Teza de ablitare: Managementul transformării digitale și sustenabile a organizațiilor: contribuții privind capitalul uman, comportamentul consumatorului și reziliența organizațională

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Domeniul: MANAGEMENT

Universitatea: TRANSILVANIA din Brașov

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Data: 11.09.2026 Semnătura:

Conf.dr.Zamfirache Alexandra

ISSN 1611-1699 / eISSN 2029-4433

VILNIUS TECH
Vilnius Gediminas Technical University

JOURNAL of BUSINESS ECONOMICS & MANAGEMENT

2025
Volume 26
Issue 3
Pages 621–643

https://doi.org/10.3846/jbem.2025.23777

COLLABORATIVE ACTIONS TO SUPPORT SMES' SUSTAINABILITY IN TIMES OF CRISIS

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Article History:
- received 08 July 2024
- accepted 07 February 2025

Abstract. The paper provides a detailed analysis of SMEs' interest in collaborative action for sustainability as a way of responding to the challenges posed by recent crises. This study attempts to bridge the research gap on how managers of small and medium-sized enterprises manage business sustainability, providing complex insights into the application of collaborative practices for sustainability and the collaborative advantages that can support the competitiveness of these enterprises in the marketplace. The research design is quantitative and targeted 672 SMEs in Romania. A moderated moderation analysis is also carried out, and the model tests the relationship between the age of the analysed SMEs and the impact felt after recent crises, a relationship moderated by sustainable cooperation, and a moderator moderated by possible changes felt from the application of collaborative practices. Finally, this regression function is statistically significant and was shown to be a significant moderated moderation. The research results showed the major impact of recent crises on the activity of SMEs, indicating that the interest of these companies in collaborative actions and the level of results expected from collaboration for sustainability decreases the greater the impact of crises on their business.

Keywords: sustainability, crises, collaboration for sustainability, SMEs, moderation analysis, business management.

JEL Classification: M10, H12, Q56.

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1. Introduction

Small and medium-sized enterprises have been subject to major challenges in recent years with significant consequences for their business. The extent of the effects of the COVID-19 pandemic on the business environment has increased the need for these enterprises to find solutions to help them survive and compete in an uncertain and turbulent environment (Do et al., 2022). Several studies on this research stream have highlighted the positive results that collaborative arrangements can generate among companies in crises (Sawalha, 2014; Ganeshu et al., 2024). In addition, collaborative arrangements enable individual organizations to enhance sustainability efforts and comprehensively address sustainability issues.

Despite a wealth of research on the challenges and benefits of collaboration for sustainability, few studies focus on a detailed analysis of how SMEs manage sustainability issues in

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a crisis environment. Therefore, the authors of this article set out to analyse the interest of SMEs in Romania in sustainable development, addressing organizational collaboration with stakeholders for sustainability as a way of responding to current challenges. We believe that this study succeeds in bridging the knowledge gap existing at this point in the literature, providing complex information on the application of collaborative practices for sustainability in the context of recent crises.

The research questions guiding the authors' approach are: What have been the main problems confronted by SMEs in Romania in the recent context of the crises? Is there interest in applying sustainability practices in these enterprises? Is there openness on the part of SMEs to collaborate to ensure sustainability and what are the expected results of collaboration on sustainable business development?

The findings revealed that the interest in collaborative actions and the level of expected results from collaboration for sustainability decreases the higher the effect of crises on business activity. The results of research can be considered by SME managers to succeed in developing strategic plans to implement the application of collaborative actions for competitive advantage and sustainability at the same time.

Considering this context, the authors organized the paper in following sections: 2 a review of the literature; 3 presents the research methodology and design of the study; 4 focuses on quantitative research and highlights the results; 5 discussions. The final section is dedicated to conclusions, implications, and further research directions.

2. Literature review

2.1. The implications of crises on SMEs

The crises have harmed the entrepreneurial sector around the world and continue to affect the evolution of this sector.

According to the specialized literature research, the SME sector was strongly influenced by the crises that happened in the last 20 years.

Starting with the financial crisis of 1997/1998, the global financial crisis of 2008/2009 and until 2020, different types of crises have had different effects on Asian SMEs (Tambunan, 2019).

During the COVID-19 crisis in 2020, small businesses in Macao faced temporary closures and human resource issues and have reported financial losses (Alves et al., 2020).

The research carried out in USA by Dua et al. (2020), on a sample composed of 1,004 respondents, covering a representative range of industries, reveals the need of a new business model which will ensure the survival of US SMEs.

