299	0.524	0.167	0.272	0.343	0.641	0.491	0.422
StDev	72	0.058	0.118	0.112	0.125	0.139	0.118	0.105
Teaching staff	x	0.958	0.533	0.427	−0.582	0.990	0.889	0.921
General	-	x	0.604	0.585	−0.723	0.931	0.918	0.925
Vice-Rector (VR)	-	-	x	−0.088	−0.945	0.609	0.858	0.820
Senat (S)	-	-	-	x	-0.227	0.299	0.259	0.247
Dean (D)	-	-	-	-	x	−0.615	−0.876	−0.827
Vice-Dean (VD)	-	-	-	-	-	x	0.918	0.950
Faculty Council (FC)	-	-	-	-	-	-	x	0.996
DepDirector (DD)	-	-	-	-	-	-	-	x
Medicine	**Teach**	**General**	**VR**	**S**	**D**	**VD**	**FC**	**DD**
Average	808	0.571	0.397	0.416	0.717	0.512	0.552	0.487
Median	720	0.574	0.250	0.395	0.667	0.500	0.544	0.500
StDev	369	0.044	0.245	0.085	0.163	0.150	0.098	0.089
Teaching staff	x	0.175	0.308	−0.118	0.322	0.409	−0.646	0.338
General	-	x	−0.761	−0.581	−0.564	0.917	−0.534	0.221
Vice-Rector (VR)	-	-	x	0.761	0.893	−0.566	0.427	0.372
Senat (S)	-	-	-	x	0.895	−0.637	0.829	0.610
Dean (D)	-	-	-	-	x	−0.510	0.499	0.642
Vice-Dean (VD)	-	-	-	-	-	x	−0.684	0.210
Faculty Council (FC)	-	-	-	-	-	-	x	0.298
DepDirector (DD)	-	-	-	-	-	-	-	x
Arts	**Teach**	**General**	**VR**	**S**	**D**	**VD**	**FC**	**DD**
Average	152	0.454	0.500	0.427	0.593	0.474	0.528	0.574
Median	170	0.475	0.500	0.444	1.000	0.500	0.538	0.500
StDev	57	0.125	0.351	0.157	0.466	0.218	0.127	0.222
Teaching staff	x	−0.443	−0.270	−0.346	−0.694	x	−0.358	−0.300
General	-	x	0.203	0.943	0.752	x	0.938	0.254
Vice-Rector (VR)	-	-	x	−0.018	0.528	x	−0.267	−0.405
Senat (S)	-	-	-	x	0.564	x	0.786	0.169
Dean (D)	-	-	-	-	x	x	0.533	0.230
Vice-Dean (VD)	-	-	-	-	-	x	x	x
Faculty Council (FC)	-	-	-	-	-	-	x	0.802
DepDirector (DD)	-	-	-	-	-	-	-	x

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Using Chatbots to Enhance Integrated Reporting: Insights from Accounting and Consultancy Companies from Romania

Carmen Elena Anton [1], Eliza Ciobanu [2,*], Gabriel Brătucu [2] and Loránt Bucs [3]

[1] Faculty of Economic Sciences and Business Administration, Department of Finance, Accounting and Economic Theory, Transilvania University of Brașov, Colina Universității Street, No. 1, Building A, 500068 Brașov, Romania; carmen.anton@unitbv.ro
[2] Faculty of Economic Sciences and Business Administration, Department of Marketing, Tourism Services and International Affairs, Transilvania University of Brașov, Colina Universității Street, No. 1, Building A, 500068 Brașov, Romania; gabriel.bratucu@unitbv.ro
[3] Faculty of Economic Sciences and Business Administration, Department of Management and Economic Informatics, Transilvania University of Brașov, Colina Universității Street, No. 1, Building A, 500068 Brașov, Romania; bucs.lorant@unitbv.ro
* Correspondence: eliza.nichifor@unitbv.ro

Abstract: Integrated reporting is essential for businesses to communicate long-term value creation. Despite growing interest, little research has examined AI technologies like chatbots in sustainable reporting practices. This study addresses this gap, exploring chatbot adoption within 11,113 Romanian accounting and consultancy firms in Romania's emerging digital landscape. Researchers used Python's Seaborn library to analyze financial data from 2018 to 2022, finding that companies with higher revenue and liquidity were more likely to make their mark on how to achieve integrated reporting. Additionally, this study revealed the potential of chatbot technology adoption to enhance financial reporting and management, significantly improving financial reporting efficiency, accuracy, and accessibility. By automating data collection and analysis, generating real-time reports, and improving communication with stakeholders, chatbots can significantly improve efficiency and accuracy in financial processes. By addressing the challenges and capitalizing on the opportunities, firms can use chatbot technology to create more efficient, effective, and sustainable reporting practices. The findings contribute to this field of knowledge on sustainable reporting by examining the potential of technology and artificial intelligence (virtual assistants) to improve stakeholder communication. This study provides a case study from Romania, with implications for other regions.

Keywords: sustainable accounting; integrated reporting; chatbots; artificial intelligence; digital technologies; financial performance; communication; management optimization

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1. Introduction

Sustainability accounting plays a critical role in addressing Environmental, Social, and Governance (ESG) objectives by enabling organizations to quantify and disclose their impact on stakeholders and the environment. It is the process by which companies must assume responsibilities, become aware, and act for the well-being of all stakeholders. An active contribution to this global movement is represented by the multitude of organizations that target objectives concerning environmental issues, social responsibility, and corporate governance (ESG). Institutions with responsibilities in the accounting field such as the International Accounting Standards Board (IASB) (an independent body within the IFRS Foundation) and the International Sustainability Standards Board (ISSB) (an independent standard-setting body within the same foundation) are responsible for the development of the IFRS Accounting Standards and the IFRS Sustainability Disclosure Standards, respectively [1]. Although, in most of them, the companies do not make a complete disclosure of the internal and external sustainability strategies, the expectations

and the need to inform clients about the environmental and social performances attract the development of sustainability accounting [2]. While prior research emphasized the use of digital tools for sustainability reporting, limited attention has been given to AI-driven solutions like chatbots. These tools offer transformative potential by automating data collection, generating real-time reports, and enhancing communication with stakeholders. Previous studies on sustainability accounting have largely focused on reporting processes using traditional digital tools, often overlooking AI-based interactive technologies. This lack of empirical data on AI-driven automation and engagement tools in sustainability contexts highlights the need for research on chatbot applications in integrated reporting. The existing literature on AI applications in sustainability reporting primarily focuses on analytics and predictive capabilities, with little attention given to the role of interactive tools like chatbots. Moreover, the potential of chatbots to improve real-time communication and automate data-driven reporting in sustainability contexts remains largely unexplored. As an emerging market in the European Union, Romania provides a compelling context for exploring digital transformation in sustainability reporting. Despite growing interest, challenges such as limited infrastructure and varying digital literacy levels create opportunities for innovative solutions like chatbots to address gaps in reporting practices. Studying chatbot adoption in Romania provides insights into the potential for digital tools to enhance sustainability practices in similar emerging markets, where the dynamics of digital adoption may differ significantly from those in more developed countries.

Sustainability accounting must emphasize environmental performance reporting so that management decisions on resource consumption operations optimize and pursue sustainability goals. It also contributes to the assessment of the impact of the activity on the environment [3–5] and assesses the sustainability efforts that companies are making to meet regulations. In this context, the accounting profession actively participates in delivering quality information related to sustainability to all stakeholders [6]. Professional entities identify the existing stage in the professional training of specialists and establish key areas for developing new skills and updating the knowledge they possess so that the data they produce on sustainability issues conveys confidence to users. The significant changes in stakeholder expectations regarding sustainability, as communicated through reports prepared by companies, require the accounting profession to prepare for sustainability reporting and a certain alignment at a global level regarding mandatory disclosure. So, entities like the International Sustainability Standards Board (ISSB) and the International Auditing and Assurance Standards Board (IAASB) work together to provide direction for aligning sustainability standards.

In this complex sustainability reporting process, accounting firms are interested in working with professional accountants whose skills are in the following areas: analysis and systemic thinking, critical thinking and solving problems, working in teams interdisciplinary, communication skills, ease of adaptation and flexibility, etc. [7,8]. To achieve such qualities, the existence of strategies aimed at training professional accountants in an adequate way, starting in the academic framework, to provide services related to sustainability, is required.

While studies by PwC US [9] and Deloitte [10] underscore the importance of integrating sustainability into education programs, promoting innovation, and the role of technology in achieving business goals. The existing literature on AI applications in sustainability reporting [11] primarily focuses on analytics and predictive capabilities, with little attention given to interactive tools like chatbots [12].

The integration of sustainability in the accounting curriculum appears as a necessity in the context where issues such as social and environmental responsibility, environmental and social accounting, and, currently, sustainability are topics that concern the business world, the academic world, governments, and all other stakeholders [13]. According to a study, the traditional accounting curriculum focuses more on the technical side of training future professionals, while the sustainability curriculum aims to contribute to the development of independent and holistic thinking regarding economic phenomena. Curriculums

must quickly adapt to the implementation process of sustainability standards and actively participate in supporting companies that prepare sustainability disclosure reports.

Moreover, while artificial intelligence is increasingly implemented across various sectors to enhance efficiency and support data-driven decision-making, limited research by refs. [14–16] has explored its specific application within sustainability management and financial reporting [17–19]. Most studies on AI in business contexts have focused on predictive analysis [20], data processing [21,22], or customer engagement, with few examining the potential role of virtual assistants [23,24], such as chatbots, in supporting reporting on sustainability standards. A systematic review of a recent literature review revealed a gap in understanding how chatbots might contribute to sustainable business operations by optimizing financial management and reporting. In this context, the study examines how the use of artificial intelligence can improve the dissemination of information related to the fulfillment of sustainability standards. The study addresses the central research question, namely, *how can digital technologies, such as chatbots, enhance sustainability-focused reporting and value creation for stakeholders?* To explore this, this study examines the following subquestions: (1) How can chatbot technology enhance the accuracy and timeliness of financial reporting? (2) In what ways can chatbots optimize financial management and operational efficiency? (3) How can chatbots support effective communication with stakeholders in sustainability reporting? All these questions represent the basis of the objectives of this study, which, for greater specificity, are represented by the following: (1) to assess the potential of chatbots in improving the timeliness, accuracy, and efficiency of sustainability reporting; (2) to explore how chatbot technology can optimize financial management and operational processes in sustainability contexts; and (3) to evaluate the role of chatbots in facilitating effective communication and engagement with stakeholders.

This study employs a mixed-method approach, combining exploratory data analysis and cost amortization analysis to assess chatbot adoption and its financial impact. These methods allow the capturing of early-stage adoption patterns in emerging digital landscape markets, providing insights distinct from those in the existing literature.

This study demonstrates the potential of chatbot technology to enhance financial reporting and management, and it focuses on the economic dimension of sustainable development, specifically examining how chatbots may enhance financial reporting and management efficiency. Although sustainable development encompasses economic, social, and environmental aspects [25], the scope of this paper is limited to economic impacts, with a goal to establish how AI-driven technologies can support economically sustainable practices within organizations. By automating data collection and analysis, generating real-time reports, and improving communication with stakeholders, chatbots can significantly improve efficiency and accuracy in financial processes.

To introduce the outcomes of this study, this paper presents five sections. After introducing the literature review about the topic of interest, namely, sustainability in accounting, integrated reporting, and virtual assistants' implications in sustainable accounting, the third section draws attention to the materials and methods used for this study.

Therefore, the results and discussions present the contributions to the specialized literature, followed by the final section, where the conclusions highlight the theoretical and managerial implications, limitations, and potential for further research.

2. Literature Review

2.1. Sustainability in Accounting

At the European level, the private association European Financial Reporting Advisory Group (EFRAG)—established in 2001—was involved in the development of the International Financial Reporting Standards, and currently contributes through the consultancy offered to the development of directives regarding EU sustainability reporting standards.

The professional entities, in turn, are engaged in the development, adoption, and implementation of international standards for accounting, ethics, and deontology education in the public sector, as well as auditing and assurance. They participate through collective

actions at the global, regional, and local level in the training of members in order to deepen existing knowledge, but also to accumulate new knowledge to adapt to the requirements regarding the implementation of sustainability reporting standards [26].

The process regarding the adoption and implementation of sustainability reporting standards aims at the direct and responsible participation of accounting in the sense of expressing sustainability in quantitative indicators, such as the analysis and reporting of the social and environmental impact of a company [27–29].

Along with the professional bodies, the companies that offer accounting, taxation, audits, and insurance services in the process regarding the sustainable reporting standards, through the activity carried out, claim the need for digitization and the use of advanced technologies in carrying out their actions [30]. Research indicates that AI adoption in sustainability and integrated reporting varies significantly between developed and developing countries. Developed countries, with advanced digital infrastructures and greater regulatory support, have seen a more widespread integration of AI technologies, including chatbots, in corporate reporting [31]. In contrast, developing countries face challenges such as limited technological infrastructure, lower levels of digital literacy, and budget constraints, which can hinder AI adoption in reporting practices [32,33]. This disparity highlights the need for context-specific studies, such as this study on Romania, to understand the unique opportunities and barriers in emerging markets.

Digital transformation has required the development of skills and competencies to help develop accounting and finance work in a digital economy. In this sense, some of necessary the skills are as follows: learning and applying transformative technologies, ease in analyzing and presenting data, critical thinking and communication with partners, openness to learning new things, etc. [19,34].

The existence of a wide range of stakeholders with multiple and varied concerns gives rise to the need to find solutions that combine all environmental, social, and governance aspects of an organization with common interests and future well-being. The intervention of sustainability accounting can help companies develop businesses that differentiate them in the market, are competitive, and achieve financial and environmental performance. The issue of sustainability and stakeholder engagement formed the premise from which the Sustainability Accounting Standards Board (SASB) identified issues relevant to investors that vary by industry. At the same time, the analysis carried out by the Global Reporting Initiative (GRI) established a whole range of sustainability issues of importance to society. Joint research by the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB) explored the experiences of companies using the two sets of standards together to meet their reporting needs [35].

From investors to consumers and state institutions, a joint effort to change lifestyles and practices can support the development of a society where companies are interested in measuring and reporting their sustainability information.

According to the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS), users interested in a certain company must be allowed to know not only the significant impacts it has on the environment and people but also the significant effects that environmental aspects have on the company's development and performance.

In the conditions of an ongoing digitization process, the business model, the sustainability management system, and its monitoring are easier to access, and transparency in the disclosure of sustainability information is increasing [36]. Accounting service companies are directly involved in the use of digital technologies, and communication with the users of financial accounting information tends to be performed in real time. For the preparation of integrated reports comprising financial and non-financial information, they offer consultancy in order to apply sustainability standards that are intended to allow investors and other users to evaluate the risks of the investment from the point of view of the impact on the environment and other aspects of sustainability and to increase the degree of transparency in communication [37]. In Europe, the most common accounting

services offered by specialized companies are as follows: external audits, accounting and financial reporting, accounting and auditing in the public sector, real estate valuation, and financial consulting [30].

The training accounting services to measure specific sustainability indicators are resource consumption (materials, water, energy) and the impact of the entity's activity on the natural environment (conditions of land use, emissions in the air, in water, in the soil that seriously affect the natural environment, waste, the number of indemnities paid by judicial decisions regarding the natural environment). The measures taken by the entity to reduce these impacts (Global Reporting Initiative (GRI) represent the stage of involvement of the field in the creation of value for sustainable businesses. Accounting must respond to the needs of the interested parties and find a balance in the creation of the value related to each party. According to Harrison, ref. [38], conducting business is the result of a set of relationships that contribute to the creation of value for stakeholders in the firm's activities and results and that influence the achievement of its objectives.

Effective stakeholder relationship management can bring competitive advantages to the company and impact the company's conduct of responsible business [39–41]. Sustainability accounting can provide information on different aspects of sustainability and help to compare ESG performance indicators considering the investment function developed in the company. The impact of each project and the business model can be reflected by cost accounting and measuring the benefits recorded [42–44]. In this sense, an important role belongs to management accounting, which must provide relevant data on the consumption of raw materials, energy, water, and the waste generated by the company's activity, as well as data on the costs of protecting and maintaining the environment in relation to performance financial because of the application of environmental policies and the reduction in the consumption of natural resources.

Sustainability accounting deals with tracking, aggregating, and reporting environmental and social information, often linked to economic information related to reducing sustainability problems or contributing to sustainable development [45–47]. In conventional accounting, thinking in relation to stakeholders registers a certain gap that is also maintained regarding sustainability accounting and stakeholder information. The results of a study on the level of reporting of value creation and distribution to stakeholders [48] shows that, in general, companies do not address the full variety of stakeholders when reporting on value creation. Sometimes, in the development of integrated reports, significant influences are found in some departments within the company.

With the help of sustainability accounting, the business model managed by the entity; the monitoring of the impact of the activity carried out on financial performance, the environment, and society; and the quality of the disclosure of non-financial information, are reflected in all interested parties [49].

Artificial intelligence can be implemented into this communication process, bringing with it opportunities and challenges that influence everything from data analysis to decision-making processes. AI intervenes in the accounting processes not only for the processing of transactions of purchases, payments, receipts, and closings of the month but also for the realization of a real-time analysis to substantiate business decisions. The integration of AI into the organization and management of companies allows professionals to focus more on strategic analysis to achieve performance goals and create value.

2.2. Integrated Reporting

Integrated reporting encompasses an entire process of developing a report based on the concept of integrative thinking (IT) [50], intended to convey information in a clear format and increase corporate transparency. According to a recent reference, ref. [51], an integrated report must contain information about all aspects of the company, conveying it accurately and in a balanced way to investors and other interested parties [52,53].

According to the study carried out by Nandram et al., company management is tempted to disclose information on performance indicators (KPI—Key Performance In-

dicator) emphasizing good performance and minimizing poor performance through the presentation in the form of the integrated report. Therefore, there are situations where management turns to positive presentation models, using impression management, to express a better picture of the result in their integrated reports for the purpose of transmission to users [54].

In this way, the concept of information asymmetry is present, but it can be ameliorated by considering the content elements of an integrated report. According to Ghofar, 2023, an integrated ratio presented with fidelity negatively influences the information asymmetry (IA) and cost of equity (COE) of companies [55].

Accounting also contributes to the reduction in information asymmetry, which reflects the process in which information flows are provided for managerial decision-making, becoming a tool for designing a company's relationship with its stakeholders [56].

The quality of integrated reporting has increased over time, a phenomenon also supported by the study conducted by Nada and Hassan [57]. This study uses a company disclosure index based on the balanced scorecard (BSC) relationship that reflects the information content of integrated reports. The transmission of financial information with fidelity supplemented with non-financial information about the objectives regarding the sustainability of the company's business model is a necessity under the conditions of the introduction of sustainable reporting standards. Their implementation directly involves the work of professional accountants and sustainability accounting.

Integrated reporting can be considered a derivative of sustainability accounting as long as sustainability accounting is analyzed as a part of financial accounting. It aims to convey non-financial information to stakeholders and focuses on issues such as social and environmental accounting along with social and corporate responsibility reporting [58].

Stakeholders aim to understand how companies manage and use resources to achieve their strategic goals while considering sustainable development goals.

Along with sustainability accounting, which highlights all the processes directly related to a company's external performance, sustainability audits examine the strategy for achieving sustainable development goals and their disclosure through integrated reports. Thus, sustainability audits and reports guarantee an oversight of how the organization complies with tax laws, environmental laws, and social protection laws and how stakeholders are involved in its processes [59]. The use of innovative management accounting tools (IMAT Innovative Management Accounting Tools) results in better financial and sustainable organizational performance [60]. The companies that used innovative management accounting tools performed significantly better and created the framework to measure and manage a sustainable approach. They provide more and more detailed information on company performance and business sustainability behavior. Integrated reporting is influenced by innovation performance, especially within companies that have a high level of sustainability performance—a factor with an impact on the tendency to publish integrated reports, along with innovation performance at the country level [61].

The managerial control system (MCS) has an important role in the qualitative process of integrated reporting [62]. Also, integrated reporting developed based on reporting data formation methodology that includes a basis for generating financial and non-financial information and a complex integrated accounting policy would lead to a qualitative increase in the flow of information [63] and could contribute to the sustainable accounting paradigm [64].

The increase in the quality of financial and non-financial information disclosures has also been influenced by the means of disseminating content through ICT that can transmit information in real time and at the right time for all interested parties. Thus, the eXtensible Business Reporting Language (XBRL) can be used for the unitary representation of the content of financial statements or other types of performance and business reports. However, studies conducted on industry reporting [5,65,66] show that factors such as online financial reporting, profitability, size, and stakeholder involvement have little significant effects on integrated reporting. However, a complex business system with performance results

requires the development of a sustainability report whose premise consists of a business model that contains the objectives of sustainable development, namely, performance, environment, and social responsibility. Through integrated reporting, it is conveyed how the merging of objectives related to governance, performance, and social responsibility leads to the creation of value in the short, medium, and long term. Measuring the achievement of sustainability objectives is facilitated with the help of integrated reports that analyze the integrated transmission of financial and non-financial information for the six types of capital ("financial capital, manufactured capital, intellectual capital, human capital, social and relationship capital, and natural capital") [67].

2.3. The Role of Digitalization in Increasing the Level of Sustainability in Accounting

The digitization of the process of accounting activities has reached the stage where the automatic recording of repetitive transactions in accounts is ensured, contributing to the dedication of accountants to the control activities of accounting operations and the financial management of the company. Digitization brings benefits in terms of time savings, lower costs, and an overview of the amount owed on invoices [68].

Using technical knowledge and developing skills specific to digital transformation, accounting professionals are challenged in thinking about accounting processes using digital technologies. In the development of the accounting field, the existence of a balance between the improvement of technological knowledge and communication, critical thinking, and creativity is affirmed. In this context, the accounting professional must relate to technology, adapt, accumulate digital knowledge and skills, and use analysis and synthesis for communication in client relations [69].

All economic entities are oriented towards the digitization of business and pursue the use of information technology (intelligence, software robots, and blockchain) to increase performance. The digitization of accounting is not left out of the process and is leaving its mark on the working style and role of accounting professionals [70]. The research by Coman et al. shows that the accounting digitalization process, in addition to the implementation stages, has a component related to the human factor (change in mentality) and a component related to the organizational culture of economic entities that must be oriented towards sustainable business models.

Digitization is associated with technologies such as artificial intelligence, process automation through robotics, blockchain, intelligent data analysis, and cyber security, which help change processes inside and outside the company. Digitization assimilated in the field of management accounting and control contributes to the creation of value by designing new forms of collaboration between all interested parties, including organizations, suppliers, customers, and employees [71].

The use of AI leads to the development of new skills and knowledge, such as data analysis, critical analysis, and creative thinking. In the study carried out by the Institute of Management Accountants (IMA), the development of the following skills is identified as a result of the impact of AI on accounting and finance: cognitive skills (analytical thinking, creative thinking), self-efficacy (resilience, flexibility and agility, motivation and self-awareness, curiosity and lifelong learning, reliability and attention to detail), managerial skills (quality control), technological skills (technological literacy), and skills for working with others (empathy and active listening, leadership and social influence). Digitization in all areas of business (The European Green Deal) encourages organizations to adopt the latest digital technologies; the accounting function of a company cannot be excluded from this process, highlighting the need to update university curricula [72].

The digitization of the accounting field brings opportunities and also risks, which can be expressed in the decrease in the importance of providing information related to the other functions of the organization (marketing, IT, etc.). Accounting professionals must engage in technological development, participate in training through education, and activate the role of the educational system in the evolution of digital technologies [73].

By emphasizing the usage of the virtual assistants (chatbots) in integrated reporting [74,75], the process of making the information about reporting becomes more easy to communicate and more transparent [76], with a particular impact on the company's image to users who access the organization's presentation platform in search engines. Increasing transparency, clients identify the organization as a reliable one, wanting to collaborate with it. In this sense, in the long term, it can be stated that the use of artificial intelligence through chatbots to operationalize integrated reporting will increase the degree of interest for the company's stakeholders, and, implicitly, the financial performance will also experience improvements [77,78]. It can thus be said that, by increasing the company's trust using chatbots, AI also helps in the long-term growth of organizations that apply the principles of integrated reporting, even with financial implications.

A relevant example is given by Manifest Climate, which supports the use of AI to report with confidence, arguing that chatbots offer several advantages for financial reporting, such as automating routine tasks, freeing up human resources for strategic work, and providing real-time insights to process and analyze data quickly for timely decision-making. Also, the potential to obtain improved communication with personalized financial information and 24/7 accessibility is another factor [79].

In this context, the accounting profession requires people qualified in information technology (IT) and accounting information systems (AISs) and who can quickly familiarize themselves with the software tools used to maximize accounting functions [80]. The changes that take place through the adoption of digital technology influence the company's business model, its strategic and competitive objectives, and also the demands of consumers in the market [81].

Under these conditions, business management is more creative, and the training of the accounting function and its tasks contributes to the ability to access information much faster, from anywhere, and with impact in terms of corporate reporting [82]. The use of technology simplifies accounting tasks; therefore, accounting practice becomes easier, faster, and more accurate. Plus, accountants can access their work from almost anywhere, and corporate reporting is more efficient. Undeniably, there are advantages to digitization in the accounting profession, but its implementation can also encounter some difficulties, especially in smaller accounting service companies where investments in AI involve considerable efforts [83]. Thus, to be competitive, organizations must invest in new technology that brings with it increased productivity and the creation of new types of jobs with different skills.

Conversational artificial intelligence can be successfully used for communication and prospecting [84–86]. It can connect with accounting professionals to ask specific management consulting, accounting, taxation, or international business development questions due to its acceptance in the communication process in business [87]. Therefore, the integration of artificial intelligence in accounting, accounting education, and consultancy is a necessity and a present reality [59,88–90]. Thus, the integration of AI in this field allows companies to remain present in an ever-evolving field and contribute to the application of sustainable business models. By promoting integrated thinking, the existence of a global reference framework for sustainable reporting, which ensures ethics and independence and strengthens the application of sustainable practices, is enhanced [91–93]. This can be considered a holistic approach to business that helps create value and quantify performance.

In summary, while prior research has explored AI's potential in various business functions, limited studies have focused on AI applications in sustainability reporting, particularly in the form of chatbots. Furthermore, few studies address the unique challenges faced by developing countries in adopting AI for integrated reporting. These gaps highlight the need for research on how emerging digital technologies can support sustainability reporting within developing market contexts, providing a foundation for our study's research questions and objectives.

3. Materials and Methods

For the purpose of determining how effectively accounting and consultancy firms can ensure communication with users by using artificial intelligence, this study employed a methodology that used a mixed-method approach to integrate exploratory qualitative analysis with quantitative cost amortization modeling. This design allows for a comprehensive examination of the early adoption patterns of chatbots in sustainability reporting, combining financial data insights with an interpretive analysis of their managerial and operational impacts. Specifically, this study first explored the database (compounded by 11,113 consultancy and accounting companies from Romania) based on revenues and liquidity, as these metrics were seen as indicators of companies' openness to digital technologies [94–96]. The researchers' assumption that revenues and liquidity can serve as indicators of a company's openness to digital technologies is supported by prior research. Studies on organizational innovation have demonstrated that companies with higher revenue and stronger liquidity positions are more likely to adopt new technologies due to their greater financial flexibility and risk tolerance [97,98]. Additionally, from a Resource-Based View (RBV) perspective, financial resources represent a critical asset that enables firms to invest in and experiment with innovative solutions, including digital tools such as chatbots [99,100]. Consequently, this study proposes that revenue and liquidity are relevant indicators of a company's capacity and willingness to embrace digital transformation.

The researchers used the Seaborn library in Python 3.11.0 to analyze financial data from 2018 to 2022, including revenues, profits, debt, equity, and liquidity. They found that companies with higher revenue and liquidity were more likely to make their mark on how to convey information through integrated reporting. Additionally, they analyzed the potential and cost-effectiveness of using chatbots for financial reporting because this technology can significantly improve financial reporting efficiency, accuracy, and accessibility [101]. By following a mathematical model to calculate the amortized cost of chatbot usage, this study concludes that chatbots can be a valuable tool for improving financial reporting efficiency and accuracy. The research methods used (1) exploratory data analysis to understand the openness of the companies to digital technologies [102,103] and (2) the analysis of potential and cost amortization of chatbot usage as a continuation of the potential existing in the literature [104,105]. The dataset used in this study was fully anonymized and organized using an automated system with continuous numbering to ensure confidentiality and maintain data integrity.

The methodological approach is grounded in scientific basis, with the authors selecting the exploratory data analysis (EDA) and cost amortization analysis as methods that are suitable for studying the emerging adoption patterns of chatbots. EDA allows us to understand potential barriers and analyze preliminary patterns in the data, which are crucial when dealing with early-stage adoption where established models may not yet apply. Cost amortization analysis complements this approach by examining the economic impact and long-term return associated with chatbot implementation, offering insight into the financial feasibility of digital adoption for Romanian companies. Together, these methods provide a structured yet flexible approach to understanding the relationship between chatbot adoption and economic factors in a market where the digital transformation of companies is developing. The researchers state that this methodology is well-suited to the Romanian context and helps to establish a foundational understanding that can guide further research in similar emerging markets.