During the same crisis, small businesses in Kosovo felt negative effects on revenue, regardless of the field of activity, the intensity of the effects being directly proportional to their size (Kryeziu et al., 2022).

In Europe, in the analysis carried out on small businesses in Calabria, Italy, the pandemic crisis highlighted the need to develop an anti-fragile behavior, which would help companies in managing the negative effects and which would include elements such as lean financial resources, strategic agility, and relations with research institutions (Corvello et al., 2023). The COVID 19 pandemic crisis and the Russian Ukrainian war had a negative impact on Hungarian companies, according to a study carried out by Toth et al. (2023), between the years 2021–2022, companies with increased financial capacity were less affected by crises of this type, they developed more precise and efficient decision-making processes, managed risks better and improved their credibility.

The 2022–2023 energy crisis brought changes to SME policies in response to the new situation. Government policies were defined, lowering the price of electricity and natural gas paid by SMEs (Marchese, 2023).

The ROL indicates that all types of crises in the period under study had a strong impact on SMEs and reveals the importance of developing a conceptual model that would facilitate the resilient behavior of SMEs in times of crisis. The differences observed in the analysis of the specialized literature, related to the way SMEs reacted in times of crisis, mainly concern the geographical region from which the companies come and the level of preparation of managers and employees to deal with times of crisis. Some of the cited authors considered that managers are not sufficiently prepared for times of crisis (Dvorský et al., 2023).

2.2. Sustainable development within small firms/SMEs

The COVID-19 pandemic has had a major impact on SMEs by substantially reducing their revenues and profits. The COVID-19 pandemic has led to a series of inequalities between nations and deepened the gap between North and South. This uneven development has produced many inequalities between large and small businesses (Meramveliotakis & Manioudis, 2021).

Several studies address the possibility of developing strategies within SMEs that would lead to the achievement of sustainable development objectives, established in its three domains: social, economic and environmental (Álvarez Jaramillo et al., 2019; Seisenbayeva et al., 2020; Nasiri et al., 2022; Avila et al., 2023; Al-Karkhi, 2024).

The main barriers and facilitators for the adoption of sustainable practices in SMEs in Romania were identified by Costache et al (2021), based on a study developed on a panel of 71 companies. According to the cited study, Romanian managers mention among the barriers the difficulties related to the business environment, finding partners and customers with common values, the legal environment and unpredictable regulations, bureaucracy and corruption. The facilitators study aims at the company's reputation, positive image and the respect of the communities.

The results of the study carried out by Aristei and Gallo (2024), indicate that green firms are more resistant to the pandemic shock and the COVID-19 crisis prevented the beneficial influence that ecological management exercised on access to credit in the pre-pandemic period, firms with solid environmental management practices did not benefit of improved access to finance and this led to a slowdown in their green investment activities.

2.3. The role of collaboration in the sustainable development of SMEs

Sustainability requires initiatives of several stakeholders and a requirement for the implementation of sustainable management approaches is the ability of different actors to collaborate.

In the opinion of many researchers, collaboration has a positive impact on companies' sustainable development efforts (Govindan et al., 2016; Wassmer et al., 2014) through innovation and the introduction of new technologies (Lozano et al., 2021), the development of sustainable business models (Witjes, & Lozano, 2016), research and education (Jirapong et al., 2021). Also, the ability to collaborate is essential for the use of renewable resources and the effective implementation of a cleaner production that offers competitive advantages for companies (Van Hoof & Thiell, 2014).

Considering the study carried out by Smith et al. (2022), the SDGs, i.e., Sustainable Development Goals, are a call to action for governments, businesses, and communities to balance the relationship between the economy, environment, and society. Although businesses are

key partners in achieving the SDGs, discussion of the involvement of Small and Medium Enterprises (SMEs) in such goals is limited. In the case of SMEs, sustainability is interpreted in terms of meeting the needs of the local community. These types of strategies with beneficial effects on all local community stakeholders can only be implemented through their collaboration under the 17th SDG, namely "Partnership for the Goals" (https://www.un.org/sustainabledevelopment/news/communications-material/).

Das and Rangarajan (2020) believe that SMEs in emerging economies have not paid enough attention to their responsibilities towards society and the environment. Their research shows that, among other factors, collaborative synergy positively influences company sustainability performance, and business growth is positively influenced by increased sustainability performance. The mentioned authors tried to build a model that relates the sustainability improvement factors to those of the firm's business growth.