The exploratory data analysis addressed Objective 1 by identifying patterns in financial readiness for chatbot adoption. Cost amortization modeling supported Objective 2 by evaluating the economic sustainability of integrating chatbots into reporting processes. Together, these methods inform Objective 3 by highlighting the potential managerial and financial benefits of chatbot deployment for stakeholder communication.

3.1. Exploratory Data Analysis (EDA)

The openness of the companies to digital technologies is determined by high values in revenues and liquidity. Based on this, the authors explored the database from the point of view of these two significant metrics. The exploratory analysis involved examining financial performance indicators (e.g., revenue, profit, equity, and liquidity) for 11,113 Romanian accounting and consultancy firms from 2018 to 2022. Using Python's Seaborn library, we computed a correlation matrix to identify patterns between financial metrics and digital adoption potential. Outliers were identified and treated using the interquartile range method, and year-over-year growth rates were calculated to evaluate financial consistency and trends.

Financial resources, risk tolerance, or strategic vision are characteristics of companies that invest in new technologies without jeopardizing their core operations and might be more forward-thinking and open to adopting technologies that could drive future growth. Assuming a possible strong influence on how to achieve integrated reporting, the authors assigned an important role of revenues and liquidity in the analysis of discovering how companies could report sustainability in an integrated manner. Thus, they explored the database and calculated the average revenue and the average liquidity for each year across all firms. The outcomes will confirm a valuable opportunity for going further and finding correlations presented in the Results Section.

By using Python 3.11.0 and the "seaborn" library, the authors intended to compute the heatmap of the correlation matrix, including total assets, revenue, number of employees, profit, debt, equity, and liquidity, between 2018 and 2022. Before this step, they checked for the lack of missing values; searched for outliers; checked data distribution; evaluated consistency across years; searched for zero or negative values; and finally, calculated correlations. By using the interquartile range (IQR) method computed by using Python 3.11.0, 733 outliers in the revenue data for 2022 were found. These outliers were identified as being significantly higher than the typical revenue values in the dataset. Data distribution was not illustrated as being normal but rather skewed to the left, indicating that most companies have relatively low revenue values, with a few companies having very high values. The consistency of revenues and profit across years was evaluated by detecting the presence of zero or negative values. Afterward, all these values were cleaned, and year-over-year growth rates were calculated.

In the continuation of the results obtained, the authors computed the correlation matrix as a heatmap to identify possible relationships between financial metrics. Each cell of it shows includes the correlation coefficient between pairs of variables, ranging from -1 to 1. Values closer to 1 indicate a strong positive correlation, values closer to -1 indicate a strong negative correlation, and values around 0 indicate no correlation. The result of the matrix was used to understand the financial context of the development of integrated reporting.

3.2. Analysis of Potential and Cost Amortization of Chatbots Usage

The cost amortization analysis was conducted to evaluate the financial feasibility of chatbot adoption. A mathematical model was developed using variables such as initial development costs, monthly operational expenses (e.g., maintenance, hosting, customer support), and estimated benefits (e.g., savings from reduced manual reporting and improved stakeholder engagement). The total costs and benefits were projected over a five-year period to calculate the net amortized cost per month. This approach ensures a realistic assessment of long-term cost efficiency.

The second part of the data analysis section is dedicated to the potential and cost amortization of chatbot usage analysis. To formalize the amortized analysis, the mathematical model is used to calculate the net amortized cost per month (ϕ_{amort}) of utilizing basic chatbots to communicate reports to stakeholders. To proceed, the authors used the following variables: (1) the initial cost of developing the chatbot (ϕ_{dev}), (2) the initial cost of integration and setup (ϕ_{int}), (3) the total initial cost (ϕ_{init}), (4) the monthly maintenance and updated cost (ϕ_{maint}), (5) the monthly hosting and data storage cost (ϕ_{host}), (6) monthly customer support fee (ϕ_{sup}), (7) the total monthly operating cost (ϕ_{op}), (8) monthly savings

from reduced manual reporting (ϕ_{rep}), (9) monthly benefits from improved stakeholder engagement (ϕ_{eng}), (10) monthly benefits from improved data analytics and feedback (ϕ_{data}), (11) total monthly benefits (ϕ_{tot}), (12) time period in months for amortized analysis (T), (13) total benefits for the period $T(\phi_{totT})$, (14) net cost for period $T(\phi_{net})$, and (15) the amortized cost per month (ϕ_{amort}). The calculation method is presented as follows:
Initial costs:

$$\phi_{init} = \phi_{dev} + \phi_{int} \tag{1}$$

Monthly operating costs:

$$\phi_{op} = \phi_{maint} + \phi_{host} + \phi_{sup} \tag{2}$$

Monthly benefits:

$$\phi_{tot} = \phi_{rep} + \phi_{eng} + \phi_{data} \tag{3}$$

Total cost for period T:

$$\phi_{tot} = \phi_{init} + \left(\phi_{op} \times T\right) \tag{4}$$

Total benefits for the period T:

$$\phi_{totT} = \phi_{tot} \times T \tag{5}$$

Net cost for period T:

$$\phi_{net} = \phi_{tot} - \phi_{totT} \tag{6}$$

Amortized cost per month

$$\phi_{amort} = \frac{\phi_{net}}{T} \tag{7}$$

Considering the hypothesized scenario with market analysis results, the size of the variables is shown in Table 1.

Table 1. Value for assumed scenario.

Variable	Notation	Value
The initial cost of developing the chatbot	ϕ_{dev}	RON 50,000
The initial cost of integration and setup	ϕ_{init}	RON 10,000
The monthly maintenance and updated cost	ϕ_{maint}	RON 1000
The monthly hosting and data storage cost	ϕ_{host}	RON 500
The monthly customer support fee	ϕ_{sup}	RON 500
Monthly savings from reduced manual reporting	ϕ_{rep}	RON 3000
Monthly benefits from improved stakeholder engagement	ϕ_{eng}	RON 1000
Monthly benefits from improved data analytics and feedback	ϕ_{data}	RON 500
Time period in months for amortized analysis	T	12 months

To analyze the long-term potential of using chatbots in the reporting process, the authors performed an analysis in which the initial state (without chatbot) is the starting point. Specifically, C_0 is the initial total cost for integrating reporting without chatbots in the communication process.

The potential function was defined as a simple equation to reflect the difference between the current situation and the desired situation (with the implemented chatbot):

$$\Phi = C_{without\ chatbot} - C_{with\ chatbot} \tag{8}$$

The authors identified long-term investment analysis (five-year potential period) as being mandatory for this study. Thus, several aspects are presented. Firstly, *the cost spread over time* allows a more accurate reflection of the utility and financial performance for sustainable reporting purposes. Also, amortizing the cost acknowledges that the chatbot will provide value over an extended period rather than the starting point of the investment. This approach helps in budget planning and management by allocating a predictable expense over multiple fiscal periods.

Secondly, approaching the long-term potential of using chatbots for integrated reporting from the point of view of *technological depreciation*. Due to advancements in technology and changes in user requirements, technology assets typically depreciate over time. Amortizing the cost of a chatbot over five years aligns with the expected lifecycle and decreases the efficacy of the technology, ensuring that cost accounting practices match the practical depreciation of the asset.

Another argument is the *matching principle* because, in accounting, it dictates that expenses should be recorded in the same accounting period as the revenues they help to generate. By amortizing the cost of the chatbot, expenses are matched with the benefits realized from its use, such as improved customer service, increased sales, or cost savings from automation, throughout its operational life.

Also, the five-year period provides a framework for evaluating the performance and return on investment of the chatbot over a realistic timeline during which its benefits can be fully assessed and quantified. By emphasizing that a five-year amortization period for a chatbot deployment is prudent financial and strategic planning for integrated reporting, it aligns accounting practices with business benefits, supports effective budgeting, and provides flexibility in managing technological advancements. Thus, based on these aspects, continuing the calculation of amortized cost ($\hat{C}$) for the five-year potential period, the authors intended to determine the $\hat{C}$ for each operation as the sum of the effective costs of the operation and potential change by using the elements in the following formula:

$$\hat{C} = C_{effective} + \Delta\Phi \tag{9}$$

To draw up the initial scenario, the values used for communication and stakeholders' engagement are presented in Table 2. Therefore, they evaluated the costs and the benefits over an extended period using data shown in Table 3 and the results obtained by applying Equations (1)–(7).

Table 2. Costs without chatbot.

Costs without Chatbot (C_0)	Value
Manual reporting	
Monthly cost for manual reporting	RON 5000
Annual cost for manual reporting: (12 months)	RON 60,000
Five-year cost for manual reporting	RON 300,000
Costs for communication and stakeholders' engagement	
Monthly costs for communication and engagement	RON 2000
Annual costs for communication and engagement	RON 24,000
Five-year cost for communication and engagement	RON 120,000

Table 3. Costs with chatbot.

Costs with Chatbot ($C_{with\ chatbot}$)	Value
Initial costs	
Chatbot development	RON 50,000
Integration and setup	RON 10,000
Total initial costs	RON 60,000
Monthly operating costs	
Maintenance and updates	RON 1000
Hosting and data storage	RON 500
Customer support	RON 500
Total monthly operational costs	RON 2000
Five-year costs with chatbot	
Annual operating costs	RON 24,000
Five-year operating costs	RON 120,000
Annual economies and benefits	RON 54,000
Five-year economies and benefits	RON 270,000

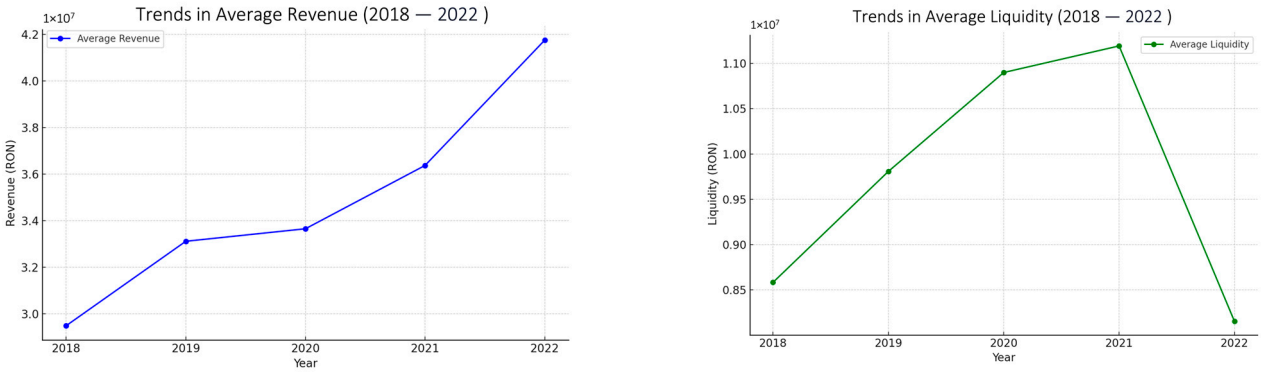
After calculating the five-year total costs for the current (C_0) and desired situation ($C_{with\ chatbot}$), the authors calculated the function of potential (Equation (9)).

4. Results

This section provides a comprehensive overview of the study's findings, focusing on three key areas. Firstly, it presents the results of an exploratory analysis, which presents the current state of chatbot usage and identifies potential areas for improvement. Secondly, it explores the potential cost savings and revenue generation opportunities that chatbots can offer. Lastly, it examines the factors influencing the return on investment for chatbot implementations, including cost amortization and long-term benefits.

4.1. Exploratory Analysis Outcomes

The EDA outcomes illustrate the trends for the average of two of the most significant financial performance indicators, namely, revenue and liquidity. Figure 1 shows a noticeable increase in average revenue in 2022, indicating a high financial performance over the years; however, regarding the average liquidity, the trend suggests fluctuations, with a general upward trend towards 2022, indicating improvements in terms of financial stability.



(**a**) (**b**)

Figure 1. The evolution in average revenue (**a**) and liquidity (**b**) between 2018 and 2022. Source: authors' conceptualization based on the dataset.

To determine what generates a consistency of revenue and profit across years, the authors first detected the presence of zero or negative values (Table 4). After this step, they cleaned the t database, and year-over-year growth rates were calculated (Table 5).

Table 4. The number of occurrences of zero and negative values.

Year	Occurrences of Zero or Negative Values
2018	1109
2019	968
2020	937
2021	943
2022	950

Source: calculated by the authors using Python 3.11.0.

There was significant revenue growth in 2019, followed by moderate growth rates in the subsequent years. Profit growth was the highest in 2019 and showed a decreasing trend in the following years but still maintained relatively high growth rates. Visualized as a heatmap, Figure 2 illustrates all the relationships between firms' indicators. After the heatmap presentation, the centralization of the outcomes can be found in Table 6.

Table 5. Year-over-year growth rates for revenue and profit.

Year	Average Revenue Growth (%)	Average Profit Growth (%)
2019	50.5	172.01
2020	12.3	110.81
2021	17.11	90.17
2022	16.64	88.44

Source: calculated by the authors using Python 3.11.0.

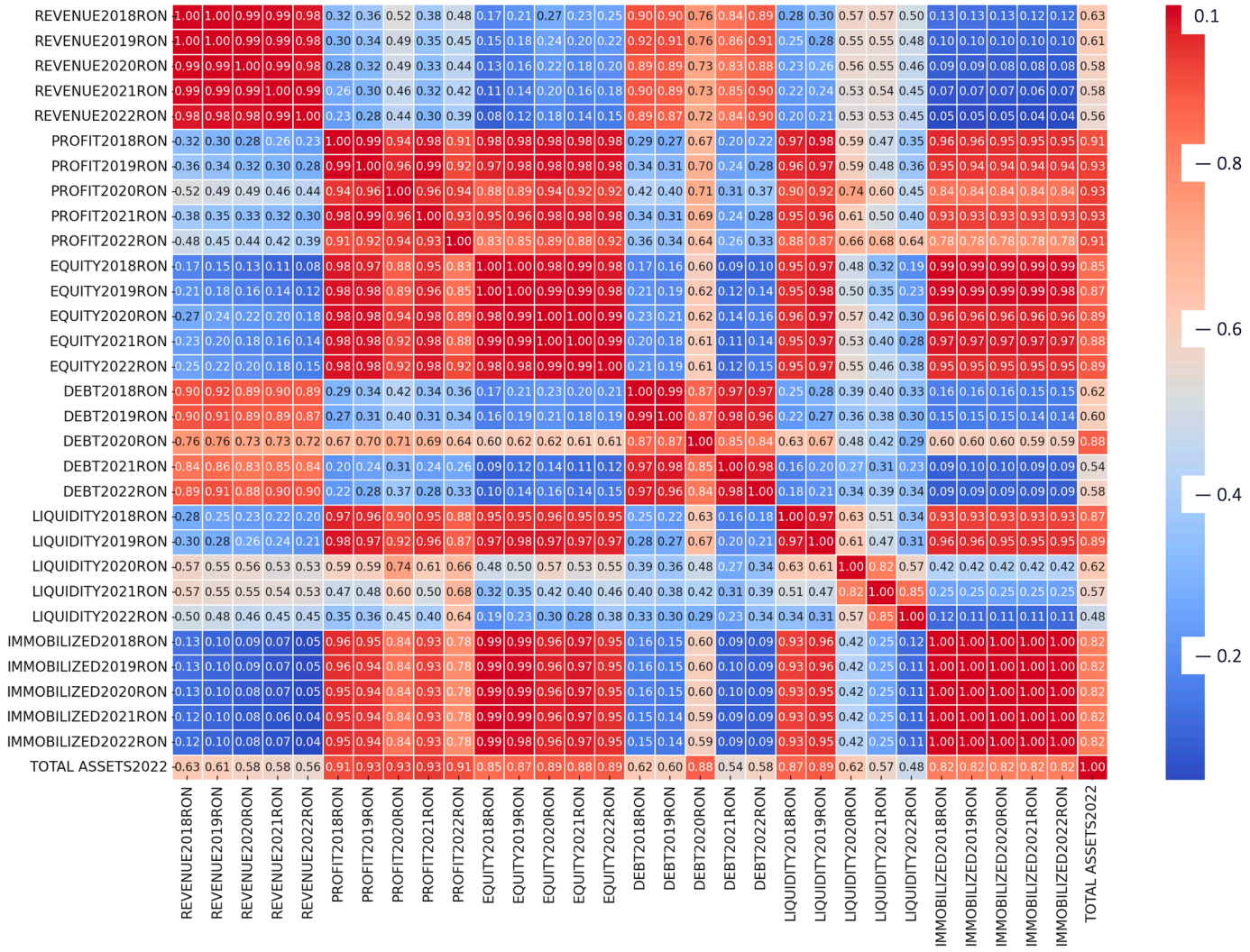


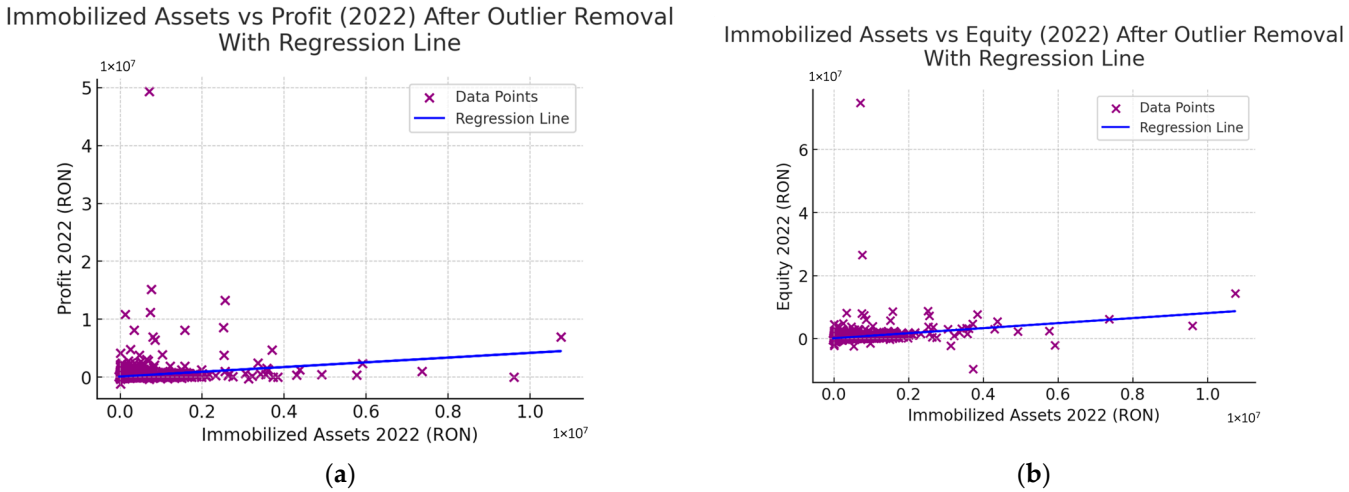
Figure 2. The heatmap of correlation matrix for financial metrics. Source: authors' computation using Seaborn library in Python 3.11.0. The currency used: RON (Romania's currency). Not relevant to convert it to euros or dollars. The relationships are not affected [106].

Table 6 highlights the strong positive correlation between profit and equity, underscoring how efficient management of digital tools like chatbots can enhance financial stability. This correlation supports the study's conclusion that investments in AI technologies contribute to both operational efficiency and profitability in sustainability reporting.

After outlier removal, correlations between immobilized assets and profit, and immobilized assets and equity, were illustrated (Figure 3).

Table 6. The centralization of the correlation matrix outcomes.

Relationship	Observation
Revenue and profit across years	Revenue and profit present which relation indicates a consistent performance year over year, suggesting effective business strategies, consistent demand for their services, or consistent profitability, which could reflect effective cost management and stable operational efficiency. This indicates that the company's ability to generate revenue has a direct and significant impact on profitability. While revenues in one year do influence profits in future years, the strength of that influence tends to weaken as the time gap increases.
Debt and revenue	A strong positive correlation between debt and revenue suggests that as revenue increases, debt levels also increase, and vice versa. This relationship can be indicative of several underlying dynamics within a business. It demonstrates significant implications for sustainable accounting. Debt should not just be seen as a financial burden but as a catalyst for growth. Especially, within the context of using digital technologies used in integrated reporting to ensure and enhance transparency, accuracy, and strategic insights into financial management, this correlation can be addressed effectively through digital technologies in integrated reporting for sustainable purposes. However, if revenue growth does not keep up with increases in debt (as is shown for 2020), it could signal potential financial distress or inefficiency in using borrowed capital.
Profit and equity	The strong positive correlation between profit and equity highlights effective financial management and successful operations, primarily because profits contribute directly to retained earnings, thereby enhancing equity. This correlation signifies sustainable growth as higher profits enable further investment into the business, enhancing the equity base and financial stability. This outcome is valuable to assess a company's long-term viability and operational efficiency.
Profit and liquidity	A strong and positive relationship between profit and liquidity was discovered. This kind of relationship is symbiotic. Strong profitability supports and often enhances liquidity, providing a company with a protection period against financial instability and the means to capitalize on growth opportunities without needing external financing. This dynamic is integral to maintaining the day-to-day operations and strategic flexibility.
Total assets and profit	A strong, positive correlation between total assets and profit implies that as the assets of a company increase, its profits generally also increase. This relationship suggests effective asset management and the ability to use assets to generate higher income.
Total assets and equity	The companies demonstrated a similarly strong, positive relationship between total assets and equity. This fact highlights that as a company's asset base grows, its equity does as well. This relationship can be attributed to the reinvestment of profits back into the company (increasing both equity and assets) or/and effective overall growth management. This outcome became very interesting for the researchers during the process of data analysis. Total assets include immobilized assets, the ones that can highlight the investments made for the adoption of technologies in the company. Based on this premise, the authors tried to identify a possible correlation between immobilized assets and other indicators (Figure 2) to find out if the company could be oriented to the adoption of digital technology to become more sustainable.



(**a**) (**b**)

Figure 3. The correlation between immobilized assets and profit (**a**) and the correlation between immobilized assets and equity (**b**). Source: authors' computation.

The trend between immobilized assets and profit (a) appears flatter. The same trend is related to the relationship between immobilized assets and equity. The positive correlation is still present but is less pronounced compared to the version with extreme values. However, visually emphasizes the strong positive correlations, namely, 0.78 and 0.95, respectively (Figure 4).

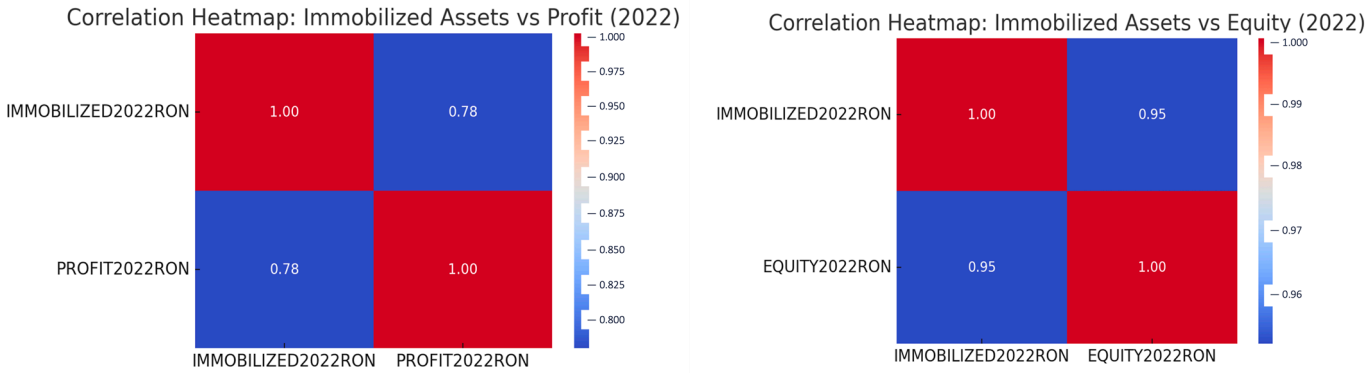


Figure 4. The heatmap for visualizing the correlation between immobilized assets and profit (**a**) and the correlation between immobilized assets and equity (**b**). Source: authors' computation.

The strong correlation between immobilized assets and profit indicates that as the value of immobilized assets increases, profit also tends to increase. This finding can suggest that investments in assets that are not readily convertible in cash, potentially including long-term investments such as digital technologies, especially in the case of consultancy and accounting companies. Also, a strong and positive relationship between immobilized assets and equity was identified. This very strong positive correlation indicates a robust link between the value of immobilized assets and the equity of the company.

Investments in immobilized assets, potentially including substantial expenditures on digital technologies, are directly correlating with an increase in the company's total equity. The strong correlations of immobilized assets and profit and equity suggest that the value of long-term assets held by these companies changes proportionately, reflecting consistent investment or depreciation policies over time. This indicates that such investments are not only enhancing operational capabilities but are also significantly increasing the company's net worth, far beyond just impacting profitability. The correlation underscores that digital technology investments, (immobilized assets), are a critical driver of both profitability and overall company value (equity). Investments in technology can be seen as capital investments that substantially increase the worth of a company, reflecting confidence and growth potential. The almost direct proportionality (with a correlation close to 1) suggests that equity growth is heavily dependent on how much is invested in these fixed assets.

These aspects highlight the strategic importance of investing in digital technologies such as chatbots. These investments are crucial not only for maintaining competitive advantage but also for significantly enhancing shareholder value through increased equity. In conclusion, this might involve long-term commitments to digital development through sustainable and integrated reporting.

4.2. The Analysis of Potential and Cost Amortization of Chatbot Usage Results

In the first stage, the authors obtained results for amortized costs:
Initial costs:

$$\phi_{init} = \phi_{dev} + \phi_{int} = \text{RON } 50{,}000 + \text{RON } 10{,}000 = \text{RON } 60{,}000 \quad (10)$$

Monthly operating costs:

$$\phi_{op} = \phi_{maint} + \phi_{host} + \phi_{sup} = \text{RON } 1000 + \text{RON } 500 + \text{RON } 500 = \text{RON } 2000 \quad (11)$$

Monthly benefits:

$$\phi_{tot} = \phi_{rep} + \phi_{eng} + \phi_{data} = \text{RON } 3000 + \text{RON } 1000 + \text{RON } 500 = \text{RON } 4500 \quad (12)$$

Total cost for 12 months:

$$\phi_{tot} = \phi_{init} + \left(\phi_{op} \times T\right) = \text{RON } 60{,}000 + (\text{RON } \ 2000 \times 12) = \text{RON } 84{,}000 \quad (13)$$

Total benefits for the period T:

$$\phi_{totT} = \phi_{tot} \times T = \text{RON } 4500 \times 12 = \text{RON } 54{,}000 \quad (14)$$

Net cost for the period T:

$$\phi_{net} = \phi_{tot} - \phi_{totT} = \text{RON } 84{,}000 - \text{RON } 54{,}000 = \text{RON } 30{,}000 \quad (15)$$

Amortized cost per month:

$$\phi_{amort} = \frac{\phi_{net}}{T} = \frac{RON\ 30{,}000}{12} = \text{RON } 2500 \quad (16)$$

Thus, the method of amortized analysis of chatbot usage for reporting shows that the net amortized cost per month of using chatbots to communicate sustainability reports is RON 2500 over the first year.

Secondly, the five-year total cost without a chatbot shows the amount of C_0 = 300,000 + 120,000 = RON 420,000.

Therefore, the five-year total cost with a chatbot is $C_{with\ chatbot} = \text{RON } 60{,}000 + \text{RON } 120{,}000 - \text{RON } 270{,}000 = -\text{RON } 90{,}000$.

The equation of the potential calculated, $(\Phi = C_{with\ outchatbot} - C_{with\ chatbot})$ resulted in $\Phi = \text{RON } 420{,}000 - (-\text{RON } 90{,}000) = \text{RON } 510{,}000$. Thus, the five-year amortized cost is

$$\hat{C} = \frac{\text{RON } 510{,}000}{5 \times 12} = \text{RON } 8500 \quad (17)$$

These results demonstrate that using artificial intelligence through chatbots for integrated reporting and sustainable communication can lead to significant long-term savings. Over a five-year period, the net savings represent RON 510,000, and the monthly amortized cost is RON 8500. This result suggests that implementing chatbots not only covers the initial costs but also offers considerable savings over time.

5. Discussion

Examining chatbot applications is a novel development in sustainable reporting, a domain that has predominantly focused on analytics and predictive AI tools. By addressing this gap, this study contributes to the literature on AI by demonstrating how chatbots can improve real-time communication with stakeholders and enhance the accessibility and transparency of sustainability reporting practices in emerging markets. These contributions provide a unique perspective, particularly in the context of Romania's emerging digital landscape, offering insights applicable to similar markets globally. By examining chatbot adoption among Romanian accounting firms, this study not only fills the empirical gap in AI research but also provides actionable insights for similar emerging markets with comparable challenges in digital adoption.

Regarding the objectives formulated, the authors highlight the importance of understanding the potential of accounting and consulting companies to deploy mechanisms that use artificial intelligence to gain more sustainable assets. Figure 5 visualizes the study's

key findings, demonstrating how chatbot adoption facilitates a more integrated approach to sustainability reporting, balancing financial and non-financial objectives. It serves as a practical framework for organizations seeking to align technological investments with sustainability goals.

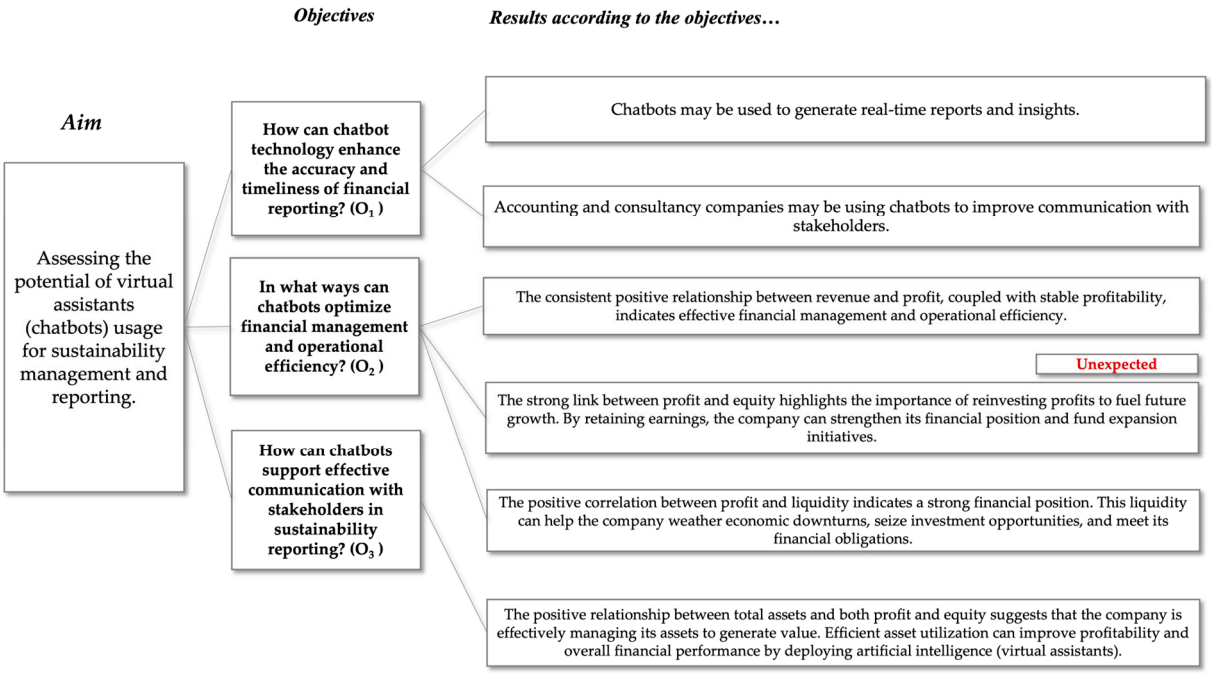


Figure 5. The overall picture of the study performed. Source: authors' conceptualization.

The findings suggest that chatbots can contribute to economically sustainable practices by enhancing financial reporting efficiency and management transparency. While these improvements may indirectly support broader sustainability goals, further research would be needed to assess their impacts on social and environmental dimensions directly. Hence, all three objectives were achieved. In addressing Objective O1, the authors investigated the potential of chatbot technology to enhance financial reporting in sustainability management. The observed correlation between asset investment and profitability underscores the strategic value of adopting digital tools like chatbots. For instance, investments in AI technologies specifically tailored for sustainability reporting contribute not only to operational efficiency but also to enhanced stakeholder trust, which indirectly drives long-term profitability. However, this relationship is contingent upon the effective implementation of these technologies and their alignment with organizational objectives. Implementing chatbots to automate data collection and analysis for real-time reporting can significantly improve financial reporting by providing timely, accurate insights. This approach is valuable not only for accounting and consulting companies, but for a broad range of businesses as evidenced in fields such as corporate finance [107], consumer behavior analysis [108], construction [109], or even government frontline services [110]. For accounting and consultancy firms specifically, chatbots offer opportunities to streamline stakeholder communication, with recent studies indicating the benefits of chatbots integrating for engaging collaborators [111] and supporting data-driven business decision-making [112]. By utilizing chatbots to generate interactive reports and answer stakeholders' queries, companies can deliver personalized financial information, enhancing transparency and facilitating more informed business decisions. This alignment with a chatbot-enabled reporting process allows organizations to provide stakeholders with real-time insights into financial performance and trends, ultimately supporting a sustainability-oriented business environment.

In exploring strategies to optimize financial management and operational efficiency (Objective O2), the researchers examined how integrated chatbots can streamline a range

of financial and administrative tasks. Chatbots can automate routine processes such as expense tracking, invoice processing, and transaction monitoring, thereby reducing manual workload and minimizing errors. Revenue and profit trends are addressed to identify areas for improvement and optimization, reinvest profits strategically to fuel future growth and strengthen the company's financial position, or maintain a healthy liquidity position to weather economic downturns and seize investment opportunities, which are three of the principal directions to develop sustainable reporting [113,114]. The outcomes generated by the correlation matrix presented in Table 6 could be aligned with the list of methods for financial management optimization (predictive analytics by using profitability and opportunity identification [115] or relationship analysis between information systems, demand, revenue, and profit management [116]). For example, the strong positive correlation between debt and revenue can be very useful for real-time reporting and dashboards communicated through a chatbot. Integrated reporting can be enhanced with real-time insights that provide a comprehensive view of financial metrics. A dashboard can be customized to alert partners about key financial ratios or other relevant metrics that exceed predefined thresholds. Real-time reporting enables quicker decision-making processes and ensures that stakeholders are consistently informed about the company's financial status.

To evaluate whether chatbot deployment can improve overall management efficiency by supporting sustainability-related functions, (Objective O3), the authors explored the relationship between technology deployment and financial performance indicators, such as profit and revenue. The findings suggest that effectively managing assets with AI-driven solutions, including chatbots, can enhance profitability and overall financial performance. The positive relationship between total assets and both profit and equity suggests that the company is effectively managing its assets to generate value. The literature supports the view, highlighting that AI technology can play a crucial role in improving profitability by maximizing resource efficiency and asset utilization [117–119].

In the context of sustainable development, the use of AI, including chatbots, offers both opportunities and challenges for accounting professionals. AI-driven automation in areas such as data entry, compliance verification, and complex financial analysis is transforming traditional practices. This shift provides new insights into financial management while also raising ethical considerations around data use. Additionally, advances in AI have led to developments in repetitive task automation, fraud detection, financial forecasting, and compliance checks, which can improve cost efficiency and support informed decision-making. The integration of ERP systems, blockchain, and virtual assistants like chatbots, not only enhances operational efficiency but also aligns with sustainability objectives by supporting ethical and accurate financial reporting.

Therefore, the findings contribute to the Technology Acceptance Model (TAM) [25,120] by demonstrating that chatbot integration in financial management might be perceived by users as both useful and easy to use, which aligns with TAM's primary constructs. Additionally, this study extends the Resource-Based View (RBV) [121,122] by showing that chatbots enhance organizational resources through the automation of repetitive tasks and the optimization of asset utilization, thereby supporting economic sustainability. Also, this study acknowledges that the dynamics of the business environment require a conceptual framework that extends strategic management and defines stakeholders as groups or individuals that can influence the achievement of a company's objectives [123]; also, it acknowledges that organizational efficiency is based on contingent factors such as technology development, the size of the organization, etc. (Contingency Theory) [124,125]. This finding suggests that chatbots can be viewed as strategic assets that improve operational efficiency, a perspective that is particularly relevant for sustainability-oriented business models. Investments in chatbots, as demonstrated in this study, enhance profitability by reducing manual reporting costs, improving operational efficiency, and fostering stronger stakeholder relationships, particularly in the context of sustainability reporting.

In a more specific way, using AI in accounting involves setting guidelines and standards to ensure fairness, transparency, and accountability. Also, a series of risks must be considered, including data security, professionalism in the use of AI, reliability of results, and, finally, compliance with copyright, etc., which we mention in this study. Accounting professionals and consultants in the financial field must participate through professional judgment in synthesizing data, completing analysis, and presenting and disseminating results. The accounting profession actively participates in the application of the latest technologies in the context of placing a special emphasis on sustainability and social responsibility. Its evolution leads to the improvement of technical skills for data analysis, presentation, and the disclosure of information. In the context of the integration of AI and other innovative technologies, the role of the accounting professional and accounting firms is changing, and they must focus on the strategic impact they can have on their clients' businesses. Finally, accounting teams can include people with expertise in various areas such as digital marketing, data analysis, or the use of AI.

6. Conclusions

This study aimed to explore the potential of chatbot technology to enhance sustainability reporting and financial management in Romania. Guided by the research questions, the authors used a mixed-method approach to collect and analyze data from Romanian accounting and consultancy firms. The outcomes of this study contribute to the existing field of knowledge. The authors emphasize analyzing the relationship between total assets, profit, and equity to identify areas for improvement in asset allocation and management and to develop strategies to increase the efficiency of asset utilization and reduce costs. This study contributes to the literature by showing a strong positive relationship between immobilized assets, equity, and profit, indicating that companies investing in long-term assets, such as infrastructure and sustainable resources, tend to experience higher profitability and equity.

The outcomes of this study highlight several theoretical implications. One of them is the importance of balancing financial and sustainability goals, considering ESG factors, and optimizing asset utilization for sustainable growth. This study underscores the importance of long-term asset investment for enhancing firm performance and also emphasizes the need to balance financial and sustainability goals. By considering environmental, social, and governance factors, firms can optimize asset utilization and achieve sustainable growth. The findings align with theoretical frameworks such as the Resource-Based View, Stakeholder Theory, and Contingency Theory, suggesting that long-term asset investment should be performed in specific firm and industry contexts. This has implications for academic research in areas like sustainable finance, accounting, and strategic management, as well as for practitioners seeking to make informed investment decisions.

For managers, this highlights the importance of balancing asset investments not only with operational efficiency and financial strategy but also with sustainability goals. This includes considering the environmental, social, and governance impacts of these investments. The key takeaway is that while investing in immobilized assets can enhance profitability and financial health, the long-term effectiveness and sustainability of these investments depend on firm-specific and industry-specific factors. Companies should ensure that their asset utilization is optimized for sustainable growth and aligned with ESG objectives, incorporating responsible resource use, minimizing environmental impact, and fostering social responsibility. Through this, firms can achieve both financial success and sustainable development, addressing the expectations of stakeholders and contributing to a more sustainable economy. Moreover, artificial intelligence has penetrated all fields of activity in the field of accounting services. This process also includes the accounting education of professionals.

A primary limitation of this study is its focus on the Romanian market, where the adoption of chatbots and other digital technologies is still emerging. From this, a key limitation of this study is its focus on a selected country, where specific market and cultural

conditions may influence the adoption and perception of chatbot technology. Factors such as digital infrastructure, regulatory frameworks, and cultural attitudes toward automation in Romania may differ significantly from those in other regions, which could limit the generalizability of the findings. This study is intended as an exploratory analysis within a regional context, and, while the results offer valuable insights, further research is needed to determine how these findings might apply in other markets with different economic and cultural dynamics. Also, as a result, the potential long-term savings and the benefits of AI chatbots, particularly in terms of scalability and 24/7 availability, may be underestimated. A more extensive analysis would require a specialized sample, including companies that have extensively implemented AI chatbots, to fully capture their impact on communicating sustainable aspects, customer service, and operational efficiency. In this ideal context, further study om the existence of chatbots and a quality assessment could provide additional insights.

Further research could focus on quantifying the impact of chatbots on specific stakeholder engagement metrics, such as response time and satisfaction rates. Additionally, employing longitudinal studies to track the scalability and cost-effectiveness of chatbot implementations over extended periods would provide deeper insights. Comparative analyses across different emerging markets would also help generalize the findings and identify regional variations in adoption patterns.

The study contributes to the literature by being one of the first to explore chatbot applications in sustainability reporting within an emerging market context. It provides actionable insights for organizations aiming to improve reporting accuracy, timeliness, and stakeholder engagement through AI technologies. Future work should focus on developing industry-specific frameworks for chatbot integration, accounting for unique regulatory, infrastructural, and cultural factors in emerging markets.

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Sustainability Reporting and Environmental Responsibility: The Case of Romania

Cristian Dobre [1], Camelia Mirela Baba [2], Carmen Elena Anton [2], Alexandra Zamfirache [3] and Denisa Aldea [4,*]

[1] Department of Econometrics and Operations Research, Tilburg School of Economics and Management, 5037 Tilburg, The Netherlands; c.dobre@tilburguniversity.edu
[2] Department of Finance, Accounting and Economic Theory, Transilvania University of Brașov, 500036 Brasov, Romania; mirela.baba@unitbv.ro (C.M.B.); carmen.anton@unitbv.ro (C.E.A.)
[3] Department of Management and Economic Informatics, Transilvania University of Brașov, 500036 Brașov, Romania; alexandra.zamfirache@unitbv.ro
[4] Interdisciplinary Doctoral School, Faculty of Economic Sciences and Business Administration, Transilvania University of Brașov, 500036 Brasov, Romania
* Correspondence: denisa.chivu@unitbv.ro

Abstract: A detailed analysis of non-financial and sustainability reporting may indicate companies' attention to and responsibility regarding environmental, social, and economic aspects. This article investigates the correlation between environmental performance as a non-financial metric and financial performance. Simultaneously, it identifies the categories of environmental information provided by companies and the implicit responsibility with which they address environmental protection issues. Data were collected from the sustainability reports of 668 companies in Romania for the 2019–2021 period. The study uses, on the one hand, a diagnostic analysis method (the grid method) to determine the environmental performance (environmental score) of the companies. On the other hand, it uses a linear regression model to test the correlation between environmental performance and financial performance (including a tolerance analysis to identify multicollinearity, forward variable selection, backward variable selection, and the Durbin-Watson test). The study's findings underscore a positive correlation between environmental non-financial performance and financial performance. In particular, high turnover and advanced age of the company are associated with high non-financial performance.

Keywords: sustainability reporting; financial performance; ESG; environmental responsibility; environmental performance

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1. Introduction

The release of non-financial information regarding the policies, results, and risks related to environmental, social, and governance (ESG) aspects that complement annual financial reports has become a necessity for all companies aiming to achieve positive performance indicators. Thus, not only the quantity of information matters, but also its quality (Ioannou & Serafeim, 2019), resulting from the transparency of disclosures to stakeholders. Enhancing credibility in a company's business model is supported by the communication of information regarding interest in the company's environmental impact, as well as an analysis of the influence of external factors on the organization within the value creation process.

There must be connectivity between sustainability information and performance indicators that meets stakeholders' requirements while ensuring high transparency in

communications (IFRS Sustainability, 2024). Companies are interested in reporting sustainability performance and choosing more sustainable business models, considering all the risks and opportunities they present. Taking into account the possibility of easier access to financing credits, knowing the requirements of partners throughout the value chain, securing the long-term future of the business by attracting new customers and investors, and the active involvement of stakeholders, it can be said that proactive acceptance of sustainability brings long-term benefits to any organization (Accountancy Europe, 2024).

Given that Eurobarometer surveys conducted in December 2019 show that 94% of citizens from all member states of the European Union pay special attention to environmental protection, and in Romania, the survey (conducted by interviewing 1081 people) revealed that 87% of Romanians agree that environmental issues are very important, all organizations are interested in achieving financial performance in line with fulfilling sustainability requirements (European Commission, 2023c).

Environmental protection aspects, as an important pillar of ESG (Environmental, Social, and Governance) issues, have come to the attention of companies as a factor influencing financial performance. According to Xue, the complex relationship between outcome-based environmental performance has implications for the adoption of managerial decisions in strategy and risk management, as well as in the development of environmental regulation policies (Xue et al., 2020).

The company's environmental performance considers the efforts it undertakes for the efficient and rational use of resources, reducing the impact of its activities on environmental objectives, and enhancing the quality of environmental management actions where the company operates. A study conducted by Ifada revealed that environmental performance has a significant positive effect on financial performance, resulting in organizations being more focused on environmental issues to strengthen their company's profitability (Ifada et al., 2021). Similarly, a study by Hanjani and Kusumadewi confirmed the existence of a positive relationship between environmental performance and financial performance, as well as between the actions of the Audit Committee, firm characteristics, ISO 14001 (ISO, 2021) Certification (International standard for environmental management systems -EMS), and environmental performance (Hanjani & Kusumadewi, 2023). Some studies have analyzed financial performance based on environmental issues (such as the effects of waste emissions, greenhouse gas reduction), with results varying according to the preferences of stakeholders. Thus, shareholders and investors focus on a company's long-term financial performance, while consumers and business partners are not interested in short-term environmental management (Iwata & Okada, 2011). Additionally, studies on the relationship between elements of corporate governance and financial and environmental performance suggest that these factors have a moderating effect on the relationship between financial and environmental performance (Nguyen et al., 2021). Empirically, most studies have focused on the effects of various variables related to ESG issues, either taken together or combined in pairs, on a company's financial performance. These studies have differently examined the relationship between sustainability and financial performance, most often considering financial performance as dependent variable, expressed through several profitability indicators. However, there are also studies that view environmental performance as a dependent variable in relation to predictors characterizing the governance structure. Based on the existing information in the specialized literature, as briefly presented above, the authors of this paper have identified a knowledge gap. Using diagnostic analysis (the evaluation grid method) to determine the non-financial (environmental) performance score brings added value and originality to our research. Environmental performance (environmental score) is less commonly used in the specialized literature as a dependent

variable, and the analysis of the correlation between it and financial factors was less widely addressed during the pandemic period (2019–2021).

The present study effectively addresses the knowledge gap in the existing literature by offering comprehensive insights into both financial and non-financial indicators that clarify the relationship between financial and non-financial (environmental) performance.

Sustainability and environmental responsibility reporting has become a crucial topic in the context of international regulations and investor requirements. European directives, such as Directive 2014/95/EU (European Union EUR-Lex, 2021) on non-financial reporting (NFRD) and EU Regulation 2022/2464 on corporate sustainability reporting (CSRD), have prompted companies in Romania to implement transparency practices when reporting their environmental impact (Mihai & Aleca, 2023). According to a study conducted by Mihai and Aleca, while the industrial sector is more sensitive to reporting requirements and faces greater challenges (Sierra-Garcia et al., 2018), research generally indicates that the industrial sector does not significantly influence corporate sustainability policies. This suggests that sustainability concerns are equally important for all companies. Aligning a sustainability strategy with a global business strategy and incorporating sustainability (non-financial) reporting requirements are key concerns for top companies in Romania (Petrescu et al., 2020). The academic literature provides diverse perspectives on sustainability reporting implementation (Pasko et al., 2021). On one hand, some authors argue that institutional pressures and legislative regulations are the primary drivers of adopting these practices (Marinescu, 2020b), while others contend that internal motivations, such as business reputation advantages and access to sustainable financing, play a significant role (Piciu, 2019). Government legislation, investor and stakeholder expectations, and voluntary international sustainability reporting initiatives have led to an increased demand for sustainability-related information (Fleacă et al., 2023). The importance of sustainability reporting frameworks is also reflected in the standardized reporting of general sustainability aspects related to business models, particularly from the perspective of the GRI reporting framework (Bunget et al., 2024). In Romania, the most frequently used frameworks are the GRI (Global Reporting Initiative) and EU standards (EFRAG, 2023). By taking proactive measures, companies can turn ESG compliance from a regulatory burden into a strategic advantage in terms of enhancing sustainability. Studies show an increasing ESG commitment among large Romanian companies, but there are still significant areas that require improvement (Dănilă & Nancu, 2023).

This study examines the relationship between environmental performance and financial performance using data from financial and sustainability reports of companies listed on the Bucharest Stock Exchange (BVB) and the listefirme.ro website. The analyzed period covers 2019 to 2021. Multiple regression analysis was used as a statistical method to evaluate the relationship between environmental performance and financial performance indicators, such as Return on Assets (ROA), Return on Equity (ROE), Solvency Ratio (SOLV), Asset Turnover Ratio (ATR), and Financial Leverage (DER), among others.

The purpose of the present paper is to calculate the environmental responsibility and performance of the companies included in the sample and examine the correlation between financial and non-financial performance (environmental performance).

In addition, the paper aims to answer research questions related to the categories of information included in sustainability reports, the performance indicators relevant to environmental performance, and the link between environmental policies and strategies and environmental performance.

Additionally, there is increased interest among the investigated firms to invest in retooling and modernization to achieve environmental objectives. There is also growing concern regarding the creation of environmental strategies. The present study's findings

are relevant to managers in Romania and beyond, providing them with the necessary framework to develop strategic plans for sustainable environmental strategies.

This paper includes five sections: Section 2 presents a literature review and some preliminary data; Section 3 presents the methods used, along with the research methodology, while Section 4 highlights the main results; Section 5 consists of discussions and conclusions. The final paragraph presents the limitations and further research.

2. Literature Review

2.1. The Regulatory Framework for Sustainability Reporting

Sustainability reporting has become increasingly important for companies worldwide, driven by growing pressure to balance financial performance with environmental responsibility. Romania, as a member of the European Union, faces both challenges and opportunities in terms of integrating sustainability into its corporate culture. This article examines sustainability reporting in Romania, focusing on environmental performance, the link between environmental and financial performance, and the role of the European Union in guiding these practices. Environmental performance, a key element of sustainability reporting, assesses how companies manage their impact on the environment, including resource use (energy, water, raw materials), waste, and emissions. Companies that demonstrate strong environmental performance can enhance their reputation and attract key stakeholders, such as consumers, regulators, and investors (Khatri & Kjærland, 2023; Papoutsi & Sodhi, 2020; Nugrahani & Artanto, 2022).

Environmental Social Governance (ESG) has emerged as a global trend in recent years, and the ESG framework has recently undergone innovative updates in terms of both regulation and sustainability standards. In Romania, the presentation of non-financial information was mandated with the transposition of Directive 2014/95/EU, which introduced the Non-Financial Reporting Rules (NFRD) (Directive 2014/95, 2023) into national legislation (Ministry of Public Finance, 2016, 2018). Thus, all companies with at least 500 employees on their most recent balance sheet, on an individual or consolidated level (regardless of whether the entity is public or private), are required to include significant ESG information in their annual report. This category also includes EU companies with branches in Romania.

It has been observed that many investors and other stakeholders have encountered difficulties in comparing ESG information among companies. In April 2021, the European Commission adopted a regulation amending the NFRD, namely, the Corporate Sustainability Reporting Directive (CSRD-2022/2464/EU) (European Union EUR-Lex, 2023). This need also arose from sustainable finance initiatives (SFRD—Sustainable Finance Disclosure Regulation) (European Commission, 2023a) and Taxonomy Regulation (European Commission, 2023b).

EU Taxonomy serves as a classification framework designed to assist companies and investors in pinpointing environmentally sustainable economic activities, thereby facilitating informed decisions when it comes to sustainable investments. Sustainable economic activities are those that create value while supporting the EU's climate and environmental goals. The CSRD seeks to broaden reporting obligations to encompass major corporations and those traded on regulated financial markets, introduce more comprehensive reporting requirements, and mandate sustainability audits.

Our analysis of the regulatory framework also outlines the answer to the first research question: "What information do publicly listed companies include in their sustainability reports?"

ESG refers to a set of environmental, social, and governance factors that organizations track to evaluate their effectiveness and influence on sustainability. These factors can

exert influence from within, impacting all areas related to ESG, and from the outside (environmental, social, governance aspects affecting the entity's activity). ESG issues are a component of an entity's operation and business model. The NFRD (Directive 2014/95, 2023) requires companies to present information that should include details about the entity's business model, a summary of the most relevant policies and outcomes regarding ESG aspects, identification of key risks and measures to mitigate their impact, the most relevant key performance indicators (KPIs), as well as aspects regarding the diversity of management bodies, their structure and size, etc. (Bucharest Stock Exchange, 2022a, 2022b).

There are certain assessment criteria through which the role of an activity in terms of achieving performance objectives related to ESG can be established, known as Technical Screening Criteria (TSC) (or performance thresholds). According to the Taxonomy Regulation (Regulation (EU) 2020/852), companies must provide information on two KPIs: turnover percentage derived from environmentally sustainable products or services, and the percentage of capital and operating expenditures aimed at acquiring assets or operational activities related to the environment. As stated by the same regulation, organizations have the option to report through a standalone environmental report or an integrated report, where financial performance is connected with sustainability performance. A sustainability report prepared in line with sustainability standards (Global Reporting Initiative (GRI) or Sustainability Accounting Standards Board (SASB)) guarantees the consistency and comparability of information communicated to stakeholders.

2.2. Present and Perspectives on Sustainability Reporting Standards

According to a study conducted by IFAC together with AICPA and CIMA ("The State of Play: Sustainability Disclosure and Assurance 2019–2022, Trends and Analysis"; International Federation of Accountants, 2024), sustainability reporting and assurance practices are improving, and companies are increasingly developing their sustainability information for stakeholders. The study, which included Romania along with six other European countries, revealed that in the 2019–2021 period, ESG information reporting in Romania followed the global trend. Thus, in 2021, approximately 88% of entities reported ESG information, but only 18% of them had their reports audited. In terms of report layout, the study revealed that 40% of them were sustainability reports, while only 4% were integrated reports, still reflecting the harmonious use of GRI and SASB standards in about 83% of companies. However, relative to other European countries, Romania needs to accelerate the implementation of sustainability standards and take a more serious approach to ESG information disclosures.

Despite progress in sustainability reporting, many European companies are not prepared for addressing sustainability according to the CSRD, as applicable from 2024. According to a study by Lefebvre Sarrut (Continuity Central.com, 2023) involving 744 European companies of various sizes and sectors, 40% of European companies are not familiar with ESG criteria, 43% have not established any benchmarks for ESG criteria, and 45% have not identified measures for implementing the requirements of the CSRD (Continuity Central.com, 2023). However, companies in the automotive, chemical, and manufacturing industries are taking serious actions to implement policies aimed at identifying risks and reducing impacts on ESG factors. Conversely, the services and consulting sectors are less committed to applying the CSRD. Awareness and understanding of the sustainability reporting framework requirements are crucial for creating value for all stakeholders and achieving a company's long-term viability. Reporting pursuant to the European Sustainability Reporting Standards (ESRS) includes requirements such as the comparability of reported sustainability information, applying the double materiality principle reporting

on the value chain, and issuing an integrated annual report (combining ESG information with financial reporting) (Wood, 2023).

The sustainable dimension of a business involves continuous monitoring of ESG criteria. The first criterion, "Environmental", considers the environmental consequences of a company's operations and its objectives regarding sustainable practices. Environmental objectives focus on carbon emissions, resource usage, waste management, pollution control, and adoption of renewable energy. The second criterion, "Social", examines a company's long-term effects on employees, customers, and society. It involves factors like labor rights, human rights, employee welfare and diversity, customer satisfaction, and product safety.

The last criterion monitors "Governance" and focuses on the structure and practices underlying the decision-making and oversight processes of a company. It includes elements like board independence, executive compensation, shareholder rights, transparency, and risk management.

ESG is perceived as a crucial determinant of long-term corporate performance, with companies increasingly focusing on integrating these pillars alongside their financial objectives. The literature on ESG and corporate performance explores how these factors interact and influence a company's financial success, stakeholder relationships, and overall sustainability.

These ESG factors are interconnected and contribute to an organization's corporate performance by improving operational efficiency, strengthening brand reputation, and mitigating risks related to social or environmental incidents. ESG's role in corporate performance has been recognized as a dynamic process in academic literature (Wang et al., 2025). Researchers have emphasized that ESG factors should be integrated into a company's overall strategy and operations. Companies with strong ESG frameworks tend to be better positioned for long-term sustainability, as they consider not only short-term profits but also the long-term implications of their environmental, social, and governance practices (R. Chen et al., 2023). The relationship between ESG practices and financial performance has been a key area of interest in management literature. Researchers have explored whether investments in ESG initiatives translate into improved financial returns for companies (Moussa et al., 2024).

Numerous studies have suggested a positive relationship between strong ESG performance and enhanced financial outcomes (S. Chen et al., 2023) supported by lower operating costs through energy efficiency and waste reduction. Attention to ESG factors drives value creation for stakeholders (Hoang, 2018) and provides a competitive advantage over competitors (Teng & Wu, 2018).