One way to ensure global sustainable development in the vision of Hu et al. (2023) is to expand the interest of companies from economic performance to the relationship between environmental performance, social responsibility and governance, integrating ESG reporting within the company and creating added value for more interested parties. We believe that despite the obstacles encountered in such an approach, ESG reporting would contribute to the intensification of cooperation between SMEs.

Other research that deals with the need for collaboration to promote sustainable development strategies within the SMEs were carried out by Wang et al. (2022), Westman et al. (2023), de Jesus Pacheco et al. (2024).

According to Belitski et al. (2022) entrepreneurship in the post-pandemic world will merge with the digital economy and entrepreneurs will look to collaborate with online communities, develop opportunities, get support on different issues, and find new collaborators.

In view of all of the above, the authors aim to test the following hypotheses:

H1. The existence of a link between the impact of recent crises felt by the SMEs in the most important areas of activity of the firms and the evolution of the companies;

H2. The existence of a link between the interest in collaborating with other firms for sustainability and the benefits recorded in the most important areas of activity;

H3. The existence of a moderating effect of the expected results of collaboration for sustainability, moderated by the concern for sustainable cooperation on the relationship between the impact of recent crises and the age of the firms.

3. Research method and objectives

The authors conducted a quantitative research that aims to analyze the opinions and attitudes of SME managers in Romania on the application of collaborative sustainability practices in the context of recent crisis periods.

3.1. Data collection and study sample

To achieve the study's objectives, the authors used an online survey. The data collection instrument for this survey (Toy & Guris, 2023) is the questionnaire. This was distributed electronically via a web platform (collection technique Computer Assisted Web Interviewing (Sowa et al., 2015)). Initially, the questionnaire was pretested to eliminate possible ambiguities. The

final version thoroughly covers the researched topic and achieves the intended purpose (Appendix). We used established scales for making the questionnaire and collecting data, scale such as: Likert, nominal with single choice, numerical scale.

The companies included in the research were selected under EU Recommendation 2003/361 for SMEs, i.e. companies with fewer than 250 employees, an annual turnover of less than €50 million and/or an annual balance sheet of less than €43 million (EU Recommendation 361 for SMEs, 2003). Thus, the questionnaire was sent to 1846 SMEs in Romania, their data being taken from the list of Romanian companies, a database providing contact, financial and creditworthiness information, including information on relationships with other companies.

The questionnaire was sent to the email address declared by the company. In the end, 689 questionnaires were completed. But, from these totals, 17 were not fully completed and were removed from the analysis. The distribution of the companies included in the research is presented in Table 1. Non-probability convenience sampling was used.

Table 1. The distribution of investigated companies according to the field of activity

NACE v2 classes*	NACE v2 Code	Number of respondent companies	I (%)
Manufacture of food products	10	52	7.74
Manufacture of textiles	13	39	5.80
Manufacture of electrical equipment	27	56	8.33
Manufacture of furniture	31	43	6.40
Construction of buildings	41	68	10.12
Specialised construction activities	43	38	5.65
Wholesale trade, except of motor vehicles and motorcycles	46	95	14.14
Retail trade, except of motor vehicles and motorcycles	47	87	12.95
Warehousing and support activities for transportation	52	49	7.30
Accommodation	55	56	8.33
Food and beverage service activities	56	89	13.24
		Sample = 672 respondent	100

Note: *NACE classification European Commission: Eurostat (2008).

Given the non-random nature of this sampling method, the data cannot be extrapolated to the whole population; although this does not mean that the research is less valuable. The research design underlying the marketing study is illustrated in Figure 1.

The final sample included 672 respondents, managers of SMEs operating in Romania. Their distribution is 50.6% female and 49.4% male. The age category of the respondents is predominantly young, with 45.8% aged 20–34, followed by 35–44 with 29.2%. A percentage of 25% of respondents are over 45 years old.