However, the literature also includes studies that question or highlight a neutral or negative relationship between ESG and financial performance. One reason for this divergence is the potential short-term costs associated with implementing robust ESG practices. For example, companies may face high initial costs when adopting green technologies or meeting social compliance standards. For smaller firms or those in emerging markets like Romania, immediate financial benefits may not justify these initial investments (Bahadır & Akarsu, 2024; Y. Xu & Zhu, 2024). The theoretical evolution of ESG and corporate performance initially focused on shareholder wealth maximization (1970–1980). Then, with the application of stakeholder theory (1980–1990), interest shifted toward creating value for all business stakeholders (Bridoux & Stoelhorst, 2022; Freeman, 1984), From 1997–2000 onward, the Triple Bottom Line (TBL) approach, introduced by John Elkington, formalized the concept of balancing environmental, social, and economic factors as part of business performance (Pasamar et al., 2023; Elkington, 1998).

The theoretical evolution of ESG literature and corporate performance reflects a growing recognition of the long-term value of sustainable practices, alongside concerns about the short-term costs of their implementation.

In recent years, researchers and practitioners have emphasized the need for integrated reporting, where financial performance and ESG factors are not treated separately but are incorporated into a comprehensive view of a company's long-term performance. This shift in perspective aligns with the increasing focus on long-term value creation rather than short-term profit maximization (Narula et al., 2023).

Empirical methods used in studies include quantitative analysis, such as regression analysis to examine the relationship between ESG performance and financial performance, case studies, meta-analyses aggregating results from multiple empirical studies to determine the overall strength of the ESG-financial performance relationship, and experimental models (Soedjatmiko et al., 2021; Pereira et al., 2023; Nguyen et al., 2021; Ifada et al., 2021; Fu & Li, 2023; Fink Babič et al., 2023). ESG performance leads to superior long-term financial results but involves high immediate financial costs and significant uncertainties.

At the EU level, the Corporate Sustainability Reporting Directive (CSRD) 2022/2462 extends ESG reporting to more categories of companies, impacting their business models. It also calls for the adoption and expansion of European sustainability reporting standards (ESRS). The CSRD application schedule is as follows: in 2025, it will include companies already applying non-financial reporting (NFRD) (over 500 employees) for the financial year 2024; in 2026, it will consist of large companies with more than 250 employees, a turnover of more than 40 million euros, and total assets of more than 20 million euros at the end of the 2025 financial year; in 2027, it will incorporate insurance companies, SMEs listed on the stock exchange, as well as credit institutions, for the financial year 2026; and in 2029, non-European companies with branches or subsidiaries in the European area will be inserted.

In Romania, the application schedule follows the directive's timeline and reports the ESG Strategy and action plan, as well as the method of achieving ESG objectives and targets, through the annual report, comprising qualitative, quantitative, retrospective, and prospective information (V. D. Dragomir et al., 2023).

The academic literature reveals a dynamic intersection of perspectives regarding the role of regulations, directives, federations, and stock exchanges in driving ESG performance. On one hand, mandatory regulations and directives are seen as essential tools for holding companies accountable and ensuring that ESG factors are systematically embedded in corporate governance (Eccles et al., 2014; Cicchiello et al., 2023).

On the other hand, there is recognition that the voluntary nature of market-based initiatives, such as those promoted by stock exchanges and federations, can complement regulatory efforts by encouraging firms to go beyond mere legal compliance (Krueger et al., 2023). The mixed nature of these frameworks—regulatory versus market-based—raises important questions about the most effective ways to encourage companies to adopt sustainable practices (Gafni et al., 2024; Aluchna et al., 2023).

The ongoing debate revolves around an optimal balance between mandatory and voluntary approaches. Proponents of regulations argue that as global sustainability challenges become more complex, they require a more rigorous legal framework (Bu et al., 2024; Kuzey et al., 2023), Meanwhile, others suggest that the flexibility offered by voluntary stock exchange frameworks allows firms to tailor their ESG strategies to their specific circumstances (Cheng & Huang, 2024; R. Chen et al., 2023; Ismaili & Kjøsnes, 2021).

This highlights the need for a holistic approach that integrates the strengths of both regulatory mandates and voluntary market mechanisms, ensuring that all firms, regardless of size or location, are encouraged to improve their ESG performance.

In conclusion, the literature offers a rich and diverse perspective on the role of regulations, directives, federations, and stock exchanges in promoting ESG integration within corporate strategy. The convergence of regulatory mandates, market-based mechanisms, and global sustainability initiatives creates a complex landscape in which companies must navigate competing pressures to meet growing stakeholder expectations (Ullah & Sun, 2021; Abeysekeraa & Fernando, 2020; van der Merwe & Al Achkar, 2022).

While evidence suggests that these frameworks can positively impact corporate performance, the debate over their relative effectiveness continues, with differing views on the appropriate balance between legal enforcement and voluntary adherence. Considering the provisions of reporting standards and the application method used by companies which are subject to these standards, the following research question arises: "What are the most relevant performance indicators associated with environmental performance?"

2.3. Empirical Literature

Alongside other studies, this work complements information regarding the relationship between environmental capabilities and various financial indicators grouped into profitability, liquidity, risk, and efficiency indicators.

Environmental capabilities enhance profitability through cost savings from energy efficiency, waste reduction, and resource optimization. Companies that implement green technologies can lower operational costs, improve margins, and access premium markets by offering eco-friendly products (Yang & Chen, 2022). Financial performance metrics include return on assets (ROA), return on equity (ROE), and net profit margin, while indicators for environmental capabilities include energy-efficient technologies and sustainable product offerings. Liquidity is another financial metric impacted by environmental capabilities, as cost reductions and minimized exposure to regulatory fines contribute to stronger cash flow.

Proactive environmental practices improve cash flow and protect companies from legal sanctions, making it easier to meet short-term financial obligations (Arco-Castro et al., 2023; K. Kim, 2018; Saleem et al., 2021). Environmental capabilities also mitigate risks, particularly environmental and regulatory risks. By adhering to environmental standards, companies avoid penalties, minimize climate-related disruptions, and safeguard their reputation (Y. Chen et al., 2021; Geng et al., 2017). The impact of environmental capabilities on financial performance often unfolds over a longer time frame (3–5 years), with short-term benefits primarily reflected in cost reductions.

In conclusion, environmental capabilities can positively influence profitability, liquidity, risk management, and operational efficiency. Proactive environmental practices lead to improved financial outcomes over time, although the full benefits may only be recognized after a longer evaluation period (Tyler et al., 2024; Saleem et al., 2021). Key financial performance measures include ROA, the current ratio, and stock price volatility, while energy efficiency, waste management, and environmental compliance are the main variables of environmental capability.

Research by Haninun et al. (2018) on 108 companies listed on the Indonesia Stock Exchange (BEI) showed that environmental performance is influenced by financial metrics such as return on assets (ROA) and return on equity (ROE). Similarly, an analysis of the impact of environmental performance and management on firm value, measured with return on assets as a financial mediator (ROA), was conducted on a sample of 144 manufacturing organizations listed on the Indonesia Stock Exchange (IDX) (Soedjatmiko et al., 2021).

Investigating the relationship between environmental performance and financial performance, as represented by indicators such as profit margin increases, market share growth, revenue growth, return on investment improvement, and overall financial performance

improvement, with environmental innovation as a mediator, highlighted the effect of environmental innovation in transforming environmental achievements into financial success (Ong et al., 2019). Studies have deepened the issue of environmental performance, connecting environmental strategy, reporting, and firm performance. Moreover, they have shown a positive impact of climate action plans on environmental management control system usage, as well as an indirect positive impact on environmental performance. Environmental governance itself positively influences environmental performance and, ultimately, economic progress (Petera et al., 2021).

As environmental reporting is voluntary, research has shown that there is no meaningful association between environmental performance and the qualitative environmental information in company reports (Fink Babič et al., 2023). However, it is worth noting that developed environmental consciousness affects environmental management performance and thus overall performance, suggesting that companies need to develop environmental awareness when disclosing environmental information (M. Kim & Ha, 2022).

In general, it is expected that organizations will improve their environmental performance and become more interested in communicating actions to stakeholders, as confirmed by a study by Rúbia Maria Pereira et al. (Pereira et al., 2023). This study showed that environmental disclosure is positively associated to environmental performance, indicating a revelatory positive correlation between the two. Some studies have identified factors that can have an influence on environmental disclosure and performance by analyzing the top 100 Fortune Global companies, showing that the region and level of environmental information disclosure are key factors (Bednárová et al., 2019). Environmental performance analyses have also been conducted across multiple countries to demonstrate success in achieving environmental sustainability goals (Wendling et al., 2022).

Corporate environmental practices influence environmental performance. Proactive environmental practices can lead to better environmental performance (K. Kim, 2018). In contrast, reactive environmental practices are correlated with poorer environmental performance. The distinction between proactive and reactive environmental practices is essential for assessing their impact on environmental performance. While proactive practices involve strategies that prevent ecological damage before it occurs, reactive practices are responses to existing environmental issues. These different approaches have significant implications for a company's sustainability and efficiency. Proactive environmental practices focus on innovative measures that lead to efficient production processes, waste and energy reduction, and pollution minimization. These include investments in green technologies and renewable energy sources, which improve environmental performance and operational efficiency while significantly reducing costs (Ahmed et al., 2021a; Ahmed et al., 2021b; Laguir et al., 2021; Galbreath et al., 2023; S. Zhang et al., 2019).

Additionally, integrating sustainability into corporate strategies through the adoption of the ISO 14001 environmental management standards enhances stakeholder trust (Eccles et al., 2014). Proactive measures reduce non-compliance risks, making companies more attractive to investors (Eccles et al., 2014). In contrast, reactive environmental practices are implemented in response to existing problems, such as regulatory compliance or ecological damage remediation. These practices are less effective in minimizing environmental impact and primarily focus on damage control (Arco-Castro et al., 2023; Y. S. Chen et al., 2016; Liston-Heyes & Vazquez Brust, 2016; Fazli et al., 2023; Bouwman & Berens, 2024), without driving significant innovation. They tend to prioritize short-term actions over long-term sustainability improvements. The measurement of environmental performance for reactive companies includes indicators such as high pollution levels, excessive waste production, and remediation costs. Performance is often assessed in the short term, typically in response to environmental crises or regulatory compliance requirements.

In conclusion, proactive practices based on prevention and innovation lead to long-term sustainable improvements in environmental performance. In contrast, reactive practices are associated with corrective measures and lower long-term efficiency, often proving costly and ineffective.

In Romania, companies' sustainability reports show continuous improvement in non-financial information disclosure, with companies focusing on sustainable processes and business models prioritizing ESG objectives (Marinescu, 2020a). This idea is supported by a study by Piret Tamm and Natalie Aleksandra Gurvitš-Suits (Tamm & Gurvitš-Suits, 2023), which concluded that non-financial information disclosed through environmental reports, CSR reports, and ESG reporting increases stakeholder credibility and contributes to creating value in sustainable business operations. ESG reporting aims to align with CSRD reporting requirements to ensure the comparability of the disclosed information, with a crucial role in producing high-quality reports being attributed to the education of specialists. Most research illustrates that a company's financial achievements are influenced by the complexity and quality of ESG reporting, and ESG performance positively impacts market capitalization (Janicka & Sajnóg, 2022).

The quality of sustainability report content can be highlighted through indicators grouped into domains such as Credibility (CRE), Content (CON), and Communication (COM) (Loza Adaui, 2020). Environmental disclosures focus on reducing electricity consumption, reducing water usage, decreasing carbon footprint, and waste recycling and management. They also analyze the existence of action plans for environmental incidents, provide information disclosures on environmental protection training programs, and summarize monitoring environmental progress.

Based on considerations regarding the nature of the information published in sustainability reports, as well as their diversity and quality, the research question arises: "What is the connection between environmental policies and strategies and environmental performance?"

Sustainability implementation is a complex process that encompasses the entire activity of an organization, requiring well-prepared structures to implement all initiatives dealing with environmental, social, and governance aspects. Evaluating the risks associated with environmental factors that can affect a business helps in developing an environmental policy aimed at reducing resource consumption and waste (International Federation of Accountants, 2023).

The increasing demand for information and stakeholders' expectations have led to the development of quality reports on sustainability disclosures. Continuous communication with stakeholders and the understanding of their information needs contribute to the clarification of an entity's priorities from both an economic strategy perspective and in terms of stakeholder expectations.

The general framework and structure of the information released within sustainability reports are outlined by the GRI Sustainability Reporting Standards (Global Reporting Initiative, 2022), including context for a better understanding of a business's environmental impact, activities, governance, policies, and the most relevant topics impacting the economy, environment, and employees. Communicating sustainability information can be harmoniously achieved through integrated reports where managers promote a high level of divulgence and transparency regarding economic activities, a view shared by several authors. (Băndoi et al., 2021).

A review of the literature showed that sustainability performance and external assurance are factors that determine the credibility of sustainability information (Misiuda & Lachmann, 2022).

According to GRI reporting, companies must explain their economic performance in relation to ecological concerns such as resource conservation, pollution management, waste control, etc., amid increasing stakeholder demands. Studies convey that 66% of the largest global companies adhere to GRI standards when reporting their environmental performance (Bednárová et al., 2019). In various sectors, performance indicators can be grouped into environmental impact, operational and safety, waste management, and public safety indices (Farouk et al., 2024).

Studies conducted at the EU level on factors influencing environmental performance reveal positive relationships between the EPI (Environmental Performance Index) and organic farming area, resource consumption, energy productivity, the ratio of active labor force participation between women and men, digitalization through internet use, eco-innovation, etc. (Stoian et al., 2022). Thus, ecological innovation within firms could impact the link between sustainable entrepreneurial motivation and environmental performance. An additional factor that may moderate the interconnection between ecological entrepreneurial motivation and green innovation is knowledge sharing (Al Shammre et al., 2023). The most commonly used performance indicator is return on assets (ROA), which reflects resource allocation efficiency, with studies demonstrating that ESG performance contributes to increased financial performance (Fu & Li, 2023).

The implementation of sector-specific development strategies, such as those in industrial sectors implemented by governments, can influence environmental performance through technological progress achieved via technology imports (Z. Zhao et al., 2023). Collaboration among government environmental policies, focused media attention, and investment preferences, contributes to the acknowledgement of environmental performance (D. Wu & Memon, 2022). Enterprises within the same sector can aim to align their environmental strategies and policies with the environmental standards set by policymakers and encourage innovation in green technology (Kong, 2024).

There is statistical evidence that there is a correlation between each country's environmental regulations and their implementation with the outcomes achieved regarding environmental performance. However, the degree of rigor in the implementation of these policies and their impact on environmental performance should also be examined in greater depth (Tian et al., 2023).

According to Kumar et al. (2021), most research highlights the relationship between sustainability and business strategy. One of the themes researched in the specialized literature is related to collaboration among firms for sustainability (C.-C. Dragomir & Foris, 2022; Bărbulescu et al., 2021).

Environmental regulations can impact technological innovation for sustainable development. Incorporating environmental principles and policies into business strategies ensures resilience to extreme events and adaptation to ecological developments (Y. Wu & Tham, 2023; Zhou et al., 2022). In the development of SMEs, an important relationship is constituted by social and environmental practices (Crossley et al., 2021).

An entity's strategy and sustainability objectives are described in its sustainability report, highlighting the company's policies and procedures that outline its commitments and actions to monitor both quantitative indicators and qualitative information. The integration of ESG factors is aligned with the entity's economic strategy, objectives, and key risks throughout the value chain. In the context of corporate sustainability, measuring financial and environmental performance is essential for evaluating a company's efficiency. Environmental and financial indicators are interconnected, and their selection depends on the company's strategic objectives, ranging from regulatory compliance to long-term sustainability. In this study, indicators from two categories were selected (Table 1): (1) Environmental strategies and policies, i.e., Definition of environmental objectives; Planning

actions to achieve the objectives; Procedure for environmental incidents; Training programs on environmental protection; and Involvement in the development of community environmental projects; and (2) Environmental performance, i.e., Improving air quality; Reducing electricity consumption; Reducing water consumption; Reducing carbon footprint; and Recycling and waste management (K. Kim, 2018).

Table 1. Analysis criteria.

Analysis Criteria for Sustainability Reports	Importance Coefficient pi
Environmental strategies and policies	**0.55**
Definition of the environmental objectives	0.15
Planning actions to achieve the objectives	0.15
Procedure for environmental incidents	0.05
Training programs on environmental protection	0.05
Involvement in the development of community environmental projects	0.15
Environmental performance	**0.45**
Improve air quality	0.07
Reduce electricity consumption	0.08
Reduce water consumption	0.08
Reduce carbon footprint	0.08
Recycling and waste management	0.14
Total	**1**

Source: realized by the authors.

The analysis of environmental reporting aims to reflect the relevance of these indicators (especially proactive environmental strategies) in relation to financial performance. This study contributes to environmental sustainability research by emphasizing the organizational system and adapting the business model to achieve compatibility with sustainability requirements (Junquera & Barba-Sánchez, 2018; Leonidou et al., 2015). The financial performance indicators used include return on assets (ROA) and return on equity (ROE), net profit margin, current ratio, and quick ratio, which measure the ability to meet short-term liabilities, as well as asset turnover ratio, among others. In conclusion, environmental and financial performance indicators are essential for ensuring a company's sustainability and long-term success. Proper measurement of these indicators supports the achievement of a balance between profitability and environmental responsibility, which is crucial for competitiveness in the green economy.

3. Materials and Methods

This study relies on data collected from the Bucharest Stock Exchange website (Bucharest Stock Exchange, 2022a), supplemented with data from website Romanian Companies (Romanian Companies, 2020). Based on the general objective of the paper, we selected companies with at least 500 employees which were mandated to address environmental, social, and employee-related aspects, as well as human rights and anti-corruption measures in the administrator's report when preparing financial statements (OMFP 3456/2018, point 8). For the financial year 2021, environmental reports had to address objectives such as climate change mitigation and adaptation to climate change (Ministry of Public Finance, 2024), as mentioned in Article 9(a) and (b) of Regulation (EU) 2020/852 of the European Parliament and the Council.

The database was composed of 675 companies from Romania, which were analyzed according to the research questions of this paper. Companies that presented incomplete or missing information were eliminated. For the remaining 668 Romanian companies, observations were converted into financial and non-financial indicators, such as Turnover,

Net profit, Debts, Fixed assets, Current assets, Equity, Employees, Total assets, for the 2019–2021 period. The establishment of these indicators was carried out using the SMART (Smarters, 2025) principle. Also, their availability in the databases, their relevance to the objectives established in the paper, and their publication in the specified time interval were prerequisites. The indicators used are those used in the literature, with the addition of extra indicators; the justification for their choice was also the criteria they met in addition to the SMART criterion, namely, applicability in all sectors of activity, transparency, their independent verifiability, their correspondence with the objectives pursued, and their compatibility with the specifics of the company. The companies are distributed by activity sectors as follows: Services (including a small number in financial services)—253 companies (37.48%); Production (Manufacturing and Industrial)—248 companies (36.47%); Trade—86 companies (12.74%); Transportation—42 companies (6.22%); Energy/Utilities—39 companies (5.78%); and Agriculture—7 companies (1.04%). This distribution demonstrates that the sample included diverse industries, with a balanced representation of manufacturing and service-oriented businesses. Financial and insurance companies represented only a small fraction of the service sector and did not significantly influence our findings.

By capturing a broad range of industries, the sample ensured that the insights derived from the analysis were not confined to a single sector but reflected cross-industry trends. However, we acknowledge that sectoral differences may have influenced specific outcomes, and we now explicitly discuss these implications in the revised manuscript.

The purpose of the chosen methodology is two-fold. On one hand, we sought to fit a statistical (linear regression) model that contained financial indicators as regressors and a score obtained from the non-financial indicators as a dependent variable. On the other hand, we attempted to explain the relationship between financial performance indicators and non-financial performance score (environmental performance).

To determine the environmental score, a diagnostic analysis method was used, specifically, the evaluation grid method. This involves:

- Setting up the analysis criteria and assigning grades between 1 and 5 in order to assess the state or gradual change of the procedural components;
- The allotment of importance coefficients for each criterion in conformity to its position in the analysis grid;
- Rating the generic state of the component as an average score

$$N_{med} = \Sigma\, n_i \; X \; p_i, \tag{1}$$

- where n_i is the grade awarded to each component and p_i is the importance coefficient (Achim & Borlea, 2009).

The criteria analyzed in each environmental report and the corresponding importance coefficient for each can be found in Table 1.

The conducted research used Environmental Performance (EP) as the main dependent variable and employed the content analysis method to measure EP, taking into account studies such as those of Ntim et al. (2013) and Ntim and Soobaroyen (2013).

Every effort was made to ensure that EP was a valid and reliable measure of environmental performance by reiterating the coding process three times.

In the first coding stage, two independent coders computed the environmental performance for an initial sample of 50 companies and then analyzed and discussed the criteria used by the scoring method and the allocated importance coefficients (Table 1).

In the second stage, the two coders eliminated inconsistencies from the coding process.

In the final coding round, following Krippendorff's (2004) recommendations, another 50 companies were coded by two independent coders and a new independent coder with experience in using content analysis and reading financial and non-financial reports.

No inconsistencies or mistakes were identified; therefore, the EP was considered as a valid and reliable measure reflecting the environmental performance reported by companies in Romania.

Based on the specialized literature and the coding process using the scoring method, EP included an analysis based on ten analysis criteria (Table 1). Each analysis criterion was rated between 1–5 based on the qualitative or quantitative reporting of environmental performance in the sample companies' annual and corporate social responsibility reports (Tîrnoveanu, 2018), and then the final EP value was determined. The score varied between each element due to differences in quantitative information. As a result, the optimal score was five and expressed a measure for EP (Nguyen et al., 2021).

After all these coding and pretesting stages, the authors created a database comprising 668 companies for the three analyzed years. Thus, 2004 valid observations emerged.

To understand the contribution of each financial indicator (or predictor) to the non-financial indicators combined to form the environmental performance score (EP), an economic explanation of these indicators is provided.

Return on Assets (ROA) refers to the efficiency of capital allocated in the total assets (fixed assets and current assets) of the company and reflects the company's profitability relative to its total assets. The calculation method of this indicator did not consider the sources of capital (equity or borrowed) and thus did not take into account the relevant financing policy (Țilică & Ciobanu, 2019).

Return on Equity (ROE) is a financial performance metric that highlights a company's ability to generate profit using its available equity. Since the difference between the value of total assets and liabilities represents equity, ROE signifies the profitability of net assets. Investors use ROE to assess whether their investment is profitable or not (Robu et al., 2014).

Financial Leverage (DER) signifies the degree of total indebtedness of a company relative to its equity. If the indicated value is greater than two, it reflects over-indebtedness of the company due to its use of external financing sources much more than internal (own) sources.

The Solvency Ratio (SOLV), determined by dividing total assets by total liabilities, should present a value larger than 0.3. A value below 0.3 indicates significant prudence from creditors, with the company's condition being semi-bankrupt.

The Asset Turnover Ratio (ATR), calculated by comparing total revenues to the total value of assets, signifies the efficiency in utilizing the company's assets (Niculescu, 2003). A company with a high asset turnover ratio indicates high operational efficiency compared to its competition.

A lower ATR signifies a company's potential inefficiency in leveraging its assets to generate revenue. It is crucial to acknowledge that the ATR can exhibit substantial variability across different industries. For example, retail businesses typically possess smaller asset bases yet achieve higher sales volumes, resulting in an elevated ATR. In manufacturing or construction enterprises, the value of assets is high, and they record much lower turnover.

The analyzed database included companies from various industries, and the average recorded for this indicator was 3.24 (in the retail sector, a ratio of 2.5 or higher is considered good) (GoCardless, 2022).

Labor Productivity (LP) is a dynamic economic indicator reflecting the efficiency with which labor is utilized. The extension of labor productivity hinges on three primary factors:

the accumulation and investment in physical capital, the advent of new technologies, and the development of human capital.

Capital Intensity (CAP) signifies the large capital input invested in a business process across different industries. The need for investments in fixed assets (land, buildings, installations, and equipment) is higher in special activities (oil extraction, chemical and oil plants, aircraft production, etc.). Industries requiring large capital investments are recognized as capital-intensive businesses.

The Equity Multiplier (EQM) represents the quantitative relation between a company's total assets and its equity, reflecting the portion of the company's assets financed by equity. An elevated ratio denotes increased financial leverage (total debt to equity), whereas a diminished ratio signifies reduced financial leverage.

The performance indicators (model variables) ROA, ROE, DER, SOLV, ATR, LP, CAP, and EQM were determined by using simple indicators (Turnover, Net Profit, Debt, Fixed Assets, Current Assets, Equity, Employees and Total Assets).

The initial hypothesized model chosen for the conducted regression analysis is:

$$\begin{aligned} EP = b_0 + b_1 * ST + b_2 * NoE + b_3 * TA + b_4 * ROA + b_5 * ROE + b_6 * DER + b_7 * SOLV + b_8 * ATR + \\ b_9 * LP + b_{10} * CAP + b_{11} * EQM + b_{12} * FA + e \end{aligned} \quad (2)$$

The variables are described in Table 2.

Table 2. Description of models' variables.

Variable	Coding	Measuring
EP (environmental performance)	EP	Score
Sales turnover	ST	Total sales
Number of employees	NoE	Average number of employees
Total assets	TA	Total assets
Return on assets	ROA	Net income/Total assets
Return on Equity	ROE	Net income/Equity
Debt-to-Equity Ratio (leverage)	DER	Total debt/Total equity
Solvency ratio	SOLV	Total assets/Total liabilities
Asset turnover ratio	ATR.	Turnover/Total assets
Labour productivity	LP	((Turnover/1000)/Number of employees
Capital intensity	CAP	Total assets/Sales Turnover
Equity multiplier	EQM	Total assets/Equity
Firm age	FA	Years since the foundation

Source: realized by the authors.

Our data analysis was performed utilizing the IBM SPSS Statistics software versione 26 (Howitt & Cramer, 2006), implementing an array of analytical methods (Malhotra, 2004). The chosen models and techniques for data analysis were meticulously aligned with the research objectives (Constantin, 2006; Jaba & Grama, 2004).

The following methods were employed: coefficient of variation analysis [cv], t-tests on the Beta (b_i) coefficients of the regression, coefficient of variation R Squared, F test on the set of the ten aforementioned regressors, Tolerance Analysis for identification of multicollinearity, forward variable selection, backward variable selection, as well as the Durbin Watson test (Bobbit, 2024).

4. Results

The study results indicated that the fit of the linear regression model with EP as a response variable and the ten indicators (turnover, number of employees, ROA, ROE,

DER, CAP, LP, SOLV, ATR, and FA) as explanatory variables was good (α = 0.01% and R = 0.21). This implies that the variability in the values of EP could be partially explained by the variability in the values of any of the ten indicators. Moreover, the findings of the study indicated a significant positive correlation between turnover and environmental performance, suggesting that increased turnover corresponds with higher environmental performance values.

For the application of the Durbin Watson Test, the tabulated values were d1 = 1.891 and d2 = 1.901 for the significance level α = 1%, and dcal = 0.75, so dcal < d1, resulting in the declining of the null hypothesis of residue independence, i.e., the errors exhibited autocorrelation.

According to the descriptive statistics (Table 3), there was a moderate variation in the score for the environmental performance (EP) indicator [10% < cv < 20%] and a high variation [cv > 20%] for the indicator's turnover, number of employees, total assets, ROA, ROE, DER, CAP, EQM, LP, SOLV, ATR, and FA.

Table 3. Descriptive statistics.

Variable	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Mean Std. Error	Std. Deviation Statistic
EP	2004	3	2	5	3.44	0.010	0.456
ST	2004	24,671,024,844	1239	24,671,026,083	822,327,295.77	42,604,382.579	1,907,230,285.9
NoE	2004	22,844	0	22,844	1211.19	42.574	1905.868
TA	2004	83,216,748,402	25,401	83,216,773,803	904,843,681.38	89,372,100.600	4,000,836,690.1
ROA	2004	3	−2	1	0.06	0.004	0.158
ROE	2004	340	−280	60	0.04	0.149	6.675
DER	2004	3556	−251	3306	5.20	1.806	80.868
CAP	2004	55,723	0	55,723	29.39	27.807	1244.789
EQM	2004	3561	−280	3281	6.57	1.813	81.162
LP	2004	2,459,929,135	0	2,459,929,135	54,173,298.68	4,565,975.919	204,400,745.41
SOLV	2004	122	0	122	3.22	0.120	5.359
ATR	2004	13	0	13	1.86	0.030	1.340
FA	2004	2011	−1980	31	15.28	1.734	77.644

Source: realized by the authors, using the results obtained from SPSS 26.