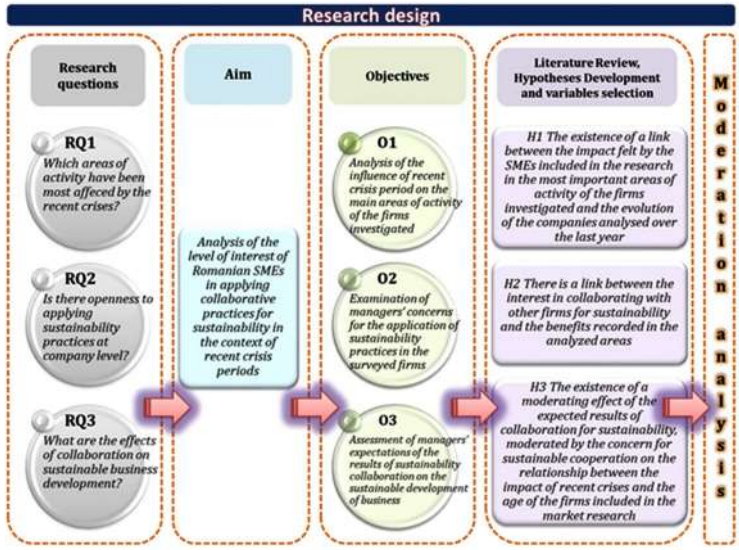


Figure 1. Research design

3.2. Regression function design

In order to analyze the relationship between age of the SMEs included in the research and the impact of recent crises, the authors applied regression analysis In this way, it is checked whether dependent variable (in these case the impact of recent crises) are estimated by market age of SMEs (the independent variable).

Two moderator indicators are then included in the model and the interaction between the two is analysed. To test whether sustainable cooperation influences the strength of the link between the two variables, the variable expected results of collaboration for sustainability is used as a moderator. Then, the second moderator (which is assumed to moderate the first moderator) is related to concern for sustainable cooperation.

For the design of the regression function, the following factors are proposed:

- Indicator on the **firm's age in the market** (**X** (IV)) – indicator calculated as the average for the age of the firms included in the research, declared by the respondents, for the year 2023 – **the control variable.**
- Indicator on the **impact of periods of recent crisis felt** for the business areas: Finance, Human Resources, Logistics, Sales (**Y** (DV)) – the average of the specify degree mention by respondents to which they have felt the impact of the recent crises.
- Indicator on **expected results of collaboration for sustainability** (**W** (MOD1)) –the average for observed effects of collaboration for sustainability in the following: Economic growth, Sustainable HR Management, Efficiency of supply chains and Sustainable trade practices – **moderator 1.**
- Indicator on **concern for sustainable cooperation** (**Z** (MOD2)) – indicator calculated as the average between the extent to which respondents declare themselves interested in cooperation with other firms for sustainable development and the level of expectations regarding the results of such cooperation **moderator 2.**

Except for the control variable, the rest of the variables included in the calculation of the indicators had a Likert Scale (with 5 points) as the measurement scale.

The model proposed by the authors is rendered as follows should be written as:

$$Y = \beta_0 + \beta_1 X + \beta_2 W + \beta_3 Z + \beta_4 XW + \beta_5 XZ + \beta_6 WZ + \beta_7 XWZ + \varepsilon, \quad (1)$$

where: Y – dependent variable; X – independent variable; W – moderator 1; Z – moderator 2; ε – error.

3.3. Data analysis

Data analysis methods corresponding to the objectives of the study were applied. IBM SPSS Statistics software was used. To achieve the purpose of the research are carried out the descriptive analysis and regression model. Indicators calculated were mean, frequency, SD (Howitt et al., 2006; Malhotra, 2004), Top Two Box (T2B) score, Bottom Two Box (B2B) score, χ^2 test (Constantin, 2006).

To test Hypothesis 1 the Chi-square test (χ^2) is used, which confirmed with a 95% probability that there is a link between the impact felt by the investigated SMEs in the most important areas of activity and the last year's evolution of the investigated companies (Finance: $\chi^2_{calculated} = 207.760$; HR: $\chi^2_{calculated} = 623.400$; Logistics: $\chi^2_{calculated} = 381.383$ and Sales: $\chi^2_{calculated} = 152.227 > \chi^2_{0.05;8} = 15.51$).

For the second hypothesis (H2), the authors applied a χ^2 test. The results show that the alternative hypothesis is accepted so is a link between the level of interest in collaborating with other firms for sustainability and the benefits recorded in the firms' main areas of activity (Economic growth: $\chi^2_{calculated} = 237.120$, Sustainable HR Management: $\chi^2_{calculated} = 403.200$, Efficiency of supply chains: $\chi^2_{calculated} = 235.200$ and Sustainable trade practices: $\chi^2_{calculated} = 161.280$. All 4 values > $\chi^2_{0.05;4} = 9.488$). In conclusion, hypothesis 2 is also confirmed.

A moderated moderation analysis is performed with Process Model 3. The model is estimated with one independent variable, one dependent variable and two moderators, and those two moderators interact. The second moderator moderates the moderating influence of the first moderator. To test the moderating role of sustainable cooperation, moderated by possible changes experienced from the application of collaborative practices to the relationship between the age of the SMEs investigated and the impact experienced by recent crises (Hypothesis H3), Hayes PROCESS macro model 3 for SPSS was used (Hayes, 2013). R^2, F, p-value, β, Se, t, Coefficient Effects were calculated. The regression function is overall statistically significant ($R^2 = 0.407$, $F(7, 664) = 65.180$, $p = 0.000$).

4. Results

The results obtained are details on each individual objective.

O1. Analysis of the influence of crisis periods on the main areas of activity of the firms investigated.

First of all, the authors wanted to identify those of the most recent crises strongly felt on the Romanian market that had a major impact on the activity of the SMEs investigated. The COVID-19 pandemic, along with the financial crisis, are the crises that had the greatest impact on the activities of the SMEs surveyed (81% and 80%).

However, the energy crisis (64.3%) and the military conflict in Ukraine (53%) also exceeded half of the responses, having a major influence on the activities of the SMEs surveyed. The analysis shows that the COVID-19 pandemic along with the financial crisis are the two crises

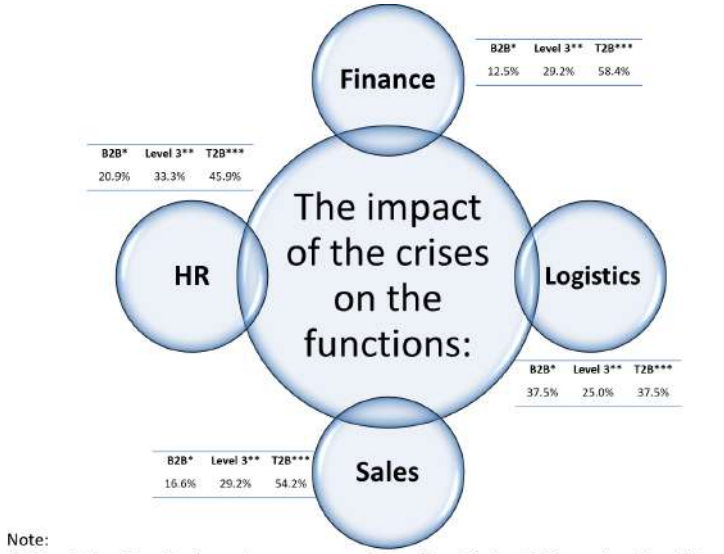


Figure 2. Felt impact of recent crises (source: authors based on research results)

with a major impact of the surveyed firms. However, the effects of the other crises analysed (energy crisis, military conflict) should not be neglected. Is then analyzed the impact on Finance, Logistics, Human Resources and Sales (Figure 2), and can be observed a balanced distribution of results for the Logistics impact, where it is observed that all three variants recorded percentages close to 30%. For the Finance, Sales and Human Resources areas, the scores on the positive side of the scale (T2B) are around the middle 50%. The middle level is around 30% for all three areas analysed.

Hypothesis 1 (H1) is tested – Recent crises have had a strong impact on firms. For the application of statistical testing, the two hypotheses are formulated as follows:

- H_0 = There is no link between the impact of recent crises felt by the SMEs investigated in the most important areas of activity and last year's evolution of the companies analysed.
- H_1 = There is a link between the impact of recent crises felt by the SMEs investigated in the most important areas of activity and last year's evolution of the companies analysed.

To test the proposed hypotheses, the χ^2 test was used. The test is valid for all areas analysed: Finance, Human Resources, Logistics and Sales (there are no cells with expected values < 5, and their percentage does not represent > 20% of the total cells containing expected frequencies). The test χ^2 can be applied in all 4 business areas, and the results show that:

- Finance: $\chi^2_{calculated} = 207.760 > \chi^2_{0.05;8} = 15.51 \rightarrow$ alternative hypothesis H_1 is accepted, so is a link between variables.
- Human resources: $\chi^2_{calculated} = 623.400 > \chi^2_{0.05;8} = 15.51 \rightarrow H_1$ hypothesis is accepted.
- Logistics: $\chi^2_{calculated} = 381.383 > \chi^2_{0.05;8} = 15.51 \rightarrow H_1$ hypothesis is accepted.

- Sales: $\chi^2_{calculated} = 152.227 > \chi^2_{0.05;8} = 15.51 \rightarrow H_1$ hypothesis is accepted.

In conclusion, there is a link between the impact felt by the investigated SMEs in the most important areas of activity and the evolution in the last year, which confirms hypothesis 1, and it can be stated with a 95% probability that the level of impact of the recent crises felt by the investigated companies is significant in the most important areas of the investigated companies, namely Finance, Logistics, HR and Sales.