The descriptive statistics revealed several key characteristics of the dataset: Outliers and Extreme Values. Some variables exhibited a wide range and extreme values, particularly ROE (range: 340, minimum: −280, maximum: 60), DER (range: 3556, minimum: −251, maximum: 3306), and EQM (range: 3561, minimum: −280, maximum: 3281).

These extreme values suggest potential outliers that could have influenced regression estimates and require appropriate treatment.

Skewed Distributions: Several financial variables, such as ST (Short-term liabilities), TA (Total Assets), and LP (Liquidity Position), exhibited high standard deviations relative to their means. This suggests a right-skewed distribution, likely driven by a few large firms.

Negative Values: Variables like ROA, ROE, FA, and CAP included negative values, which may indicate financial distress or specific accounting treatments in certain firms. These values were carefully considered in our model specification to ensure that they did not introduce unintended biases.

Economic Implications: The solvency ratio (SOLV), with a maximum value of 122 and a mean of 3.22, suggests that while most firms maintained reasonable solvency, a few exhibited extremely high values, likely distorting the distribution. Similarly, the ATR (Asset Turnover Ratio) had a mean of 1.86 but reached a maximum of 13, implying variability in operational efficiency among firms.

To mitigate the potential impact of extreme values, we conducted further analyses by testing different thresholds for outlier exclusion. Additionally, we assessed model robustness until we reached the final regression model.

An important statistical indicator of interdependencies is the coefficient of variation (cv), proposed by K. Pearson. To study the potential associations among the economic-financial indicators, a correlation matrix was calculated (Table 4).

Table 4. Matrix of correlations.

Variable	EP	ST	NoE	TA	ROA	ROE	DER	CAP	EQM	LP	SOLV	ATR	FA
EP	1	0.164 **	0.093 **	0.040	−0.041	0.001	−0.003	0.003	−0.006	0.075 **	−0.034	−0.091 **	0.066 **
ST		1	0.436 **	0.423 **	−0.001	0.005	−0.011	−0.010	−0.013	0.244 *	−0.028	0.011	0.026
NoE			1	0.365 **	−0.056 *	−0.007	0.002	−0.003	0.002	−0.166 **	−0.018	−0.062 **	0.011
TA				1	−0.033	0.001	0.002	−0.003	0.004	0.097 **	0.101 **	−0.160 **	0.014
ROA					1	0.054 *	−0.027	−0.216 **	−0.028	0.039	0.043	−0.207 **	0.027
ROE						1	−0.895 **	0.000	−0.890 **	0.003	0.005	0.032	0.016
DER							1	−0.002	0.999 **	−0.011	−0.024	0.001	−0.015
CAP								1	−0.002	−0.0006	−0.012	−0.032	−0.003
EQM									1	−0.012	−0.019	−0.002	−0.014
LP										1	0.013	−0.044	0.016
SOLV											1	−0.226 **	0.028
ATR												1	−0.021
FA													1

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed). Source: realized by the authors, using the results obtained from SPSS.

Pearson's coefficient of variation assumes that the data are measured on a ratio scale with a meaningful zero point and that the underlying distribution is approximately normal when making inferential comparisons. However, in this analysis, model selection was employed to determine the most relevant regressors, ultimately defining the threshold for inclusion. At this stage, the primary purpose of the correlation table was to serve as an initial diagnostic tool for identifying potential collinearity among explanatory variables, rather than to assess the strength of individual relationships.

Upon examination of the correlation matrix, it was evident that there were statistically significant correlations among the variables studied, both positive and negative, as follows:

- EP was positively correlated with ST (sales turnover) (r = 0.16 ***), NoE (number of employees) (r = 0.09 ***), LP (labor productivity) (r = 0.07 ***), FA (firm age) (r = 0.07 ***) and negatively with: ATR (r = −0.09 ***);
- Sales turnover (ST) was positively correlated with Number of employees, Total assets (TA), LP (correlation coefficients range between 0.24 and 0.44);
- Number of employees was correlated with Total assets, ROA, LP and ATR, exhibiting both positive and negative associations;
- TA (Total assets) was correlated with LP, SOLV, ATR, involving positive as well as negative interconnections;
- ROA was correlated with ROE, CAP, and ATR, having bidirectional correlations;
- ROE is correlated with DER and EQM (very strong negative correlations);
- DER was positively correlated with EQM, indicating a strong straight connection between these two variables, implying a strong linear dependence;
- SOLV was negatively correlated with ATR.

The correlation matrix suggested high collinearity between EQM and DER and between EQM and ROE. Therefore, we eliminated the regressor EQM (Equity Multiplier) in the regression model, retaining DER and ROE to obtain:

$$\begin{aligned} EP = b_0 + b_1 * ST + b_2 * NoE + b_3 * TA + b_4 * ROA + b_5 * ROE + b_6 * DER + b_7 * SOLV + b_8 * ATR + \\ b_9 * LP + b_{10} * CAP + b_{11} * FA + e \end{aligned} \quad (3)$$

For the aforementioned equation, we then tested the analysis of variance of the response EP (Table 5).

Table 5. Variances for Examining Multiple Regression (Equation (1)—F-test).

ANOVA [a]					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	19.423	11	1.766	8.857	<0.001 [b]
Residual	397.128	1992	0.199		
Total	416.550	2003			

[a] Dependent Variable: EP [b] Predictors: (Constant), FA, CAP, NoE, DER, SOLV, LP, ROA, ATR, TA, ST, ROE.

The F-statistic (8.857) and the very low *p*-value (<0.001) suggested that the regression model was statistically significant. This means that the independent variables collectively explained a significant portion of the variance in the dependent variable.

The regression coefficient estimation is shown in Table 6.

Table 6. Regression coefficient matrix [a].

Variable	**Unstandardized B**	**Coefficients Std. Error**	**Standardized Coefficients Beta**	**t**	**Sig.**	**Collinearity Tolerance**	**Statistics VIF**
Constant	3.476	0.022		161.578	<0.001		
ST	3.745×10^{-11}	0.000	0.157	5.744	<0.001	0.644	1.554
NoE	1.074×10^{-5}	0.000	0.045	1.702	0.089	0.688	1.453
TA	-6.838×10^{-12}	0.000	−0.060	−2.373	0.018	0.749	1.336
ROA	−0.064	0.067	−0.022	−0.951	0.342	0.898	1.114
ROE	0.001	0.003	0.012	0.240	0.810	0.197	5.069
DER	4.885×10^{-5}	0.000	0.009	0.176	0.860	0.198	5.058
CAP	-1.401×10^{-6}	0.000	−0.004	−0.171	0.865	0.953	1.050
LP	1.022×10^{-10}	0.000	0.046	1.919	0.055	0.840	1.191
SOLV	−0.004	0.002	−0.048	−2.095	0.036	0.929	1.076
ATR	−0.035	0.008	−0.103	−4.380	<0.001	0.872	1.147
FA	0.000	0.000	0.061	2.783	0.005	0.997	1.003

[a] Dependent Variable: EP Source: realized by the authors, using the results obtained from SPSS.

The magnitude of the standardized coefficients reflects the importance of the independent variables in predicting the EP indicator. The larger the absolute value of the Beta coefficient, the stronger the effect of the corresponding independent variable on the dependent variable, while a positive Beta suggests a direct relationship and a negative Beta indicates an inverse relationship. In this case, ST is the most influential variable, followed by ATR (in the negative direction) with CAP having the least negative impact on EP.

The multiple correlation coefficient (R) (Table 7) signifies the extent of association between the dependent variable, environmental performance (EP), and the array of independent variables, with a recorded value of 0.216. An R value near 0 denotes an insignificant regression. Given that R often exaggerates the association between the variables, the more reliable metric is the coefficient of determination ($R^2 = 0.047$), which represents the square of the multiple correlation coefficient. For this model, 4.7% of the variance in EP could be explained by the independent variables (FA, CAP, NoE, DER, SOLV, LP, ROA, ATR, TA, ST, ROE). R^2 is equivalent to the F-test when it concludes whether the model is significant. R2 shows, however, the proportion of explained variance of the full model, which cannot be concluded from the t-tests for the regressors.

Table 7. Initial model summary.

Initial Model Summary [b]					
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Durbin-Watson**
1	0.216 [a]	0.047	0.041	0.446	0.756

[a] Predictors: (Constant), FA, CAP, NoE, DER, SOLV, LP, ROA, ATR, TA, ST, ROE [b] Dependent Variable: EP. Source: realized by the authors, using the results obtained from SPSS.

From the analysis of the regression coefficients (Table 6) related to the model, it can be observed that there were only five variables with a statistically significant influence, specifically, SOLV, FA and TA, ATR and Turnover on environmental performance (EP). Hence, we applied the forward selection method to identify and validate the previous results.

Consequently, the relevant information was consolidated within multiple correlation coefficient and Durbin-Watson test values (Table 8), F-test (Table 9), regression coefficients, and collinearity statistics (Table 10).

Table 8. Model summary [f].

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.164 [a]	0.027	0.026	0.450	
2	0.188 [b]	0.035	0.034	0.448	
3	0.197 [c]	0.039	0.037	0.447	
4	0.204 [d]	0.042	0.040	0.447	
5	0.209 [e]	0.044	0.041	0.446	0.753

[a] Predictors: (Constant), ST [b] Predictors: (Constant), ST, ATR [c] Predictors: (Constant), ST, ATR, FA [d] Predictors: (Constant), ST, ATR, FA, SOLV [e] Predictors: (Constant), ST, ATR, FA, SOLV, TA [f] Dependent Variable: EP Source: realized by the authors, using the results obtained from SPSS.

Table 9. Variances for Examining Multiple Regression (Equation (2)—F-test).

ANOVA [a]					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	18.247	5	3.649	18.306	<0.001 [b]
Residual	398.303	1998	0.199		
Total	416.550	2003			

[a] Dependent Variable: EP [b] Predictors: (Constant), ST, ART, FA, SOLV, TA Source: realized by the authors, using the results obtained from SPSS.

The coefficient of determination (R^2) was then 0.044, so that 4.4% of the variance in EP could be explained by the five independent variables (ST, ATR, FA, SOLV, TA).

Corresponding to F-test, the linear relationship between the five variables and EP was statistically significant. The tabular value F0.01; 5; 1993 = 2.37 was below the F value calculated based on empirical data, Fcal = 18.306, thus supporting the hypothesis that the linear regression between EP, ST, TA, SOLV, ATR, and FA was a good fit.

The matrix helped us to understand which variables significantly impacted the dependent variable and assesses the presence of multicollinearity.

The ST variable showed the highest standardized beta (0.184), alongside a t-value of 7.556, with significance lower than 0.001 indicating a significant positive relationship with the dependent variable EP. Meanwhile VIF values were below 10, displaying no severe multicollinearity.

Table 10. Regression coefficients and collinearity statistics.

Model		Unstandarized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Tolerance	Statistics VIF
1	Constant	3.411	0.011		311.581	<0.001		
	ST	3.917×10^{-11}	0.000	0.164	7.431	<0.001	1.000	1.000
2	Constant	3.469	0.018		196.877	<0.001		
	ST	3.941×10^{-11}	0.000	0.165	7.506	<0.001	1.000	1.000
	ATR	−0.031	0.007	−0.092	−4.207	<0.001	1.000	1.000
3	Constant	3.463	0.018		195.411	<0.001		
	ST	3.904×10^{-11}	0.000	0.163	7.445	<0.001	0.999	1.001
	ATR	−0.031	0.007	−0.091	−4.156	<0.001	0.999	1.001
	FA	0.000	0.000	0.060	2.715	0.007	0.999	1.001
4	Constant	3.486	0.020		173.771	<0.001		
	ST	3.870×10^{-11}	0.000	0.162	7.387	<0.001	0.999	1.001
	ATR	−0.035	0.008	−0.104	−4.605	<0.001	0.948	1.054
	FA	0.000	0.000	0.061	2.778	0.006	0.998	1.002
	SOLV	−0.005	0.002	−0.055	−2.441	0.015	0.948	1.005
5	Constant	3.491	0.020		173.075	<0.001		
	ST	4.388×10^{-11}	0.000	0.184	7.556	<0.001	0.811	1.233
	ATR	−0.038	0.008	−0.111	−4.878	<0.001	0.924	1.082
	FA	0.000	0.000	0.061	2.775	0.006	0.998	1.002
	SOLV	−0.004	0.002	−0.051	−2.254	0.024	0.940	1.064
	TA	-5.787×10^{-12}	0.000	−0.051	−2.060	0.040	0.788	1.269

Dependent Variable: EP Source: realized by the authors, using the results obtained from SPSS.

Regarding the linearity hypothesis, the relationships between the explanatory variables and the response variable were examined by plotting the unstandardized residuals against each explanatory variable. The resulting two-dimensional plots (Figure 1) suggested that the relationships exhibited linearity, supporting the appropriateness of our analytical approach.

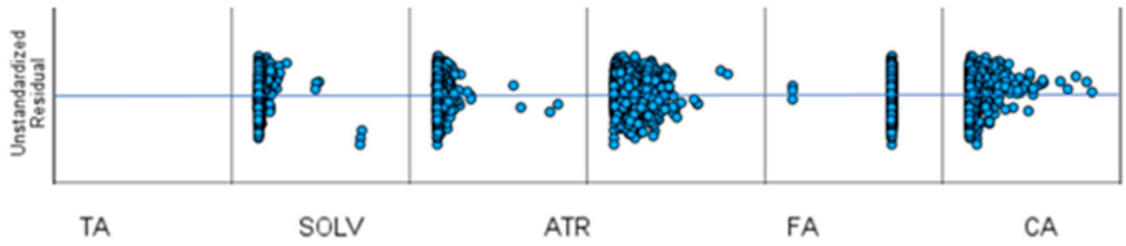

Figure 1. Unstandardized residuals plot.

A scatter plot of residuals (obtained after fitting the identified regression model) against each explanatory variable showed that the linear assumption was correct. In these figures, we noticed that the residuals were symmetrically distributed around zero over the range of the explanatory variable in the discussion (x axis).

The correlations between Sales turnover and EP and Firm age and EP were positive, meaning that a high turnover or age of the company was associated with a high EP value. Since the correlations between ST/FA and EP were statistically significant, increasing the turnover value or the age also increased the EP value, considering that all other variables remained unchanged. The correlations between SOLV/ATR/TA and EP were negative, meaning low values of these variables corresponded to high EP values, when all the other variables remained unchanged. So, decreasing solvency or assets turnover or total assets values increased EP values.

To test the linear relationship between each explanatory variable and the response variable (EP), the t-test was applied to each regression coefficient, demonstrating whether a linear relationship existed between the variables (in this case, ST, TA, SOLV, ATR, FA, and EP). Therefore, it was applied five times, once for each regression coefficient. The F-test in Table 9 combines these five tests into one, testing all five explanatory variables simultaneously to determine if at least one of them is not zero. The parameters in the preceding equation were estimated utilizing the least squares method.

Through the above regression equation, we aimed to see how non-financial and financial factors (ST, TA, SOLV, ATR, FA) influenced environmental performance (EP). This means that we were investigating the relationship among the five variables, i.e., turnover, number of employees, SOLV, ATR, FA, called explanatory variables, and EP, called the explained variable.

In conclusion, according to the F-test (Table 9), the regression equation was statistically significant at the $\alpha = 0.01\%$ level. The relationship among EP and the five variables (both non-financial and financial) could be assumed to be linear, as described by Equation (3).

The multiple correlation coefficient R (R = 0.209) was significant. The relationship between the five variables and environmental performance (EP) was robust, as indicated by the multiple correlation coefficient R (R = 0.209). The total coefficient of determination D = 0.04% [$D = R^2 \times 100 = 4.4\%$], which means that the variation in EP values between 2.0 and 4.65 was influenced by the five variables studied to the extent of 4.4%.

Collinearity denotes a significant correlation between the independent variables. In such cases, tolerance statistics are computed by solely considering the independent variables, excluding the dependent variable from the model. This leads to multicollinearity, where including one variable from the group in the model renders the remaining variables in the group insignificant. Simultaneously, there is an overestimation of the coefficient of determination and the dispersions of the estimated coefficients, which can distort the model interpretation and widen confidence intervals. Thus, there were two aspects to consider: determining multicollinearity and how to address multicollinearity if it existed (Table 10 Collinearity Statistics)

In Table 10, we show the standardized regression coefficients for each independent variable (Beta) and Tolerance for each variable x_i. A low tolerance value (ranging from 0 to 1) reflects a coefficient of determination close to 1, indicating a strong linear relationship between xi and the other independent variables. According to the tolerance values, multicollinearity was not indicated.

The variance inflation factor (VIF) measures the extent of multicollinearity. If the VIF value is below 0.2 or higher than 10, then multicollinearity is troublesome.

It was observed that VIF $\subset$ (0.2; 10) as it ranged between 1.00 and 1.269; thus, the absence of multicollinearity implied that there was no significant correlation between the variables.

The Durbin-Watson test was applied for the five variables as well (Table 8). The phenomenon of autocorrelation distorts not only the estimators—the partial regression coefficients—but also their variances, with unfavorable implications for accepting or rejecting a null hypothesis (H_0).

Thus, for a number of observations n = 2004 and a number $p = 5$ of independent variables (non-financial and financial indicators), the tabulated values for d were dL = 1.891 and dU = 1.901 at a significance level $\alpha = 1\%$ according to the Durbin-Watson significance table (Real Statistics Using Excel, 2023). The calculated d value dcal = 0.75 was less than d1, which means the hypothesis of residual independence could be rejected. Thus, the null hypothesis H_0 was rejected, indicating that errors exhibited autocorrelation. This case is common in situations involving time series data, such as the analyzed database.

We may therefore conclude that there were statistically significant positive correlations between sales turnover (ST) and environmental performance (EP), as well as between firm age (FA) and EP.

5. Discussion

Environmental Social Governance (ESG) is a phenomenon that has become global in contemporary times. Consequently, the inclusion of sustainability regulations and standards has become necessary. Building on this idea and analyzing sustainable reporting and environmental responsibility, a case study was developed for companies operating in Romania.

The relationship between environmental performance and financial performance, widely debated in the literature, does not always show the same influence, with existing studies often reaching contradictory conclusions. Some research highlights a positive impact of sustainable practices on firms' profitability (Pereira et al., 2023; Petera et al., 2021; Junquera & Barba-Sánchez, 2018), while others suggest that green investments can generate high costs, affecting short-term profitability (Fazli et al., 2023; Y. S. Chen et al., 2016; Y. Chen et al., 2021). In this context, the present study fills an important gap in the literature by analyzing not only the correlation among these variables but also the relationship between environmental financial performance and economic performance, expressed through ST, TA, SOLV, and ATR. The present research makes a theoretical contribution by expanding the conceptual framework regarding the relationship between environmental and financial performance by including multiple financial and performance indicators in the analysis.

The study provides statistical evidence on the impact of environmental performance on financial performance, using an extensive sample of companies from various economic sectors. The obtained results can guide managerial decisions regarding resource allocation for sustainability policies, demonstrating that well-managed ecological strategies can bring about significant economic benefits (Nishitani et al., 2017; Narula et al., 2023; Soedjatmiko et al., 2021). Therefore, in the long run, increasing environmental protection and improving environmental performance positively influence a company's financial performance (Song et al., 2017; Soedjatmiko et al., 2021; S. Zhang et al., 2019).

Empirically, existing studies provide mixed results. For example, a study conducted by Florina-Mădălina Mocanu investigated the relationship between financial performance and corporate governance practices in Romanian banking companies, highlighting the importance of corporate governance in achieving financial performance (Mocanu & Lungu, 2021). The impact of corporate governance practices on financial performance is also revealed by other studies (Nguyen et al., 2021; Ong et al., 2019; Y. Xu & Zhu, 2024; Nandini et al., 2022). The findings of this study have significant implications. Scientifically, they contribute to a deeper understanding of how environmental initiatives can influence financial performance, providing a foundation for future research. Practically, the results can serve as a basis for developing corporate policies and business strategies, encouraging companies to adopt sustainable practices that not only protect the environment but also enhance financial performance.

In conclusion, this research aims to clarify the complex relationship between environmental and financial performance, offering valuable insights for both the academic community and practitioners.

The study was designed as observational research aimed at identifying significant correlations among variables, which can provide valuable insights into underlying patterns and associations. Although no causal relationships were established, these findings serve as a foundation for future research that may employ experimental or longitudinal designs to investigate causality more rigorously. Establishing cause-and-effect relationships

would require additional methodological approaches, such as controlled experiments or instrumental variable techniques.

Machine Learning Models in general, and Linear Regression in particular, are all designed to provide accurate results (when statistical significance is present) both for observational and experimental settings. In this paper, an observational study was pursued. This means that association results were always declared and, in no case, causality was analyzed. This was because Pearson correlation is suitable for one explanatory variable, while a group of five explanatory variables was deemed crucial in our analysis. Furthermore, correlation-only analysis is not suitable for model selection. In conclusion, the use of a linear regression model with very strong model selection technique, under correct linear assumptions, was the key to the results of the paper.

Sustainability practices are becoming increasingly important on a global scale, but there are significant differences between trends specific to Romania and international trends. Analyzing these aspects in relation to applicable strategies for Romanian companies revealed that, in Romania, the implementation of sustainability standards is progressing slowly in most areas. Regarding renewable energy, global trends show a rapid increase in investments in solar and wind energy (Kurbatova & Perederii, 2020; X. Xu et al., 2019; Lanshina & Barinova, 2017; Nejat et al., 2013; J. Zhao et al., 2022), whereas in Romania, development in these categories is slow but growing (Dumitrașcu et al., 2019; Raboaca et al., 2020; Aceleanu et al., 2018). The same applies to the implementation of circular economy actions (Piontek, 2019; Holwerda et al., 2024; Topliceanu et al., 2023; Delcea et al., 2024). Regarding ESG reporting, it is mandatory at the global level (EU and USA), while in Romania, implementation is occurring gradually and unevenly. In two other categories of sustainability practices, i.e., sustainable transport and social responsibility, initiatives in Romania are limited, especially among SMEs. For Romanian companies to remain competitive and leverage global trends, they should adopt strategies aimed at optimizing energy consumption through investments in modernizing equipment for energy efficiency and installing solar panels. Additionally, they should develop circular economy practices, such as collaborating with suppliers using recycled materials and establishing product return and reuse schemes. In terms of alignment with ESG standards, companies should focus on publishing sustainability reports (even voluntarily for SMEs) and integrating clear corporate governance and ethics policies (Bunget et al., 2024; Dănilă & Nancu, 2023; Fleacă et al., 2023). Furthermore, increasing social responsibility through CSR projects in education and environmental protection, as well as partnerships with NGOs and local communities, is encouraged (Marinescu, 2020b; Petrescu et al., 2020; Mihai & Aleca, 2023).

In conclusion, while Romania is gradually adopting sustainable practices, the gap compared to global trends can be reduced through proactive strategies. Romanian companies that embrace sustainability will gain a competitive advantage and enjoy easier access to green financing and international markets.

6. Conclusions

This paper aimed to identify and analyze the relationship between firms' financial performance and non-financial performance (environmental performance) by employing a statistical model that adeptly integrates both financial and non-financial indicators. The study's contribution lies in correlating and providing a comprehensive overview of the analyzed relationship between financial and environmental performance, notably through the application of econometric models to substantiate the findings.

To achieve the paper's goal, a score for the dependent variable Environmental performance (criterion variable) EP was calculated and included in the model as dependent variable, along with the following financial indicators: ROA, ROE, Debt ratio, Indebt-

edness Degree, Capital intensity, Equity multiplier, Labor productivity (independent or predictor variables).

A key observation of this study was the statistically significant positive correlations between sales turnover and EP and firm age and EP, meaning that higher turnover or higher firm age is associated with to higher EP values. This may support the idea that as companies grow and develop, they can become more efficient in terms of resource use and innovate to reduce waste and emissions. Companies with a long history are often more aware of the importance of their reputation. They may adopt better environmental practices to protect their image and demonstrate social responsibility. Companies with higher sales are often under greater scrutiny and may be more motivated to comply with environmental regulations, leading to better environmental performance.

In summary, our analysis aimed to identify the financial indicators that significantly contribute to the environmental performance of companies subject to sustainability regulations. Thus, a model was constructed from the independent variables (predictors) that could best estimate the dependent variable (EP). In the description provided, this model was expressed by Formula (3). Collinearity among the independent variables was checked by determining tolerance statistics. In the determined model, it was acknowledged that all independent variables possessed sufficient accuracy in explaining the dependent variable. A detailed explanation of the influence of each financial indicator in the model on environmental performance (EP) supported the construction of the analysis model with the following indicators: Sales turnover (ST), Total assets (TA), Solvency ratio (SOLV), Asset turnover ratio (ATR), Firm age (FA).

The relation between SOLV and EP was negative, indicating that lower solvency corresponded to higher EP values, implying that decreasing solvency values might increase EP values. Considering that the solvency indicator refers to covering total debts from a company's assets, this negative relationship can be explained by the company's interest in spending more on retooling and modernization to achieve environmental goals (W. Zhang et al., 2021). Increasing concern for creating environmental strategies to improve climate conditions, reduce emissions, recycle waste, etc., leads to securing funding sources from investors or creditors. Under these circumstances, companies may register high debts in the short term. This is understandable for the analyzed period, given that the European Directive on sustainable reporting standards (CSRD) mandates their application starting from the 2024 fiscal year for entities with over 500 employees already applying non-financial reporting (NFRD).

The relation between ATR and EP was negative, meaning that lower ATR values correspond to higher EP values, indicating that decreasing ATR values might increase EP values. Similarly, the influence of the Asset Turnover Ratio (ATR) may be explained by investments in green technologies, which are more expensive and have a long lifespan. These investments increase the total value of assets but do not immediately generate additional revenue (Gu, 2021; Nishitani et al., 2017), thereby reducing asset turnover. Also, higher operational costs may occur when implementing environmental protection measures, like using recycled materials or less polluting production processes.

From the regression model, one can conclude that five out of the twelve financial indicators included in the model have a statistically significant influence on environmental performance (EP), namely SOLV, FA, TA (significant), ATR, and ST (very significant).

Therefore, it can be concluded that the proposed model is significant, effectively demonstrating the statistical relationship between the five aforementioned financial indicators and the non-financial (environmental) performance of the sample companies.

7. Limitations and Further Research

While this study has outlined several limitations, this does not imply that the analysis conducted is any less valuable. The study's results can be of real use to both the academic community and business representatives.

The calculation of an environmental performance (EP) score, utilizing the grid method, was conducted through a content analysis of sustainability reports released by companies. One limitation of this research is the potential collection of incomplete or unclear data and information. Furthermore, our analysis of the sustainability reports' information may have been subjective, and the EP score may have been influenced by factors not identified by the authors.

In future research, we intend to conduct comparative analyses of the EP score across various sectors. Additionally, the scope of this research could be broadened by examining the relationship between ESG and the financial performance of the examined companies.

The present study faced difficulties in defining and setting out the concepts of sustainability and environmental responsibility, as these notions are often interpreted differently in the literature. This conceptual ambiguity may affect the coherence of the theoretical framework and the comparability of our results with those of other research.

Limited access to updated and reliable data on sustainability reporting practices in Romania represented a significant constraint. Many companies do not publish detailed or standardized information, which complicates empirical analyses and may lead to incomplete or biased conclusions.

The sample selection may have suffered from reduced representativeness, especially given that it included only large or publicly listed companies, neglecting small and medium-sized enterprises. This approach could limit the generalization of our results to the entire corporate sector in Romania.

The application of econometric models may have encountered issues related to incorrect model specification, the omission of relevant variables, or the presence of multicollinearity. These factors can distort estimates and result interpretations, affecting the validity of the conclusions.

Moreover, the analysis was carried out on a single country, namely Romania, albeit with potential to expand it in the future to include data from other European countries. We believe that this research could also be improved by conducting a questionnaire-based analysis to identify managers' opinions regarding the specific strategies implemented for environmental protection.

In conclusion, while this article provides valuable insights into sustainability reporting and environmental responsibility in a Romanian context, it is essential for readers to be aware of these limitations to correctly interpret the study's results and implications

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Social responsibility in the textile industry in Romania

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NICOLETA ANDREEA NEACŞU
SIMONA BĂLĂŞESCU
MARIUS BĂLĂŞESCU
CARMEN ELENA ANTON

ABSTRACT – REZUMAT

Social responsibility in the textile industry in Romania

In a sustainable society, the integration into the activity of entities of the actions from the sphere of social responsibility becomes more and more evident.
The study analyzes the textile industry in Romania in terms of social responsibility, the involvement of companies in this industry in asserting the values of this level. Thus, a quantitative marketing research is carried out at the level of the population in Romania, a piece of research which is aimed at identifying the opinions and attitudes of the citizens regarding the social responsibility adopted by the Romanian companies, with emphasis on the companies in the textile industry. In this research, particular attention was given to the comprehension of the reality of the aspects in which consumers perceive the requirements of social responsibility and of the way in which they function in practice. The results of this research can be used by the companies in the textile industry as well as by all the companies interested in this aspect in order to improve the quality of the services and of their implications in the social life and in order to respond to the needs of the citizens as well as possible.