O2. Examination of managers' concerns for the application of sustainability practices in the surveyed firms

Within this objective, the research highlighted the knowledge of the sustainable development dimension by the managers of the respondent companies. The results showed that 92.9% of the respondents know the dimensions of sustainable development, while 7.1% do not. To continue the direction of the research, respondents were asked to indicate whether they are interested in implementing sustainable development practices within the company, and the results show that 75% of respondents are interested, while 25% say they do not want to do so. Further, only respondents who answered yes to the interest in implementing a sustainable development strategy within the business (504 respondents) were asked to mention what type of sustainable initiatives they could implement. The free results recorded by the respondents were divided into 5 categories as follows:

- Implementation of waste recycling programs (39.9%);
- Conservation of energy resources (32.7%);
- Cultivating the principles of diversity, inclusion and equity in the workplace (16.1%);
- Promoting green thinking as part of organizational culture (7.7%);
- Initiating social programs with community impact (3.6%).

The next question focused on the importance level indicated for applying sustainability practices in the business. The results show that the levels of not important at all (9.8%) and not important (6.7%) account for just over 15% of the responses, the middle level of neither important/nor unimportant is given by 33.2% of the respondents, and the important (25.0%) and very important (25.3%) scales account for half of the responses. It can be concluded that most of the managers consider it important and very important to implement a sustainable development strategy, again supporting the results recorded above (75% of respondents are interested in implementing sustainability principles in their business strategy).

O3. Assessment of firms' managers' expectations on the results of applying collaborative practices on sustainable business development

The survey results reveal that most respondents (83.3%) are open and interested in creating partnerships for sustainability, while 16.7% are not. Initiating collaborative partnerships is important for the sustainable development of the firm and accumulated 28.2% affirmative responses, followed by 70.8% negative ones.

Concerning the level of importance attached to partnerships, the results show that managers consider it not at all important (8.3%) and not important (6.4%). The middle level of the scale cumulates 21.3%, the important level 24.4% and the very important level 39.6%. It can be concluded that most of the respondents with 64% of the responses consider collaboration with other companies important and very important for the sustainable development of the business.

The time horizon in which respondents intent to initiate collaborative partnerships aimed at the sustainable development of the firm are highlighted in Figure 3.

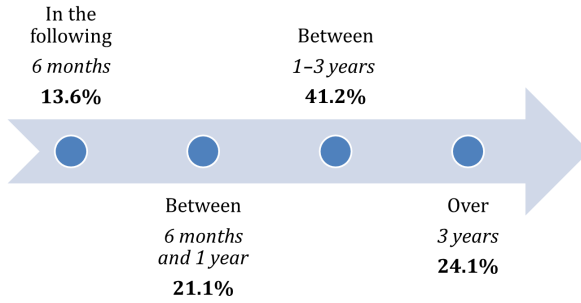
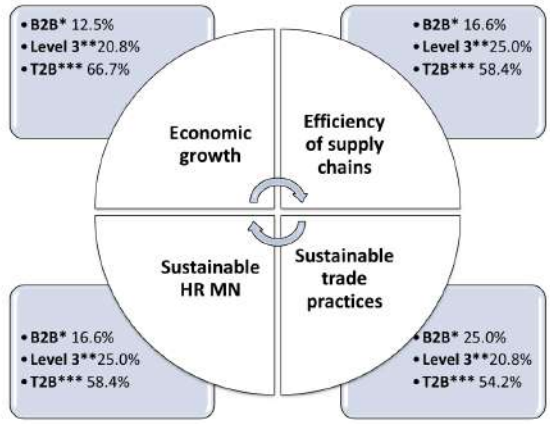


Figure 3. The time horizon in which company managers intend to initiate collaborative partnerships aimed at sustainable company development

The findings show that the areas of interest for the responding managers where they want to initiate collaborative partnerships for sustainable business development are Technological Innovation (31.2%), Environmental Protection (24.8%), Sustainable HR Practices (21.9%), Sustainable Marketing (15.2%) and Sustainable Management and Leadership (6.8%).

The research went on to measure the extent to which managers believe they will feel the effects of collaboration for sustainability in 4 areas: Economic growth, Sustainable HR Management, Efficiency of supply chains and Sustainable trade practices (Figure 4).