***Keywords**: social responsibility, social ethics, consumer behaviour, quantitative research, textile industry*

Responsabilitatea socială în industria textilă din România

Într-o societate sustenabilă, integrarea în activitatea entităţilor a acţiunilor din sfera responsabilităţii sociale se manifestă din ce în ce mai pregnant.
Studiul analizează industria textilă din România prin prisma responsabilității sociale, a implicării companiilor din această industrie în afirmarea valorilor pe acest palier. Astfel, se realizează o cercetare cantitativă de marketing la nivelul populației din România, cercetare care vizează cunoaşterea opiniilor și atitudinilor cetățenilor în legătură cu responsabilitatea socială adoptată de către companiile românești, cu accent pe companiile producătoare din industria textilă. În cadrul acestei cercetări o atenție deosebită s-a acordat cunoaşterii realității aspectelor în care consumatorii percep cerințele responsabilității sociale şi a modului în care acestea se manifestă în practică. Rezultatele acestei cercetări vor putea fi folosite de către companiile din industria textilă, dar și de către toate companiile interesate în acest sens, în vederea îmbunătățirii calității serviciilor oferite şi a implicării în viața socială şi pentru a răspunde cât mai bine nevoilor cetățenilor.

***Cuvinte-cheie:** responsabilitate socială, etică socială, comportamentul consumatorului, cercetare cantitativă, industria textilă*

INTRODUCTION

The domain of textile industry is very well developed in Romania. Romania's overall international trade in 2015 was over 117.56 billion euro, 5.9% more over 2014, according to the data provided by the Ministry of Economy. The export of textiles, leather and footwear exceeds 5 billion euro, which represents 11% of Romania's overall exports and it has over 250,000 employees. There are over 9700 companies operating in these sectors. In Romania this has been a traditional sector for more than 120 years, but it is also very innovative and creative. Highly qualified people work in the field of both design and technology. In the top 100 companies with 100% Romanian capital, there are 41 companies from the domain of textile industry [1].

The affirmation of social responsibility is outlined in the circumstances of the contemporary society as a requirement, as an ever growing necessity. In the day-to-day reality, the manifestation of the requirements of the components that form social responsibility has become an ethical and legal obligation for the commercial societies, imposed by the general interests of the community. When companies comply with and integrate these requirements into their business, they are perceived by the community as socially responsible companies.

Internationally, there are concerns to ensure a balance between moral and the personal interest of companies. The economic growth of a company does not involve only making profit, but also its reinvestment. CSR strategic approach represents a prerequisite for achieving business success [2].

Corporate social responsibility (CSR) is perceived as a new form of cooperation between governments, business and civil society, and the promotion of social objectives by companies has got economic implications (for business, by their increased power within

the community), political (for governments, by increasing the control on companies, although not always directly) and social (for the various stakeholder groups). The ethical behaviour of a commercial company has as coordinates the trust- and respect-based relationships with its trading partners.
The novelty of the information presented in this paper consists of the approach of social responsibility from the point of view of the consumer, his/ her perception of the social responsibility in the context of the sustainable development of the society.
The study carried out by CSRMedia and Valoria Business Solution explores the perceptions of CSR managers and specialists from various companies in Romania in terms of the evolution, dynamics and challenges of this field in 2017 and 2018. The results show that in Romania the companies' involvement in this field has increased from 27 % in 2017, to 35% in 2018 [3]. By comparing it to our research on the views of the Romanian citizens on CSR, it has been found out that this concept is less known among consumers. This aspect requires a more active involvement of companies in CSR actions and better information and promotion of the initiatives.

SOCIAL RESPONSIBILITY IN THE LITERATURE

Corporate Social Responsibility (CSR) stands for the duty of companies to create a positive impact on society by the measures they adopt. Internationally, there are several types of CSR. According to the World Business Council for Sustainable Development, social responsibility is "a continuous commitment in the field of business, towards some ethical behaviour and towards its contribution to the economic development, along with an increase in the quality of life of the staff and their families, as well as for the local community and society as a whole" [4]. The European Commission defines corporate social responsibility as "a concept by which companies integrate social and environmental concerns into their commercial activities and interactions with other stakeholders, on a voluntary basis" [5]. The European Forum on corporate social responsibility in Europe, set up at the initiative of the European Commission, defines CSR as a concept by which companies integrate, voluntarily, social and ecological aspects in their business operations and in their interactions with their stakeholders [6]. Kotler and Lee have identified several types of corporate social responsibility practices that have worked over time and that have produced remarkable results at the organization level [7]. CSR is complementary to specific approaches in order to deliver enhanced social and environmental performance and it should not be understood as a legal substitute or as a task for the companies with public responsibilities, which mainly remain in the hands of governments [8–10].
The basic premise behind the CSR is that the profits, the people and the environment can be harmonized in a strategic corporate approach, so that the company becomes economically sustainable, socially responsible and attentive to environmental issues. It is considered that the integration of the aspects related to social responsibility by businesses in the adopted decisions and strategies brings along more benefits: reducing the costs associated to energy consumption and resources by implementing some ecological actions, by increasing the loyalty of employees and organizational citizenship behaviour by initiating programs for human resources development, by improving relations with governmental institutions [11–12].
Significant differences in CSR approach appear in the literature, where the authors have slightly differently perceived the responsibilities of a company to the society as a whole. Thus, the main debate in this area refers to two distinct concepts: CSR perceived as a moral obligation or duty towards a wider or narrower range of interest groups and the CSR as a voluntarily assumed initiative by companies to achieve social, but also economic objectives.

RESEARCH METHODOLOGY

In order to identify the attitude of the Romanian consumers regarding the social responsibility in the textile industry, a quantitative marketing research based on a sample of 428 respondents residing in Romania was carried out.
The main objective of the paper was to know the opinions and attitudes of the Romanian citizens in relation to the social responsibility adopted by the companies operating in Romania, with emphasis on the companies operating in the textile industry. Bearing in mind the topic of the paper, the research was based on several hypotheses, including:

- H0: At least 50% of Romanians are to a little extend familiar with CSR;
  H1: Less than 50% of Romanians are to a little extend familiar with CSR.
- H0: At most 50% of Romanians are satisfied with CSR actions organized by companies;
  H1: More than 50% of Romanians are satisfied with CSR actions organized by companies.

In this paper, the sampling method being non-aleatory, volunteer sampling of the respondents was carried out on the basis of a survey. For the collection the data, the survey method was used in the electronic format. The questionnaire (containing 20 questions) was designed on the Google Forms platform and it was distributed to Facebook groups with over 1500 members. Similarly, it has been distributed by means of the Instant Messaging application, Whatsapp. Being distributed online, the questionnaire collected 428 respondents, the researcher having no control over who answers it.
After having collected the information with the help of the questionnaire, the statistical data processing was done with the SSSP (Social Sciences Statistics Package) system. The first step was to define the relevant variables of the research. Afterwards, the response options were encoded in order to facilitate data computerization. The encoding was done

according to each question and to the scale used for this question. The SSSP database was completed after all questionnaires were introduced and, in the end, the data were centralized as tables and graphs of frequency [13].

RESEARCH RESULTS

Although the practices of responsibility rendering in the Romanian corporate area have emerged as an import of values and principles taken from the European context, the indigenous companies have begun to assimilate and adapt them to the specificity of the organizational culture in Romania. Over the last three years we there has been a growing visibility of the CSR programs and there has been a large number of NGOs that promote on behalf of companies and with their financial aid various social causes [14]. In this context, it has become imperiously necessary to carry out research to provide an overview of the opinions of the Romanian citizens on the actions of companies in the sphere of social responsibility. The research has revealed a lot of information, the most relevant for the issues under consideration being presented below.

To the question referring to the understanding of the concept of "corporate social responsibility" (CSR), it is noticeable that 40.2% of the respondents know little about this concept, but a very close percentage of 30.7% know and understand to a great extent what CSR presupposes. Similarly, it is noted that 10.3% of the respondents know to some extent what CSR presupposes. The percentage of the people who do not know this concept at all is significant (19.6%) (table 1 and figure 1).

Table 1

BEING FAMILIAR TO CSR

Answers	Frequency	Percent	Valid percent	Cumulative percent
Not at all	84	19.6	19.6	19.6
To a lesser extent	172	40.2	40.2	59.8
To some extent	44	10.3	10.3	70.1
To a large extent	112	26.2	26.2	96.3
To a great extent	16	30.7	3.7	100.0
Total	428	100.0	100.0	-

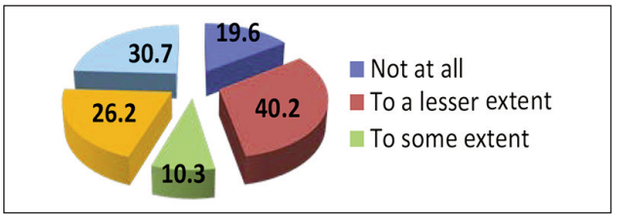

Fig. 1. Being familiar to CSR

Table 2

THE INVOLVEMENT OF ROMANIAN COMPANIES IN CSR

Answers	Frequency	Percent	Valid percent	Cumulative percent
Very poor	32	7.5	7.5	7.5
Poor	72	16.8	16.8	24.3
None	172	40.2	40.2	64.5
Strong	92	21.5	21.5	86.0
Very strong	60	14.0	14.0	100.0
Total	428	100.0	100.0	

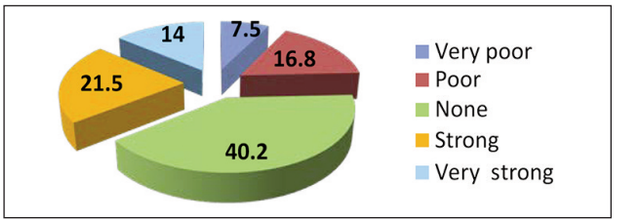

Fig. 2. The involvement of companies in CSR

The respondents' opinions on the involvement of Romanian companies in CSR actions are highlighted in table 2 and figure 2.

It can be noted that most of the respondents, 40.2% chose the option "None", which means that they have a neutral opinion regarding the involvement of Romanian companies in solving the problems the Romanian society faces. On the second place, by 21.5% are those who have a "strong" opinion, meaning they are interested in this topic. Summed up, the opinions of those who chose the "Strong" and "Very strong" variants make up 35.5%, surpassing the opinions of those who chose the "Poor" and "Very poor" versions of 24.3%. Therefore, this area is one that is not currently in the area of interest of the population.

To the question "What sources did you hear about corporate social responsibility from?", the respondents offered various answers that are highlighted in table 3 and figure 3. The majority of respondents, 41.1% found out about this concept from "the Internet", to be more precise, 176 out of 428 persons. It is important to highlight that 38 people have heard about this concept from the questionnaire they filled in. A percentage of 9.3% respondents heard about this concept from the faculty, and 7.5% of the respondents have never heard about the CSR concept, at all.

The statement "Romanian companies are actively involved in helping the citizens", the highest share is the category "Disagree" with 120 respondents, very close to the "Agree" category, which has got 188 answers. This balance may be the result of the lack of sufficient knowledge of the meaning of the concept CSR by the Romanian population.

Referring to the situation when "Romanian companies are interested in profit and not in citizen welfare", a significant number of respondents, namely 168

Table 3

SOURCES OF INFORMATION ON CSR				
Answers	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
Television	84	19.6	19.6	19.6
Internet	176	41.1	41.1	60.7
Hoardings	24	5.6	5.6	66.4
Radio	20	4.7	4.7	71.0
Faculty	40	9.3	9.3	80.4
This questionnaire	36	8.4	8.4	88.8
Others	16	3.7	3.7	92.5
Never heard of	32	7.5	7.5	100.0
Total	428	100.0	100.0	-

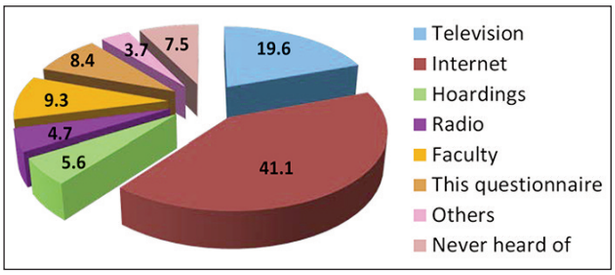

Fig. 3. Sources of information on CSR

to involve in actions of social responsibility and of support for these actions is easily noticeable (table 4). The following responses were given to the question on mentioning the name of a company in the textile industry involved in social responsibility activities, according to the following table (table 5). Thus, the

Table 4

THE DEGREE OF AGREEMENT OR DISAGREEMENT ON CSR ACTIONS					
The degree of agreement or disagreement with concern to the following statements	**Totally disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Totally agree**
Romanian companies are actively involved in helping citizens	44	120	44	188	32
Romanian companies are interested in profit and not in citizen welfare	12	72	48	168	128
I think there are more and more companies involved in social responsibility activities	20	144	32	192	40
Corporate social responsibility is a beneficial aspect for the society	4	12	44	132	236
I am willing to pay more for a product purchased from a company that is involved in social responsibility activities	20	96	40	140	132

respondents, stated that they agreed with this statement, only 12 people totally disagree with the given assertion.

For the opinion "I consider that there are more and more companies involved in social responsibility activities", 192 persons "Agree", in total contrast being the statement of total disagreement from 20 respondents.

The following statement "Corporate social responsibility is a positive thing for society" gathered the majority of respondents, 236 people for the "Totally agree" answer, which means that the population is aware of the increasing importance of CSR.

For the statement "I am willing to pay more for a product purchased from a company involved in social responsibility activities", the opinions of the interviewees are divided between "Agree" answers from 140 respondents and "Totally agree" with a total of 132 respondents. Thus, people's desire

Table 5

DISTRIBUTION OF COMPANIES IN THE TEXTILE INDUSTRY INVOLVED IN CSR ACTIVITIES IN THE OPINION OF THE CITIZENS				
Answers	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
SC Rifil SA	64	15.0	15.0	15.0
SC Rosko Textil SRL	52	12.1	12.1	27.1
SC Moden SRL	40	9.3	9.3	36.4
SC Benrom SRL	20	4.7	4.7	41.1
SC Formens SRL	16	3.7	3.7	44.9
SC Biancospino SRL	4	0.9	0.9	45.8
SC Pandora Prod SRL	8	1.9	1.9	47.7
SC Paola Confectii SRL	12	2.8	2.8	50.5
SC ITS Production SRL	12	2.8	2.8	53.3
SC Coats Odorhei SRL	4	0.9	0.9	54.2
SC Coindu Romania SRL	84	1.,6	19.6	73.8
DC Cottontex SRL	4	0.9	0.9	74.8
Others	12	2.8	2.8	77.6
I don't know	96	22.4	22.4	100.0
Total	418	100.0	100.0	-

most well-known company, from the point of view of the citizens, is SC Coindu Romania SRL with 19.6%, followed by SC Rifil SA with 15%, followed by SC Rosko Textil SRL with 12.1%. They are known by citizens as companies that get involved in CSR activities. It can be noticed that 22.4% of the respondents said that they do not know companies in this industry that are involved in CSR actions.

Similarly, for the statement "Do you think that CSR is well served in the textile industry in our country?", it is to be noticed that 42.1% of the respondents answered "Neither agree nor disagree", which may mean that they do not have all the information about these actions or that they are not convinced of the seriousness of these actions. At the same time, 24.3% of the respondents agree with the statement and 14% are in total agreement with this statement (table 6).

Table 6

AGREEMENT ON THE VALUATION OF CSR IN THE ROMANIAN TEXTILE INDUSTRY

Answers		Frequency	Percent	Valid percent	Cumulative percent
Valid	Totally disagree	4	0.9	0.9	0.9
	Disagree	80	18.7	18.7	19.6
	Neither agree nor disagree	180	42.1	42.1	61.7
	Agree	104	24.3	24.3	86.0
	Totally agree	60	14.0	14.0	100.0
	Total	428	100.0	100.0	-

When asked about the respondents' decision to buy products mainly from some companies in the textile industry that are environmental-friendly and to pay a higher price for them, the questioned respondents answered affirmatively in a very high percentage, more exactly 91.6%, while only 8.4% say they do not take this aspect into consideration when purchasing textiles (figure 4).

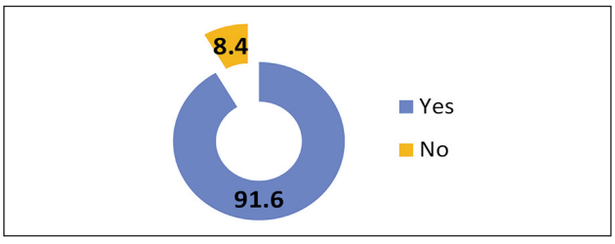

Fig. 4. Consumers' desire to pay a higher price for the environmentally friendly products

Two very important hypotheses have been confirmed, namely, that at most 50% of Romanians are satisfied with CSR actions organized by the companies in the textile industry in our country, and the hypothesis which claims that at most 50% of the Romanians are familiar to a little extent to the term CSR. That is why it is possible that this high degree of satisfaction of the population results from the thorough ignorance of the concept and its role in society. At the declarative level, the population agrees to be socially responsible, but to have a minimal to nonexistent involvement, so that the population places responsibility on companies [15].

CONCLUSIONS

Any economic entity, including those in the textile industry, prior to integrating into its activity social responsibility actions, gets down to a profitability analysis based on financial reporting. Their impact becomes evident in the level of registered expenditures, such as: social expenses, education expenses, expenses for the development of sports, cultural actions, etc. The fundamental orientation is coordinated by the tax mechanisms provided by the tax legislation [16–17]. Thus, the entities are interested in tax facilities they can benefit from in carrying out social responsibility activities, and tax deductions are the tax instrument most commonly used by the national regulator. Yet, the very complex and unstable tax legislation triggers a less-present behaviour of entities on this level. The combination of the patrimonial interests with the charitable actions aimed, in fact, at improving the public image of the entity and, implicitly, at reducing human resource costs [18]. The companies in the textile industry, by tackling with innovative solutions and interest paid to environmental actions, contribute to the sustainable development, a dimension of social responsibility.

If a company does not appeal to consumers, partners, community in the development process, then its profitability and competitiveness will suffer in the long run. CSR aims to ensuring a better connection between the society/community responsibility and the long-term financial objectives of the companies [19].

There are specialists who claim that CSR generates far too high costs in social investments without visible effects, but this concept has to be understood and promoted in terms of long-term benefits without minimizing its strategic role. Communication is an important element of CSR which guarantees transparency for the interested groups. The promoted social programs, however, should not be viewed solely from the perspective of PR and marketing benefits they bring. In setting up the CSR strategy, the companies should start from the community's real needs and afterwards it should define its measurable and honest objectives.

The results of the research are meant to outline the directions of action that companies should introduce

into their overall business strategy so that the end consumer perceives them as an ally in the sustainable social development. Consumer attitudes and opinions on CSR lead to the need for active visibility for consumer assimilation and understanding.

As a result of the study, it was found only in the reports of the large companies that CSR actions were carried out. In case the small and medium-sized companies have been involved in CSR activities, they are not visible and cannot be known to the general public.

The authors recommend to the managers of the companies a gradual manifestation of the actions regarding the essential values promoted for the improvement of the quality of life and for the optimization of the environmental performance. Similarly, large entities also must be consistent with the observance of the principles of integrated reporting, according to which the transmitted information can be perceived and respond to the needs of consumers.

The limits of the study consist in the inexistence of some reports containing CSR actions undertaken by small and medium-sized companies in Romania. Keeping in mind these limitations, we recommend including CSR actions carried out by small and medium-sized companies in administrators' annual reports.

A future research direction could consist in conducting qualitative research among the managers of companies in Romania in order to study the correlations between the consumers' and managers' opinions on the CSR concept.

The analysis emphasizes the necessity of integrating social responsibility components by the economic entities as an ethical and legal obligation imposed by the general interests of the community for some sustainable development. The attitude of complying with the CSR requirements convinces the community to perceive them as socially responsible societies.

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Authors:

NICOLETA ANDREEA NEACȘU, SIMONA BĂLĂȘESCU, MARIUS BĂLĂȘESC, CARMEN ELENA ANTON

Transilvania University of Brașov, Faculty of Economics Sciences and Business Administration,
Colina Universității no.1, 500084, Brașov, Romania
e-mail: f-seaa@unitbv.ro

Corresponding author:

NICOLETA ANDREEA NEACȘU
e-mail: deea_neacsu@yahoo.com

sustainability

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Review

Perspectives on Integrating Risk Management and Sustainability for Financial Performance: A Systematic Literature Review

Carmen Elena Anton [1], Camelia Mirela Baba [1] and Oana-Andreea Bucșoiu [2,*]

[1] Department of Finance, Accounting and Economic Theory, Transilvania University of Brașov, 500036 Brasov, Romania; carmen.anton@unitbv.ro (C.E.A.); mirela.baba@unitbv.ro (C.M.B.)
[2] Interdisciplinary Doctoral School, Faculty of Economic Sciences and Business Administration, Transilvania University of Brașov, 500036 Brasov, Romania
* Correspondence: oana.bucsoiu@unitbv.ro; Tel.: +40-733631643

Abstract: In a continuously dynamic economy, both risk management and sustainability are elements that must be constantly monitored. This study analyzes the link between risk management, sustainability, and the financial performance of companies through a systematic literature review of key articles from bibliographic databases. A total of 9092 publications indexed in the Web of Science database (2020–2024) were analyzed using bibliometric analysis with VOSviewer. Findings suggest a positive relationship between effective risk management, sustainable business practices, and financial performance. Firms that integrate risk assessment into sustainability strategies achieve greater resilience and improved outcomes. Research highlights the importance of transparency in risk identification and reporting, particularly in sustainability reports, as a driver of long-term performance and value creation. The study also identifies disparities in implementation across industries and regions, with emerging markets facing structural challenges in adopting comprehensive risk–sustainability frameworks. These findings emphasize the need for sector-specific risk strategies and stronger policy support to maximize financial benefits. This research provides valuable insights for financial managers and researchers. The field remains dynamic, offering new perspectives for future studies and policy development.

Keywords: risk management; financial performance; sustainability; bibliometric analysis; VOSviewer

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1. Introduction

Risk management plays a crucial role in corporate strategy, influencing financial performance and sustainability [1].

The uncertainties specific to the economic environment have required the development of good practices regarding risk management and reporting with the following elements: transparency, attitude towards risk, integration of risk into the business model, and allocation of resources committed to risk management [2].

Risk management includes the systematic identification, analysis, and mitigation of uncertainties that could negatively impact an organization's goals. Modern risk management frameworks extend beyond traditional financial risks to incorporate sustainability risks, such as climate change, regulatory compliance, and reputational concerns, which are becoming increasingly critical for firms operating in global markets [3].

Incorporating sustainability into risk management enables firms to assess ESG risks and adopt data-driven strategies for financial and operational resilience [4,5]. Respecting sustainability aspects aims to implement ESG principles for sustainable development,

integrate circular economy and energy efficiency practices, and commit to shareholders and transparency in sustainability reporting [6]. A model to be analyzed and applied that meets the needs of stakeholders is based on the Triple Bottom Line (TBL) concept—Economic (Profitability), Social (Social Responsibility), and Environment (Ecology) [7].

Risk management includes credit risk, interest rates, and the liquidity ratio, whereas financial performance is assessed using metrics like Return on Assets (ROA), Return on Equity (ROE), and Return on Investment (ROI) [8]. However, integrating sustainability considerations into risk management enables companies to enhance their financial stability while addressing long-term environmental and social challenges. Research indicates that companies with strong ESG practices often exhibit lower capital costs and higher financial returns, underscoring the financial benefits of sustainability integration [9].

Effective Enterprise Risk Management involves five key components: governance, strategy, performance review, and communication, as it aligns with business objectives and provides a multi-faceted approach to risk management [10]. Robust risk management frameworks enhance transparency and stakeholder engagement, aligning with corporate performance objectives [2]. A company's risk management framework must be effective and based on stakeholder involvement, so that it can achieve its performance objectives.

Despite its growing importance, there is no universal consensus regarding the actual impact of Enterprise Risk Management (ERM) on the financial performance of companies [11]. While many studies have found a positive correlation between ERM and financial performance, others reports describe a neutral or negative relationship [12]. However, recent research suggests that when sustainability factors are integrated into ERM frameworks, firms experience increased resilience and reduced operational risks [13]. Determinants of a company's likelihood to engage in ERM are company size, which brings complexity and exposure to risk, making ERM more necessary for larger companies to effectively manage these factors, and profitability, which provides the financial resources to invest in ERM. Moreover, companies with higher Return on Assets (ROA) tend to integrate sustainability into their ERM to optimize efficiency and long-term value creation [14].

This study employs bibliometric analysis to explore recent literature on the integration of risk management and financial performance, emphasizing the relationship between risk management practices and organizational performance. By analyzing research from the Web of Science database, this study identifies key themes, trends, and frequently used terms using VOSviewer software (version 1.6.20) [15]. Bibliometric analysis is valuable for deciphering and mapping cumulative scientific knowledge and evolutionary trends in well-established fields through the systematic organization and interpretation of large volumes of unstructured data. This method allows for a rigorous understanding of the development and interconnections in a domain over time [16] and provides a broad overview of the vast academic literature, enabling a comprehensive understanding of research trends and patterns in a given field [17].

VOSviewer facilitates the visualization of bibliographic data, including collaborative networks, documents, and sources linked to researchers, authors, and countries [15]. This study contributes by evaluating the historical and current state of risk management research while identifying future research directions. Despite extensive research on risk management, sustainability, and financial performance, there is a lack of comprehensive bibliometric analysis that systematically maps key trends, methodologies, and research patterns in this field. This study addresses this gap by analyzing existing literature to identify dominant themes.

To explore the impact of the relationship between risk management, sustainability, and financial performance, the following research questions have been developed:

- What are the main risks that could impact companies' financial performance?

- What are the methodologies used in researching the connection between risk management, sustainability, and financial performance?
- Is there a connection between risk management, sustainability practices, and financial performance? How frequently is this relationship analyzed?
- What are the critiques encountered in the specialized literature concerning the impact of risk management on financial performance?

By addressing these research questions, the study offers an overview of the current trends in integrating sustainability into risk management and financial performance. The paper is structured to explore the relationship between risk management, sustainability, and financial performance, followed by an analysis of specialized literature, a description of the research methodology, and a presentation of the results. The study's final section outlines the research findings and their implications, while also addressing the study's limitations.

2. Literature Review

Academic literature offers a wealth of research on the relationship between risk management and organizational performance. The proactive attitude of entities towards risk management demonstrates that their business success is greater than that of others who do not take risks [13,18].

Starting with the research questions, the most important aspects found in the specialized literature were outlined and analyzed. In the approach taken, following question was addressed:

- "Which are the main risks that could impact the companies' financial performance?", for which the authors turned their attention to financial risks.

It is certain that risks are manifested in everyday life, in a variety of ways that can be grouped in relation to different criteria, and the present study focuses on financial risks considering the field of action. Thus, financial risk includes credit risk, interest rate risk, currency exchange risk, liquidity risk, investment risk, price risk, VAT application risk, etc. All of these have an impact on the business domain of companies [19]. The risks ultimately materialize in financial losses, additional costs and reduced income; therefore, financial risk is explicitly translated into money losses. According to Blach, financial risk can be predicted based on balance sheet information [20,21], also emphasizing the idea that credit risk has a significant negative impact on financial performance, while liquidity risk management positively affects firms' financial performance.

Also, at the company level, we can talk about operational risk (personnel, technological, distribution, political, regulatory risk)—the risk that can appear unexpectedly, at any time, causing crisis situations within the company. Operational risk arises from inconsistencies in internal processes, systems, human resources, and other internal aspects, but can also be generated by external events. Chen [22] states that organizational risk impacts the project financial performance by being negatively mediated through project Supply Chain Risk (SCR) factors, such as "demand risk, internal process integration risk, and supply risk". Another dimension of risks concerns the strategic non-conformity that comes from the company's inability to achieve its goals and implement its planned strategy; these non-conformities can be caused by changes that affect the proper functioning of the organization, determined by both external and internal factors [23].

According to Kaplan and Mikes [24], risks can also be grouped into internal risks (risks that manifest internally), external risks (coming from the external environment), and strategic risks (risks assumed in order to achieve strategic objectives). Additionally, some authors [25,26] highlight risk identification as the most critical stage influencing financial performance, succeeded by risk mitigation, implementation, the monitoring of ERM programs, and risk assessment.

"Credit risk, interest rate risk and liquidity risk" are key financial risk management factors that can potentially reduce the performance of the financial sector [27]. Credit risk has a significant negative impact on financial performance, while "market risk, operational risk and liquidity risk" management positively influences firms' financial performance [21].