Note:
* B2B = Bottom Two Box (sums the response variants of level 1 = to a small extend and level 2)
** Level 3 is the middle of the scale
*** T2B =Top Two Box (sums the reponse variants of level 4 and 5 = to a large extent)

Figure 4. The effects of collaboration for sustainability (source: authors based on research results)

Two hypotheses are formulated for the statistical testing of Hypothesis 2 (H2):

H_0 = There is no link between the level of interest in collaborating with other firms for sustainability and the benefits recorded in the areas analysed.

H_1 = There is a link between the level of interest in collaborating with other firms for sustainability and the benefits recorded in the areas analysed.

To test these hypotheses, the χ^2 test is used. The χ^2 test is considered valid for all 4 areas, and the results show that:

- Economic growth: $\chi^2_{calculated} = 237.120 > \chi^2_{0.05;4} = 9.488 \rightarrow$ the alternative hypothesis H_1 is accepted, and there is a link between the level to which the surveyed SME managers believe they will feel the effects of collaborating for sustainability in Economic growth and the interest in partnering with other firms for sustainability.
- Sustainable HR Management: $\chi^2_{calculated} = 403.200 > \chi^2_{0.05;4} = 9.488 \rightarrow$ hypothesis H_1 is accepted;
- Efficiency of supply chains: $\chi^2_{calculated} = 235.200 > \chi^2_{0.05;4} = 9.488 \rightarrow$ hypothesis H_1 is accepted;
- Sustainable trade practices: $\chi^2_{calculated} = 161.280 > \chi^2_{0.05;4} = 9.488 \rightarrow$ hypothesis H_1 is accepted.

In conclusion, **hypothesis 2 is confirmed**, i.e. that there is a link between the level of concern of the SME managers investigated for the implementation of sustainability practices at the level of the business they manage and the interest in collaborating with other firms for sustainability.

Moderation analysis

To test Hypothesis 3 (H3), the relationship between the age of survey companies and the degree to which they felt the impact of crises is analysed, a relationship moderated by the variable expected results from collaboration for sustainability, a moderator moderated by concern for sustainable cooperation. A moderation analysis is conducted, using the PROCESS v4.2 SPSS macro (Hayes, 2013). The proposed model is developed based on the literature review, the results of the research conducted, and previous researches developed by the authors. The proposed model comprises the components shown in Figure 5.

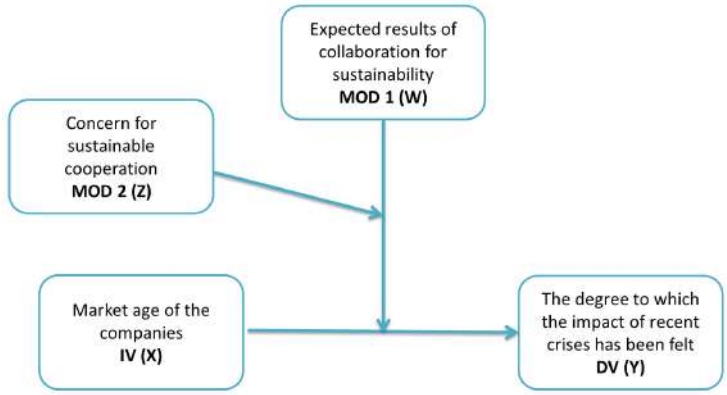


Figure 5. Regression model

The model has $R^2 = 0.407$ (40.7% of the variance of DV(Y) is explained by Mod 1(W), Mod 2(Z), IV(X) and the interaction between them. Because F(7,664) = 65.180 and p = 0.000, the variance and also the interaction term is significant.

The p-value (p-values = 0.000) means that all predictors taken together explain a significant amount of variants and the regression model is statistically significant.

Table 2. The regression table (unstandardised regression coefficients)

	β	Se	t	p	95%CI	
					Low	Up
Constant	17.121	1.228	13.940	0.000	14.709	19.532
Market age of the companies (A)	–0.865	0.060	–14.295	0.000	–0.983	–0.746
Expected results of collaboration for sustainability (B)	–3.077	0.319	–9.658	0.000	–3.702	–2.451
Interaction 1 (A*B)	0.207	0.015	14.101	0.000	0.178	0.236
Concern for sustainable cooperation (C)	–7.04	0.604	–11.649	0.000	–8.228	–5.854
Interaction 2 (A*C)	0.48	0.035	13.843	0.000	0.415	0.552
Interaction 3 (B*C)	1.532	0.153	10.015	0.000	1.232	1.832
Interaction 4 (A*B*C)	–0.111	0.008	–13.486	0.000	–0.127	–0.095

The interaction effect is statistically significant (p = 0.000 and zero is not in CI) (Table 2), so the relationship between DV(Y) and IV(X) is moderated by Mod1(W), moderated by Mod2(Z).