Liquidity is one of the major factors for industries that are highly exposed to market volatility and have significant fixed costs. Therefore, lack of liquidity often results in bankruptcy when companies face economic difficulties [28]. The risk of bankruptcy of an entity is one of the most important risks that is analyzed by investors, to be able to see the capacity of the entity to fulfill its due obligations [29].

The insurance industry faces various risks, including underwriting, compliance, reputational, credit, liquidity, strategic, operational, agency, and legal risks. If these risks are not managed effectively, they can have a negative impact on the financial performance of companies, which can lead to financial difficulties [30].

Establishing the most significant risks studied leads to the natural question:

- What are the methodologies used in researching the connection between risk management, sustainability, and financial performance?

The existing literature, as summarized in Table 1, mostly confirms the positive impact of ERM on companies' financial performance. Additionally, many studies highlight that integrating sustainability considerations into ERM frameworks enhances resilience, reduces risks associated with environmental and social factors, and contributes to long-term financial stability. In most of the analyzed studies, the most common type of methodology used is the analysis of specialized literature, emphasizing the growing academic focus on the intersection of sustainability, risk management, and corporate performance.

Table 1. Methodology and authors' major findings. Source: authors' processing.

Authors	Sample	Methodology	Major Findings
[31]		Literature Analysis and Case Study	The exposure of large companies to risk seems to be increased by partnerships with the SMEs in the supply chain
[32]	300 Canadian companies	Content Analysis in Annual Reports	An emphasis on down-side risks is noted and potential up-side effects are absent
[33]	5.8 million sets of accounts of unlisted firms	Small-Business Failure Prediction Model	The use of non-financial variables as predictors of company failure improves significantly the accuracy of the model used
[34]	100 listed Malaysian companies	Content Analysis in Annual Reports	The total number of phrases dedicated to risk information is much less compared to a previous study from 2006
[35]	32 studies	Literature Analysis	Studies that show a positive impact of the environment on financial performance are more prevalent
[36]		Information Index	Financial information regarding risks is correlated with the field of activity in which the reporting entity operates
[37]	112 US firms	Empirical Analysis	Firms should consider implementing an ERM system
[38]	40 German banks	Multiple Regression Analysis	The level of sustainability a firm upholds impacts its creditworthiness
[39]	106 firms	Matched Sample and Logit Model	There is limited evidence in the sample of ERM adopters indicating significant changes in various key firm variables

Table 1. *Cont.*

Authors	Sample	Methodology	Major Findings
[20]	100 Polish companies	Financial Risk Analysis—an Empirical Study	The importance of identifying financial risk through balance sheet information
[40]		Literature Survey; Citation/Co-Citation Analysis	The intellectual structure of the field evolved to more proactively managing supply chain risk from system perspectives
[41]	31 banks	Analysis of Financial Reports; Correlation and Regression	The parameters have an inverse impact on banks' financial performance
[42]	10 banks	Panel Data Estimation Technique; Statistical Analysis	Important relation between banks' performance and ERM
[43]	Banks' annual reports and accounts	Descriptive statistics; OLS regression	Financial performance is determined by risk management practices
[12]		Literature Review; Balanced Scorecard (BSC)	No universal agreement about the actual influence of ERM on firm performance
[44]	7 commercial banks	Content Analysis as Analytical Tool	The extent of risk management disclosure increases with the size of the reporting banks
[45]	101 questionnaires	A Five-Point Likert Scale; Data Analysis—Structural Equation Modeling Technique	The success of ERM has a weak positive relation with the financial performance of an organization, measured through ROA, ROE, Earnings per Share (EPS)
[46]	27 papers	Literature Review	The importance of risk management process in SMEs
[47]	208 SMEs	Seemingly Unrelated Regression (SUR)	Number of executive directors raises the level of cashflow volatility
[28]	79 international shipping companies	Panel Regression	Lack of liquidity results in bankruptcy when companies face economic difficulties
[48]	62 companies quoted in National Stock Exchange (NSE)	Survey Research Design	Significant relationship between risk management and financial performance
[49]	The annual reports of selected Johannesburg Stock Exchange (JSE)-listed companies	Literature Review	Attempts to avoid all risks can lead to the sacrifice of positive rewards
[50]	Financial report of the selected company	Literature Review/Regression Analysis	Risk management practice and financial performance show no correlation
[51]	Five failed banks	Literature Review	Risk management functions should be bank-specific
[52]	Non-financial companies listed on the Milan Stock Exchange	Multivariate Ordinary Least Squares (OLS) Regressions	ERM systems lead to higher performance by reducing risk exposure
[53]	18 top-performing banks	Descriptive Statistics/EViews Software	Risk management practices have a substantial effect on the financial performance of banks of all sizes
[54]	304 SMEs	Structural Equation Modeling (SEM) in Analysis of a Moment Structures (AMOS)	The company's risk management practices significantly influence the competitive advantage and the performance of SMEs
[55]	65 non-financial Romanian firms listed on the Bucharest Stock Exchange (BSE)	Econometric Software; EViews/Panel Data Techniques	ERM adoption is associated with higher firm values
[56]		Content Analysis of Annual Reports	Numerous businesses worldwide fail to integrate sustainability initiatives into their corporate strategies

Table 1. *Cont.*

Authors	Sample	Methodology	Major Findings
[57]	101 articles	Literature Review	The most commonly investigated effect of ERM is on firm performance
[58]		Generalized Method of Moments (GMM) Model	Emerging sustainability risks adversely impact a firm's profitability
[59]	6 insurance companies listed on the National Stock Exchange (NSE)	SPSS Analysis Software	Moderate level of implementation of risk management practices
[60]	1233 documents	Bibliometric Analysis	Sustainability continues to be a significant global concern, posing challenges at both individual and organizational levels
[61]	286 firm-year observations	Hierarchical Panel Regression Analysis	Companies that adopt thorough risk management strategies are more likely to attain sustainable performance results
[62]	13 companies	Analysis Tool of Partial Least Square SmartPLS3	Enterprise risk management increases the company performance
[63]	58 banks	Econometric Model	Managers' negative sentiment in risk-related disclosures within annual reports is strongly associated with the future performance of banks
[64]		Literature Review	Well-executed corporate sustainability reporting significantly boosts financial performance
[65]	Expert survey where 79 experts answered	Analytical Network Process (ANP) Method	Incorporating sustainability into risk management improves decision-making and minimizes biases in qualitative assessments
[66]		VIKOR Method	The significance of incorporating sustainability factors into risk management strategies

Figure 1 illustrates the frequency of different methodologies used in research related to sustainability, risk management, and financial performance, providing valuable insights into the preferred analytical approaches in the field. The analysis of specialized literature is the most frequently used methodology, representing 31.6% of the top five methods employed. This highlights the fundamental role of theoretical frameworks and previous studies in understanding the connection between sustainability, risk management, and financial performance. Regression analysis ranks second, representing 26.3% of the methods used, highlighting its importance in the quantitative exploration of the impact of sustainability and risk-related factors on financial results. The application of Content Analysis in Annual Reports at 15.8% indicated an increased reliance on corporate disclosures to evaluate sustainability practices and risk management strategies. Structural Equation Modeling (SEM), representing 13.2%, suggests a growing interest in understanding the complex relationship between latent variables, such as sustainability practices, risk management effectiveness, and financial performance.

Overall, the distribution of methodologies, including descriptive statistics, econometric tools and case studies, underlines a diverse approach to studying sustainability, risk management, and financial performance. These findings indicate a solid methodological foundation in the field, where quantitative models such as regression and SEM are complemented by qualitative insights derived from literature and report analysis.

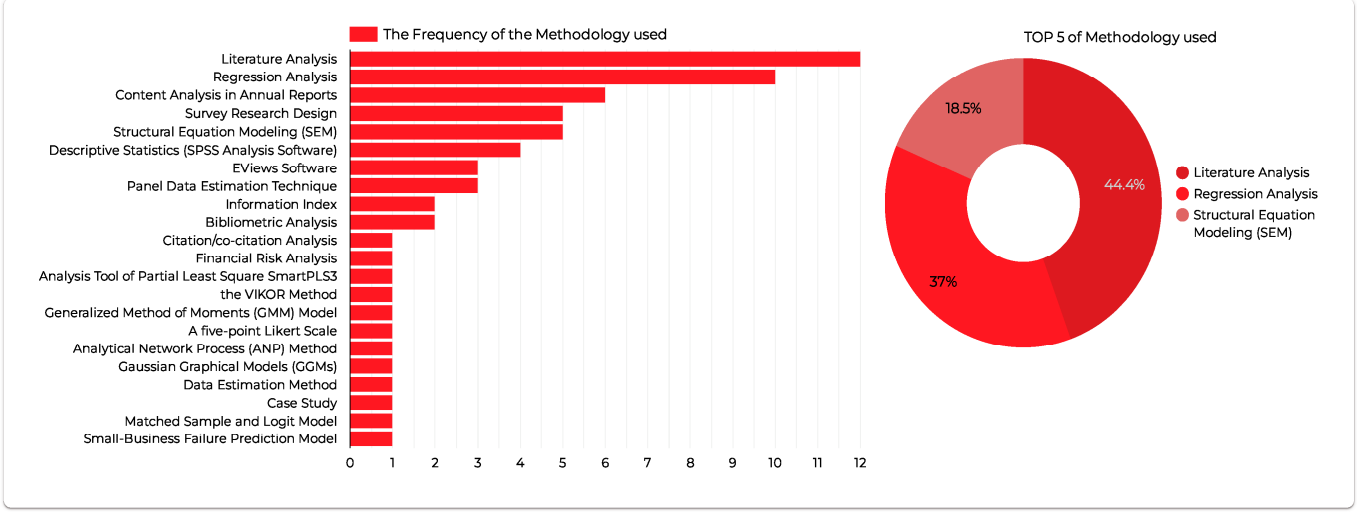

Figure 1. The most common methodologies used in the studied articles. Source: authors' processing in Tableau Public.

The documentation of the assertions for the first two questions constitutes the foundation for researching the existence of the relationship between risk management, sustainability and financial performance. The specialized literature presents various studies that analyze this link, requiring the formulation of the third research question.

- Is there a connection between risk management, sustainability practices, and financial performance? How frequently is this relationship analyzed?

Integrating sustainability considerations into ERM frameworks has become increasingly vital for enhancing company performance and securing a competitive advantage [62]. Empirical studies support the positive impact of integrating sustainability into risk management. For instance, research indicates that effective corporate sustainability reporting is associated with significant improvements in financial metrics such as Return on Equity (ROE), Return on Assets (ROA), and profit margins [67].

In the banking sector, the relationship between sustainability and financial performance is particularly pronounced. Studies have demonstrated that proper governance and Corporate Social Responsibility (CSR) practices reduce financial and reputational risks, thereby enhancing financial performance [68].

However, the effectiveness of ERM in improving financial performance is based on factors such as organizational culture and strategic alignment. Research suggests that merely implementing ERM frameworks is not sufficient in yielding desired outcomes; a developed organizational culture and continuous evaluation of strategic risk management performance are essential [69].

Considering the analysis carried out, the study also includes an examination of clarifying comments regarding the relationship between risk management and financial performance. This is performed with the objective of assessing both the strengths and limitations of the existing research, thereby shaping the following research question:

- What are the critiques encountered in the specialized literature concerning the impact of risk management on financial performance?

Research indicates that the financial performance of fund management companies is negatively affected by factors such as event identification, risk assessment, goal setting, and information communication. However, elements like risk response, internal environment, and control activities positively influenced their financial performance [70].

Despite the generally positive outlook on ERM, there are some authors who dispute the positive effects of ERM. For instance, Eikenhout, [71] states that there is minimal evidence to suggest that the implementation of ERM mitigates the negative effects on firm performance, concluding that companies that have implemented ERM tend to have lower ROA compared to companies with a lower level of ERM implementation. This hypothesis aligns with the finding of Baxter et al. [72], who found no evidence that ERM implementation mitigated the impact of the crisis. Kokobe and Gemechu [50] also conducted a study where the results of regression analysis revealed no significant correlation between risk management practices and financial performance. However, the findings indicate a strong and positive relationship between risk avoidance techniques and financial performance, suggesting that ERM remains the recommended best practice for companies.

In a related study investigating the influence of ERM and Performance Management System (PMS) on corporate financial performance, Laisasikorn and Rompho [45] identified a "weak positive correlation" between the success of ERM and PMS and financial performance metrics such as ROA, ROE, and earnings per share (EPS). The authors emphasize the importance for managers to effectively design, enhance, and implement both systems to achieve a competitive advantage. Nevertheless, the study also stated that financial risk management significantly decreases the financial performance of commercial banks [27].

3. Methodology

The study comprises a systematic content-based literature review to examine the relationship between risk management, sustainability, and the financial performance of companies. Utilizing the keywords "risk management", "sustainability", and "financial performance", a number of articles from the period 2004–2024 were selected for the literature analysis. The selection criteria included thematic relevance, ensuring the inclusion of studies directly addressing these three dimensions; publication type, prioritizing peer-reviewed articles and conference papers; and publication period. Additionally, sectoral and geographical diversity was considered to provide a comprehensive perspective. Although such an analysis is performed manually and can be time-consuming, the combination of a qualitative method (in this case, the literature review) in depth with a strong quantitative analysis (bibliometric analysis) is an important benefit of content analysis.

The Tableau Public platform was used to create visual charts that facilitate data interpretation and presentation. This allowed us to generate interactive visualizations and graph information in a clear and accessible way, helping to better understand and communicate the results of our analysis. The interactive charts and graphs provide a more comprehensive understanding of the research landscape, enabling the identification of nuanced relationships and trends that may be overlooked in conventional narrative review.

For the bibliometric analysis, this study exclusively relied on the Web of Science database due to its comprehensive coverage and high-quality indexing. One key reason for this choice is the rigorous selection and validation process that WoS applies to indexed publications. Its strict inclusion criteria ensure that only peer-reviewed journals with high academic impact are considered, thereby maintaining the quality of the analyzed studies. In contrast, databases like SSRN (Social Science Research Network) include preprints and unpublished reports that have not undergone the same level of scientific scrutiny. Additionally, WoS offers compatibility with bibliometric analysis tools, providing standardized export formats (e.g., .txt, csv.) that integrate seamlessly with software such as VOSviewer. Some databases, such as Scopus, have less compatible formats with some viewing programs.

Figure 2 illustrates the systematic methodology selected to perform a bibliometric analysis, beginning with data extraction from the Web of Science database.

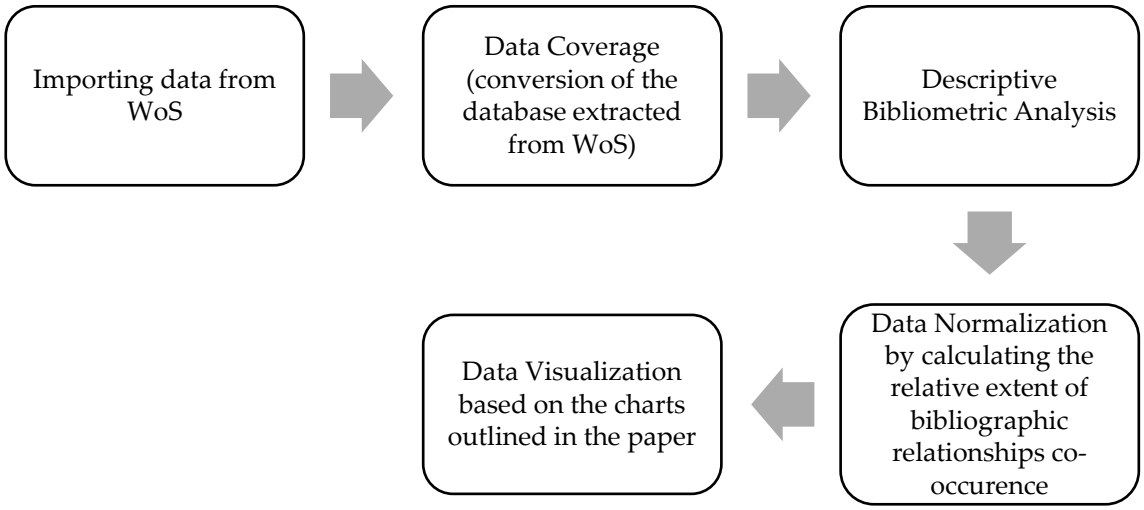

Figure 2. The data collection process. Authors' processing.

On 2 September 2024, the search terms from the phrase "risk management and the financial performance of companies" in article titles, keywords, and abstracts resulted in a total of 9092 articles, for the period 2020–September 2024. Although the keyword "sustainability" was not included in the initial search, the study aims to explore whether conclusions related to sustainability can be derived indirectly from the existing literature on risk management and financial performance. This approach allows for an unbiased assessment of the extent.

The VOSviewer program enhances analytical rigor, improving the clarity and impact of the findings [73]. While bibliometric analysis offers quantitative insights into research trends, it does not assess the qualitative depth, methodologies, or theoretical contributions of the reviewed papers. However, the integration of VOSviewer mitigates some of these limitations, providing structured visualization and data interpretation that supports a comprehensive understanding of research trends [74].

The extracted data were converted into a format compatible with VOSviewer, enabling detailed bibliometric analysis. A descriptive approach was employed to examine publication trends, key relationships, and the co-occurrence of bibliographic terms. Data normalization was conducted to calculate the relative extent of co-occurring bibliographic relationships. Finally, visualizations were created using charts and graphics, ensuring the clear and effective communication of findings, with tools like Tableau Public supporting the presentation of insights. These visualizations, created based on the papers' objectives, help to communicate the main results effectively.

The PRISMA flow chart from Figure 3 illustrates the step-by-step process of selecting studies from Web of Science to conduct a bibliometric analysis using VOSviewer. The process follows standard systematic review and scoping review methodologies to ensure the selection of relevant studies while eliminating irrelevant or duplicate records. The initial search in Web of Science identified 19,942 records. To refine the dataset, 10,850 records were removed before screening by applying a date filter (2020–September 2024). This step ensures that only the most recent and relevant studies are included in the analysis. After removing irrelevant records, 9826 studies were screened, and 726 records were excluded as they were published between September and December 2024, which were outside the predefined cutoff period.

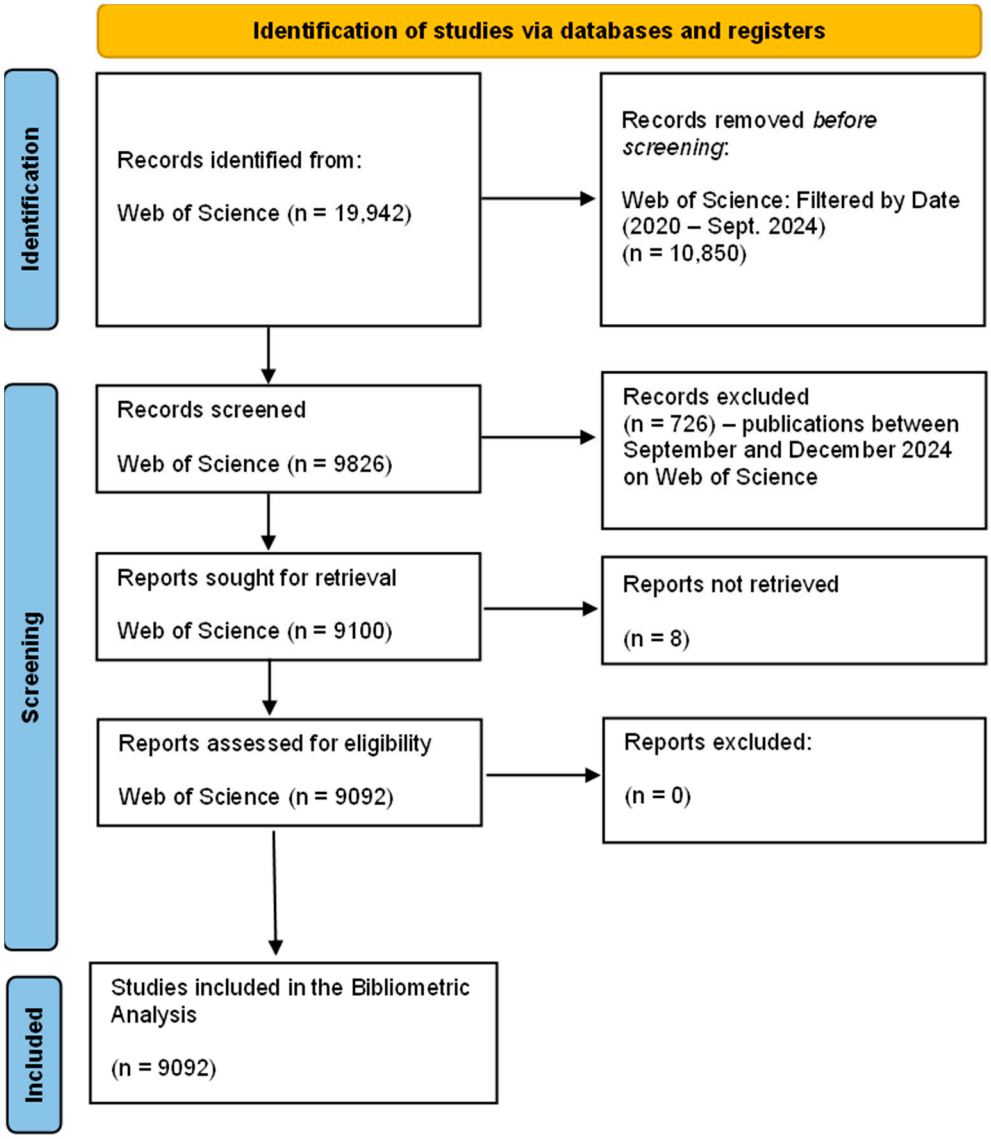

Figure 3. PRISMA flow chart.

This systematic review adheres to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure a structured and transparent research process. After the eligibility assessment, 9092 studies were included in the bibliometric analysis.

The search query used in Web of Science was as follows:

ALL = (Risk Management and the Financial Performance of Companies)

This means that all indexed fields (title, abstract, keywords, and full text where available) were scanned for this phrase. The broad inclusion of search terms ensures the comprehensive coverage of studies related to risk management and financial performance, allowing for detailed bibliometric mapping. Additionally, all included materials were in English, which might introduce a language bias but ensures consistency in text analysis and interpretation. Table 2 provides a summary of the data collection process, including the source database, the total number of documents retrieved, and the search date.

Table 2. A general overview of data collection.

Database	Web of Science Core Collection
Total Documents	9092
Search Date	02.09.2024
Research Formula	ALL = (Risk Management and Financial Performance of Companies)
Period	2020–2024
Materials' Language	English

By examining publications that specifically address the interplay between risk management and financial performance, this study lays the foundation for a deeper exploration of the role of sustainability as a critical factor in strategic risk management. The analysis of this publication trend not only informs the current state of research but also identifies emerging themes and gaps in literature.

After the aforementioned sample was obtained, we performed the actual bibliometric analysis, using scientific mapping methodology through the VOSviewer software.

We began the analysis with descriptive statistics to observe general publication trends and patterns in the dataset. Following this, we analyzed the collaboration network between the authors, considering the countries of origin, to identify the interest of the academical community towards risk management and financial performance depending on the geographical regions. By establishing a minimum threshold of 40 works with the source in the same state, 15 countries were identified that met this criterion.

Finally, the distribution of the most frequently used keywords was analyzed, with the aim of observing and evaluating the links between them, considering only those keywords proposed by the authors in the published works, and a minimum threshold of 20 simultaneous occurrences was established for the analysis. Out of the total papers, 89 of the 15,221 keywords met this requirement (benefiting from 20 simultaneous occurrences).

4. Results

4.1. Descriptive Statistics

To analyze the evolution of research on risk management and financial performance, publication trends over time were examined. The analysis allows us to identify changes in publications on sustainability practices, risk management, and financial performance, providing a holistic perspective on corporate effectiveness and accountability. A graphical representation was created to illustrate the number of publications per year from 2020 to 2025.

Figure 4 illustrates the evolution of publications over time from 2020 to 2025, showing fluctuations in the number of published works. There is a steady increase in publications from 2020 to early 2023, peaking at over 200 publications. However, a sharp decline follows in mid-2023, with publication numbers dropping significantly through 2024 and stabilizing at a lower level by 2025. This trend suggests a surge in research interest during the early years, followed by a decline, possibly due to shifts in academic focus interests or data collection limitations.

Additionally, key descriptive statistics were calculated to quantify the publication dynamics, shown in Table 3. The Mean Publication Period and its Standard Deviation provide insights into the average timing of research output, while the Mean Publication Growth Rate reflects overall trends in publication activity.

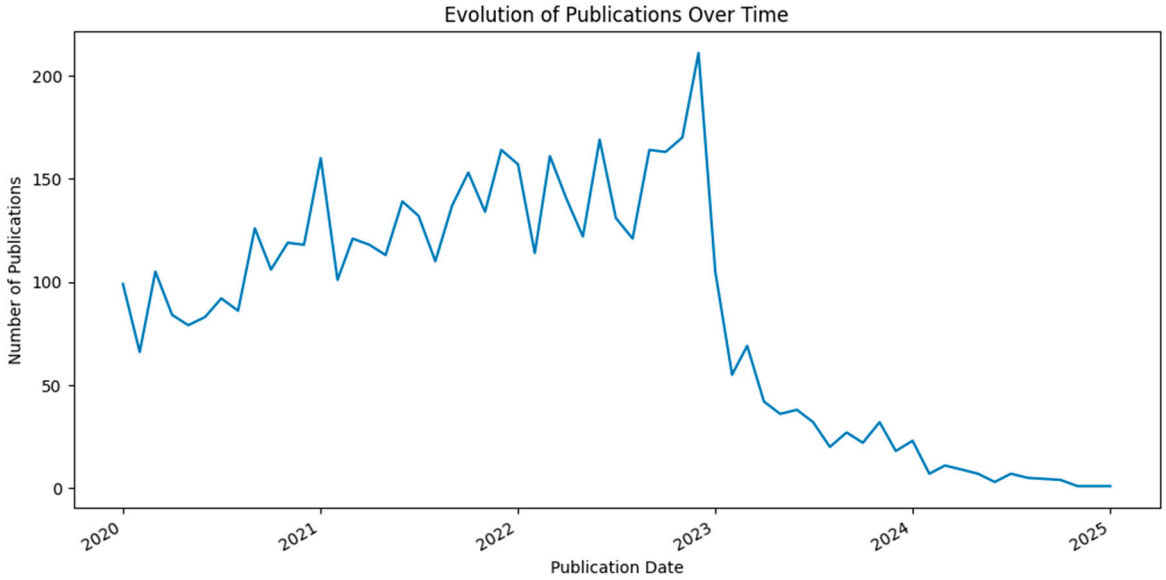

Figure 4. Evolution of publications over time.

The mean publication period of 30 October 2021 indicates a peak in academic interest in risk management and financial performance, likely driven by global corporate risk concerns. The standard deviation of 362 days suggests a steady research output rather than concentrated bursts.

Table 3. Descriptive statistics of publication trends.

Metric	Value
Mean Publication Period	30.10.2021 14:34:51
Standard Deviation of Publication Period	362 days 15:15:49
Mean Publication Growth Rate	−0.011

The mean publication growth rate of −0.011 reflects a slight decline in research activity post-2021. This trend may be due to saturation in post-pandemic financial sustainability studies and a shift towards emerging topics like ESG frameworks and digital transformation in risk management.

4.2. Authorship and Countries

The section presents a visualization analysis from Tableau Public of collaboration networks, focusing on countries/regions. It was observed that the most productive states occupy top positions in the ranking of the most cited articles. This is due to their economic size, investment in research, and economic infrastructure.

The authors' attention was first focused on the collaboration network between the authors, considering their countries of origin, to identify the interest of the scientific community in the quality of accounting information, depending on the geographical regions.

Figure 5 illustrates the global distribution of authors with published articles on risk management and financial performance between 2020 and September 2024. It highlights the countries with the highest number of authors contributing to this area, highlighting the geographical spread of academic contributions.

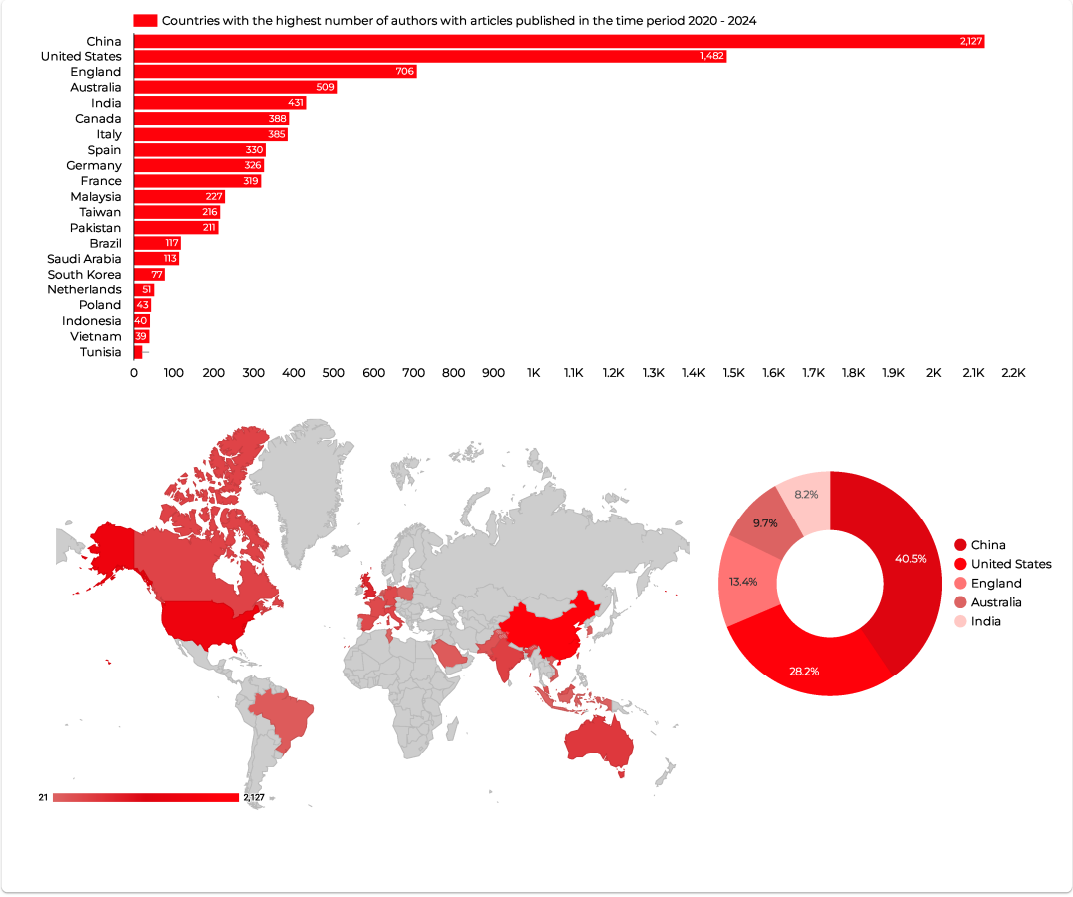

Figure 5. Countries with the highest number of authors with articles published in the time period 2020–September 2024. Source: authors' processing in Tableau Public.

In this case, the threshold value was set to 40, which means that the countries shown in the figure each have a number of authors with at least 40 published articles. A total of 15 countries met this criterion and were selected for further study and entered into the Tableau Public program to create an interactive graph. It is noted that the country with the greatest openness in terms of international collaboration is represented by China. It is followed by the United States, England, Australia, and India, which rank among the top five countries in terms of publishing research on risk management and the financial performance of companies.

China leads by a significant margin, with 2127 authors publishing research during this period, accounting for 49.3% of all top contributions. This reflects China's increasing influence and emphasis on risk management and financial performance studies, aligning with broader economic growth and expanding academic output. The United States follows, with 1482 authors, contributing to 34.3% of the publications. The strong presence of the US indicates its well-established research infrastructure and the importance given to risk management, especially in its highly developed financial markets. England ranks third with 706 authors (representing 16.4%), demonstrating its significant academic involvement in financial research, supported by its long-standing financial institutions and regulatory environment.

Other countries such as India, Australia, and Canada also have notable contributions, underscoring a growing interest in this area of research in both developed and evolving economies. The presence of countries such as Malaysia, Pakistan, and Brazil further emphasizes the global relevance of risk management and financial performance, with contributions from a variety of economic contexts. The geographic map provides a visual

representation of these data, where countries with higher author participation are marked in darker shades of red. This map further illustrates the dominance of China and the US in this academic space, while highlighting the growing research output from other regions.

4.3. Co-Occurrence of Authors' Keywords

A bibliometric analysis of authors' keyword co-occurrence examines how frequently specific keywords or phrases appear together in research papers. The correlation reflects how often two keywords are mentioned within the same paper. A stronger association between the terms results in a higher frequency of co-occurrence. Keywords within the same cluster exhibit a stronger connection, while those in different clusters have a weaker one. The relevance of each key term can be highlighted by means of connecting nodes, the size of which reflects the degree of importance: the larger the node, the more significant the term it represents within the analyzed sample.

Figure 6 highlights the relevance of the main keywords identified in the sample studied by the intensity of their connections with other keywords, analyzed based on their simultaneous appearance in the same paper. For this analysis, a minimum of 20 simultaneous occurrences of keywords was required. Out of the 15,221 keywords, 89 met this criterion. VOSviewer then assessed the degree of connectivity for each of these 89 keywords in relation to other terms or keywords.

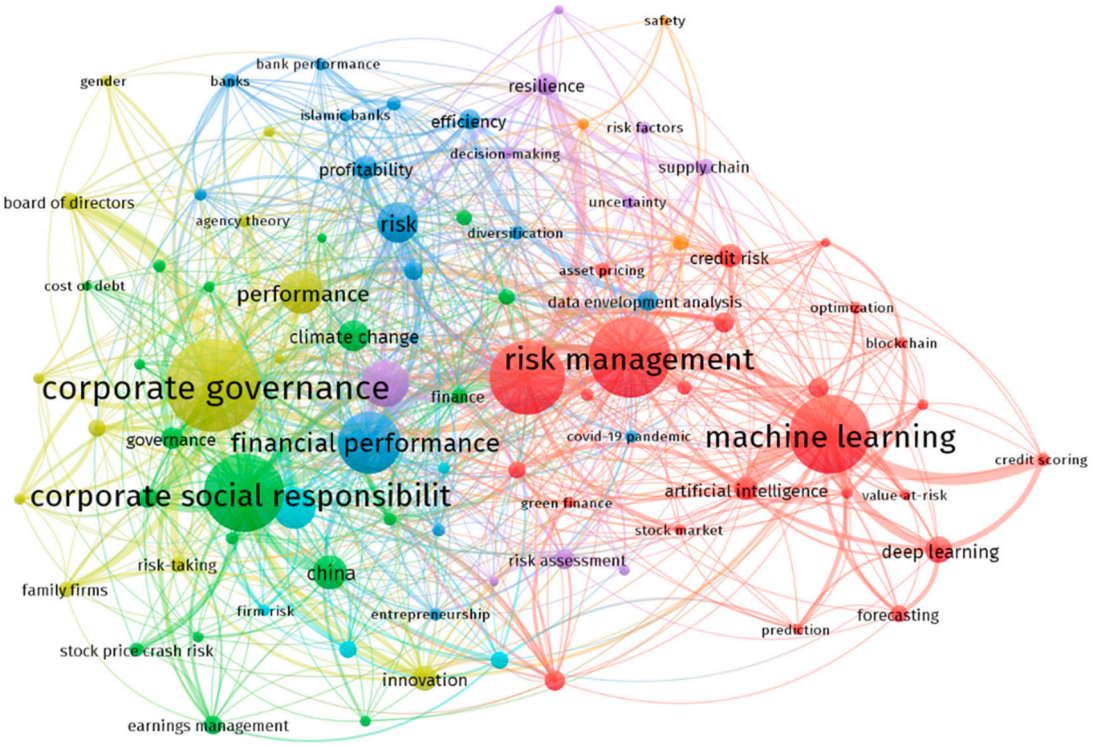

Figure 6. Map of authors' keywords. Source: authors' processing in VOSviewer (version 1.6.20).

The links between two nodes, represented graphically by curves, indicate the frequency of simultaneous occurrence of the connected terms: the thicker the link line, the more frequently the two terms appear together. Furthermore, a shorter curvature suggests a stronger relationship between the two terms.

Figure 6 illustrates the diagram generated from the authors' keywords, providing a visual representation of their interconnectedness. "Corporate governance", "Risk management", "Corporate social responsibility", "Machine learning", "COVID-19", "Financial

performance", "Sustainability", "Risk", "Artificial intelligence" were the keywords that appeared the most common and were listed with the highest TLS (Total Link Strength).

At the core of the network, "Risk management" and "Machine learning" stand out as dominant themes, suggesting a strong focus on the intersection of traditional risk management practices and emerging technologies. The significant connection between these two terms indicates a growing interest in leveraging machine learning and artificial intelligence to improve risk assessment, forecasting, and decision-making processes. Related concepts such as deep learning, credit risk, and optimization are closely related, reflecting the integration of advanced computing techniques in the financial sector.

The term "corporate governance" forms another major group, closely related to "corporate social responsibility" (CSR) and "financial performance". This cluster emphasizes the importance of governance mechanisms and CSR initiatives in shaping corporate behavior and influencing financial results. The presence of terms such as "board of directors", "governance", and "agency theory" indicates a strong focus on structural aspects of governance and their impact on risk management and performance.

In addition, terms such as "climate change", "green finance", and "sustainability" appear in close proximity to corporate governance, underscoring the growing importance of environmental and social factors in corporate risk management strategies. The link between risk-taking and performance reflects ongoing research on the balance between risk exposure and financial performance, particularly in the context of sustainability and governance practices.

4.4. Term Co-Occurrence in Abstracts and Titles

Analyzing the co-occurrence of terms in abstracts and titles is a key analytical approach for understanding the thematic structure and research trends within a specific field. Relationship analysis can be used to determine the co-occurrence of elements across different documents. This analysis helps to identify trending topics and emerging patterns in scientific research, enabling more effective monitoring and follow-up. In this study, bibliometric analysis using VOSviewer software was employed to map the co-occurrence of keywords and terms related to risk management and financial performance in article titles and abstracts.

The network visualization shown in Figure 7 highlights the co-occurrence of terms related to risk management and financial performance in academic publications indexed by the Web of Science from 2020 to September 2024. The distinct color-coded clusters reveal key topics such as process optimization, financial indices, and firm-specific factors, offering insights into the evolving discourse in the field.

To analyze the relevance of terms in abstracts and article titles, a term needed to appear for a minimum of 50 times across the articles included in the study. From a total of 114,406 keywords, 599 met the condition. For each of the 599 terms, a relevance score was calculated. An amount of 60% (359 terms) was chosen for term relevance score calculation as the default value. Thus, four clusters were created, illustrated in blue, green, red, and yellow, as depicted in Figure 7.

Different terms or phrases within each cluster are grouped around a central theme. The terms that appear most frequently are outlined as follows:

The Red Cluster ("Tools and Techniques for Assessing and Optimizing Financial Risk and Performance") encompasses concepts, methods, techniques, and tools used to assess, manage, and optimize the risk and financial performance of companies, taking into account factors such as probability, losses, financial resources, applied technologies, and simulation and estimation processes. The terms that appear most frequently are system, process, technique, problem, outcome, tool, assessment, rate, loss, probability, challenge, application,

prediction, feature, dataset, distribution, field, use, capacity, service, network, solution, optimization, accuracy, improvement, risk assessment, estimation, financial resource, parameter, comparison, algorithm, function, simulation, criterion, concept.

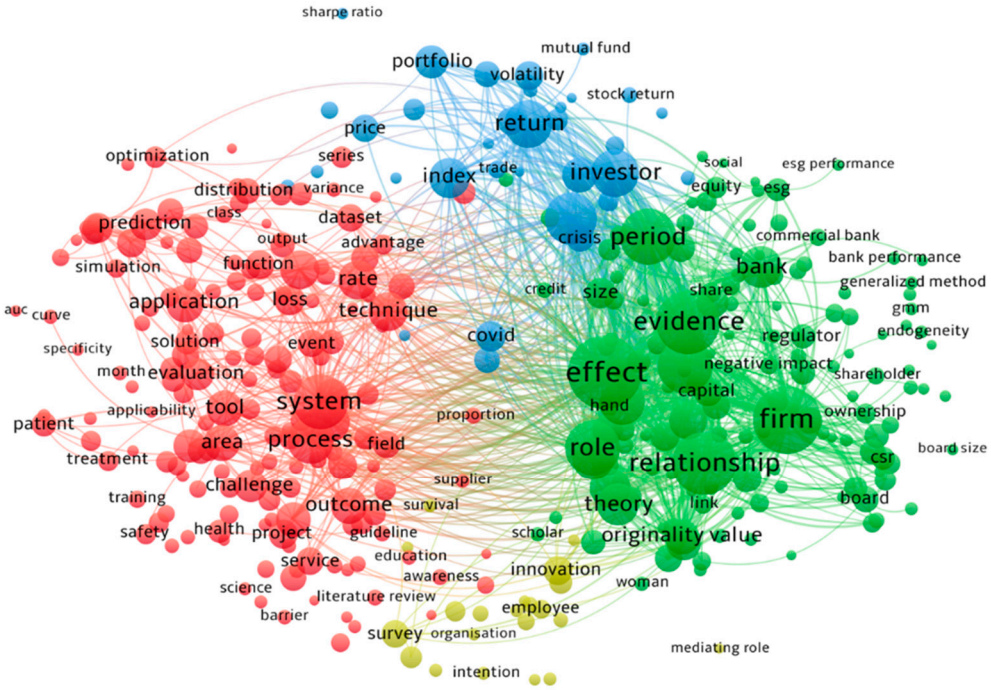

Figure 7. Map of terms in abstracts and titles. Source: authors' processing in VOSviewer.

Among the most used financial risk assessment tools are sensitivity analysis and scenario analysis, which allow for identifying and quantifying the impact of risk factors on financial indicators. For example, studies by Copeland and Weston [75] emphasize the use of these techniques to anticipate potential variations in cash flows.

To optimize financial performance, techniques such as the analysis of financial ratios (profitability, liquidity, solvency) and the Balanced Scorecard, formulated by Kaplan and Norton [76], are often used in the specialized literature.

In the context of risk and financial performance, the CAPM model (Capital Asset Pricing Model), detailed by Sharpe [77], is another example often used to determine the relationship between risk and return, being especially applied in investment decisions and portfolio management.

These tools and techniques give financial managers a clear view of risks and opportunities, enabling them to make informed decisions and improve the organization's financial performance. Table 4 presents the clusters created based on the keywords and terms from the diagram in Figure 7.

The Green Cluster ("Empirical and Theoretical Analysis of Institutional and Governance Factors in the Financial Performance of Companies"). This category includes terms related to the impact and relationships between different economic, governance, and institutional factors on the financial performance of firms. It focuses on the empirical and theoretical analysis of the role of banks, firms, capital, corporate governance, and social responsibility, also integrating practical and theoretical perspectives deriving from studies carried out in different periods and countries. It has 142 terms, and the terms frequently appearing in the abstracts and titles of the articles are as follows: effect, firm, evidence, relationship, period, role, sample, theory, implication, influence, bank, commercial bank, financial performance, size, country, originality value, empirical evidence, practical im-

plication, financial crisis, equity, governance, association, capital, corporate governance, corporate social responsibility, board, director, design methodology approach, policymaker.

Table 4. Keyword clusters. Source: authors' processing.

Tools and Techniques for Assessing and Optimizing Financial Risks and Performance—Cluster 1 (Red)	Empirical and Theoretical Analysis of Institutional and Governance Factors in the Financial Performance of Companies—Cluster 2 (Green)	Analysis of Financial Market Volatility and Investment Performance in the Context of Global Crises—Cluster 3 (Blue)	Adoption of Innovation and Organizational Culture in Small and Medium Enterprises—SMEs—Cluster 4 (Yellow)
Tool	Role	Portfolio	Employee
Technique	Evidence	Investor	Adoption
System	Effect	Market	Innovation
Rate	Theory	Volatility	Culture
Process	Firm	Return	Survey
Problem	Relationship	Index	Perception
Probability	Influence	Fund	Respondent
Prediction	Governance	Bond	Entrepreneurship
Outcome	Period	Asset	Questionnaire
Loss	Implication	Stock Market	Medium-Sized Enterprise
Feature	Size	Benchmark	Competitive Advantage
Challenge	Bank	Price	Intention
Assessment	Sample	COVID	Attitude
Application	Financial Performance	Financial Market	Organization

A significant example from the specialized literature is the study by Porta et al. [78], who explores the influence of legal institutions and property rights on financial performance. They showed that countries with a strong legal system and effective shareholder protections tend to have companies with superior financial performance. Shleifer and Vishny [79] also accentuate the relevance of effective corporate governance in maximizing shareholder value. They show that strong governance structures such as independent boards of directors, effective internal control mechanisms, and transparent reporting contribute to better financial performance.

The Blue Cluster ("Analysis of Financial Market Volatility and Investment Performance in the Context of Global Crises") contains 33 terms: market, return, investor, index, asset, portfolio, COVID, volatility, stock market, fund, stock, price, financial market, stock return, mutual fund, bond, stock price, diversification, benchmark, empirical result, trade, market risk, global financial crisis. This category covers issues associated with the performance of financial markets and investments, including market volatility, and asset returns, investor behavior, as well as the effects of global crises, such as the global financial downturn and the COVID-19 pandemic.

Within the framework of the global financial crisis of 2008, Coval et al. [80] analyzed the volatility of bond and credit markets. Volatility during periods of crisis, such as 2008, highlights the significant risks associated with investing in derivative financial assets and corporate bonds. In the present situation, the COVID-19 pandemic represented another major test for financial markets. Zhang et al. [81] analyzed the effects of the pandemic on market volatility and concluded that crisis-induced volatility was one of the most severe in history, with major impacts on stock, bond, and commodity prices.

The Yellow Cluster ("Adoption of Innovation and Organizational Culture in Small and Medium Enterprises—SMEs)" has 21 terms: innovation, survey, adoption, perception, questionnaire, employee, attitude, culture, trust, medium-sized enterprise, respondent, intention, organization, SME, entrepreneurship, competitive advantage, consumer, me-

diating role. This category explores issues related to innovation, employee perception and attitude, and the adoption of new technologies or practices within SMEs. It includes factors such as organizational culture, trust, entrepreneurship, and competitive advantage. It also includes research methods such as questionnaires and surveys, and consumer and employee responses in this context.

In an empirical study, Terziovski [82] explored the relationship between innovation and SME performance and demonstrated that businesses that adopted an innovation-oriented organizational culture achieved significantly better performance. His research shows that SMEs that emphasize openness to new technologies, encourage collaboration, and accept the risk of failure are better able to innovate and improve their market performance.

The density visualization map shown in Figure 8 represents a more refined bibliometric analysis created in VOSviewer. Unlike the color-clustered map previously discussed, this diagram uses a gradient to highlight the temporal evolution of research trends over the years. This type of map is instrumental in tracking how research priorities and focal points shift over time, providing insights into the dynamic interplay between financial performance and risk management strategies. The color gradient, ranging from blue (earlier studies, e.g., 2020) to yellow (more recent studies, e.g., 2024), highlights the timeline of research activity.

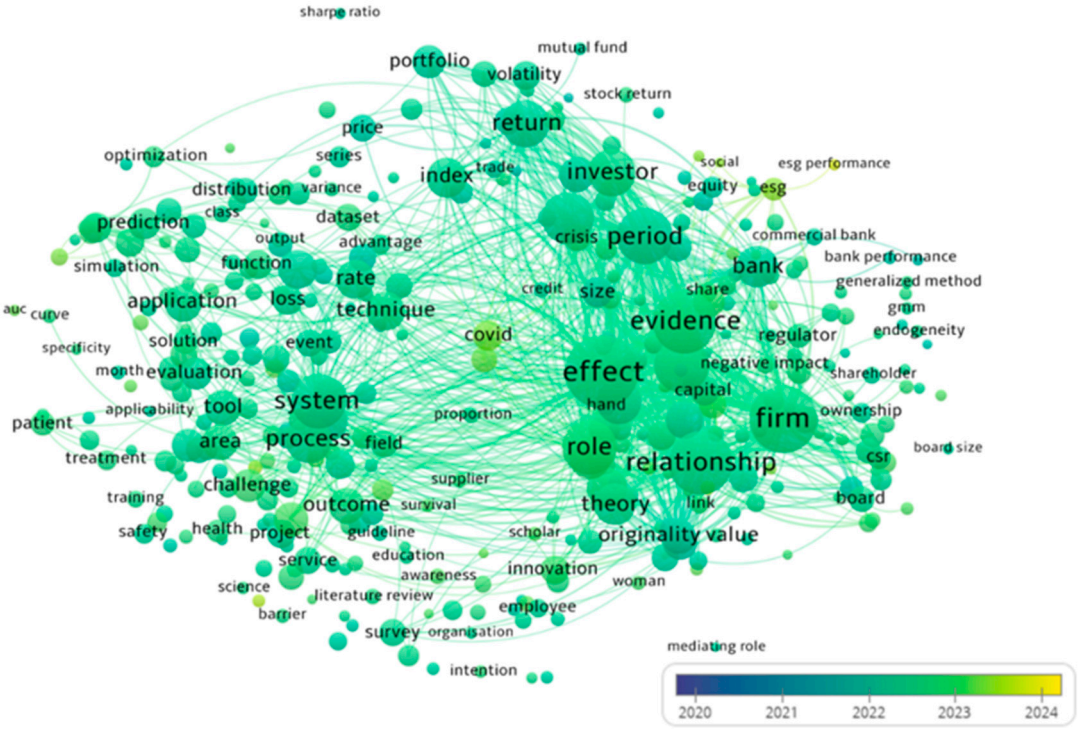

Figure 8. The density visualization map. Source: authors' processing in VOSviewer.

The maps shown in Figures 8 and 9 serve as tools for understanding the evolution of research themes and identifying emerging trends in the intersection of risk management and financial performance over the specified period. Figure 9 presents an enlarged and focused view of Figure 8, specifically emphasizing sustainability-related terms such as "ESG" and "CSR" to improve clarity and detail. Furthermore, these findings reinforce the importance of continuous adaptation, innovation, and risk management strategies in driving financial performance across industries.

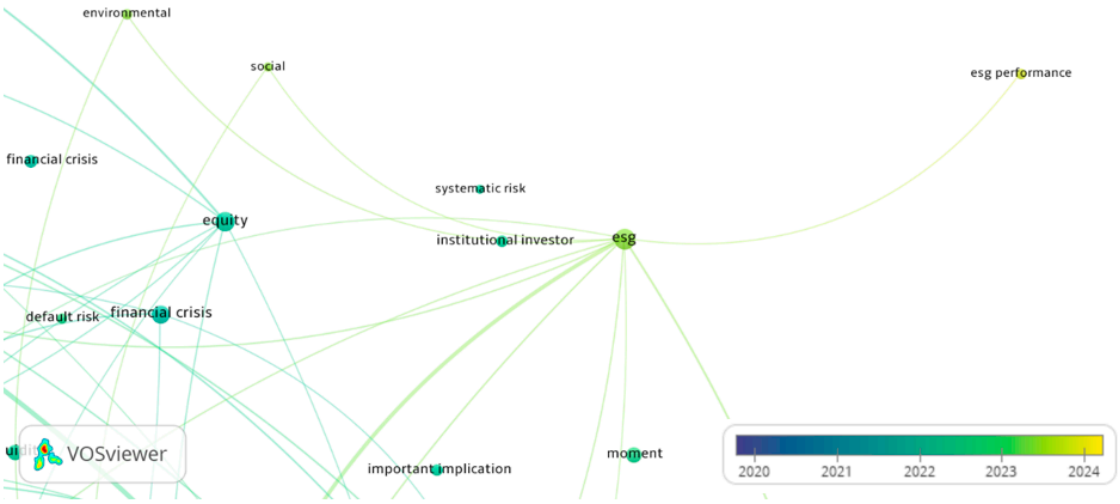

Figure 9. The density visualization map enlarged. Source: authors' processing in VOSviewer.

This VOSviewer network visualization presents key terms and their interconnections in recent academic research, focusing on topics such as investor behavior, firm performance, and evidence-based relationships. Terms in this co-occurrence map are color-coded by time, with a gradient from blue (2020) to yellow (2024), indicating recent research focus on each topic. On the right side of the map, terms like "CSR", "ESG", and "board" indicate a growing interest in corporate social responsibility (CSR) and environmental, social, and governance (ESG) factors.

As can be seen in the overlay diagram above, although still in relatively small numbers, researchers have recently begun to integrate Environmental Social Governance (ESG) into their work. The enlarged section of the overlay diagram placed at the top indicates that scholars are primarily focusing on solutions in response to current sustainability issues.

Overall, this visualization reveals that research in recent years has turned to analyzing the complex relationships between investor behavior, firm performance, and broader economic and societal factors. The growth of terms such as "COVID", "ESG", and "innovation" shows how global challenges and technological advances have influenced the field, while methodological tools such as simulation and evaluation are increasingly used to navigate this complexity. Using color to track research trends over time highlights the ongoing evolution of these research themes, with more recent topics focused on sustainability and resilience in the face of global crises.

5. Discussion

This study identifies a significant research gap in the existing literature by revealing latent connections between risk management, financial performance, and sustainability. Romanian companies such as Dedeman, Banca Transilvania, Rompetrol, and Albalact exemplify how integrating sustainable risk strategies enhances reputation and boosts sales. It extends prior knowledge by mapping how global challenges like the COVID-19 pandemic, climate regulations, and technological change shape sustainability-driven risk strategies. Despite its contributions, the study has certain limitations. It relies solely on WoS articles, potentially narrowing its scope, and it includes only eight months of 2024 data. Delayed indexing may also affect publication counts. Furthermore, most prior research focuses on developed regions, leaving emerging markets in Africa, South Asia, and Latin America understudied [83], despite their unique economic and social contexts [84,85]. To support the integration of risk management and sustainability, companies can adopt the following strategies: cultivate a sustainability-focused culture, including staff training in

risk and sustainability practices; implement integrated management systems considering the adoption of international standards, such as ISO 31000 [86] for risk management and ISO 26000 [87] for social responsibility; promote transparency through regular reporting aligned with international guidelines; engage stakeholders to identify and address key sustainability and risk concerns; and monitor and evaluate performance with clear indicators.

Figure 10 presents key recommendations and specific aspects of risk management, serving as a practical guide for structuring a risk management plan that can be tailored to the specific needs of each organization.

Figure 10. Framework for sustainable risk management strategy. Source: authors' processing.

6. Conclusions

In conclusion, this study analyzed the evolution of risk management research, focusing on the interaction between risk management, sustainability, and the financial performance of companies. The findings suggest that efficient risk management plays a major role in enhancing financial performance. This underscores the importance of adopting sustainability practices for effective risk management. This proposal is consistent with the literature, which in recent years has demonstrated a positive link between risks and performance [11,60,88], and this article further contributes to this field by highlighting the need for risks to be clearly detailed and transparent in companies' sustainability reports.

In addition, the study aligns with the conclusions of other research, confirming the significance of risk management in increasing financial performance, but stands out for its additional details regarding its systematic approach to bibliometric data and in highlighting recent trends that emphasize the contribution of sustainability in risk management. By analyzing the literature of the last four years, the study reveals that the integration of sustainability aspects is an emerging direction in this field, indicating a paradigm shift in the management of long-term financial risks.

Compared to other works, this article adds value by using in-depth relational analysis and applying VOSviewer software to explore topic networks and keyword co-occurrence,

a relatively rare approach in literature. Consequently, the most important aspects of the information content related to risk management research are highlighted (the most used methods, countries with the highest number of authors publishing articles on this topic, co-occurrence of keywords).

The results obtained from the analysis of the key terms through the graphic nodes support the research hypothesis regarding the existence of a link between risk management, sustainability, and the financial performance of companies. At the same time, the spatial distribution of the total output in the field shows that the most relevant country in terms of authors researching the topic of risk management and financial performance of companies is China, succeeded by the United States, England, Australia, and India.

The limited number of bibliometric studies addressing risk management, sustainability, and the financial performance of companies in the specialized literature gives the analysis a valuable addition to the field of finance by delivering premises for future research and a starting point regarding relevant bibliographic references on this topic. Also, the originality of this work consists of the use of an advanced method of relational analysis, which reveals not only the correlations between variables, but also the importance of adopting transparent risk management policies within companies.

Overall, the review of recent research highlights that effective risk management is important for companies seeking to improve their financial performance. The integration of sustainability practices and strong corporate governance structures are essential components that help companies manage risk more effectively. In addition, the global focus on these areas and the increasing diversity of research methodologies reflect the increasing complexity of risk management in today's business environment.

Considering the subjective nature of qualitative research, we believe that this article, based on a bibliometric analysis of scientific studies indexed in international databases, can make a useful contribution to the activity of financial research for researchers interested in the field and for future research. This study is particularly useful to managers, who can become aware of the profound impact of risks on financial performance and improve their identification and reporting processes. At the same time, the study also provides a reference base for researchers and professionals in the field, helping them to follow emerging research directions and to understand the central role of risks and sustainability in achieving organizational performance.

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Abbreviations

The following abbreviations are used in this manuscript:

ERM	Enterprise Risk Management
ROA	Return on Assets
ROE	Return on Equity
ROI	Return on Investment
PMS	Performance Management System

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