Among the four interactions (Table 2), the most important interaction is the three-way interaction between the independent variable, moderator one and moderator two (p = 0.000 is significant), concluding that there is a moderation of the effect from IV(X) variable on DV(Y) variable by Mod1(W) that is moderated by Mod2(Z). Therefore, it is a significant moderated moderation. It can be observed that interaction 4 is significant so we have a significant moderated moderation. Interaction 4 shows that the effect is statistically significant (p-value) The t-values show that there is a negative relationship and there is an effect (t = –13.486).

Because all of the p-value; 0.05, and IC does not include zero, it can conclude that the estimators are significantly different from 0.

This confirms the existence of a statistically significant interaction. In other words, the relationship between the degree to which the impact of the crises was felt and the market age of the companies analysed is moderated by the expected results of cooperation for sustainability, moderated by the interest shown in cooperation for sustainability.

Table 3. Test of highest-order unconditional interaction

	R^2-change	F	df1	df2	p-value
X*W*Z	0.162	181.863	1.000	664.000	0.000

There is the product of the three (X, W and the interaction effect of Z), which shows the main hypothesis (Table 3). The R^2 change value was 16.2%, i.e. the interactive effect of these three indicators together explained 16% of the total change, and this was statistically significant.

Just because significant moderated moderation is present, the following tests can be checked.

Table 4. Test of conditional X*W interaction at value(s) of Z

Concern for sustainable cooperation	Effect	F	df1	df2	p-value
–0.439 (–1SD)	–0.008	6.984	1.000	664.000	0.008
0.000 (Mean)	–0.057	97.234	1.000	664.000	0.000
0.439 (+1SD)	–0.106	133.808	1.000	664.000	0.000

It can be observed (Table 4) that the conditional interaction is registered for three different values of the second moderator (–1SD, mean, and +1SD). For low values of the second moderator, the conditional interaction effect between the independent variable and moderator is –0.008 and significant (p = 0.008). For the mean values of the moderator, the interaction is –0.057 (negative) and significant as well (p = 0.000). For high values of the moderator, the interaction between IV(X) and MOD1(W) is –0.106 (negative) and significant (p = 0.000 < 0.05).

Nevertheless, it can be noted that the interaction between IV(X) and MOD1(W) decreases for high values of MOD2(Z), all recording negative values, which follow a downward trend.

Table 5. Coefficient effects of the focal predictor at values of the moderators

MODE 1	MODE 2	Effect	SE	t	p-value	95%CI	
						Low	Up
–1.132 (–1SD)	–0.439(–1SD)	0.051	0.005	9.296	0.000*	0.040	0.062
–1.132 (–1SD)	0.000 (Mean)	0.143	0.011	13.023	0.000*	0.122	0.165
–1.132 (–1SD)	0.439 (+1SD)	0.235	0.017	13.522	0.000*	0.201	0.270
0.000 (Mean)	–0.439 (–1SD)	0.042	0.004	11.600	0.000*	0.035	0.049
0.000 (Mean)	0.000 (Mean)	0.079	0.005	15.874	0.000*	0.069	0.089
0.000 (Mean)	0.439 (+1SD)	0.116	0.008	14.974	0.000*	0.101	0.131
1.132 (+1SD)	–0.439 (–1SD)	0.033	0.004	7.402	0.000*	0.024	0.042
1.132 (+1SD)	0.000 (Mean)	0.014	0.004	3.918	0.000*	0.007	0.022
1.132 (+1SD)	0.439 (+1SD)	–0.004	0.006	–0.709	0.478ns	–0.015	0.007

Notes: ns: p > 0.05 ; *: p ≤ 0.005.
Mode 1 = Expected results of collaboration for sustainability.
Mode 2 = Interest in sustainable cooperation.

The 9 combinations for the first and second moderators with -1SD, mean, and +1SD are shown in Table 5. The data analysis shows that only one combination out of the 9 is not statistically significant because p-value > 0.05 (marked with red color in Table 5). The value that is not significant is recorded for moderator 2 values of +1SD. In this specific case, the alternative hypothesis can be considered, which can be developed on the idea that all sustainable actions taken by SMEs will be affected by access to capital markets and the necessary resources, as shown by the results of other studies (Falavigna & Ippoliti, 2022). This could significantly affect the results obtained.

Although the value for +1SD is not significant, their interaction effects were found to be significant (Table 3). For this reason, the analysis can be continued on the proposed hypothesis.

The effect for the three possible levels of the two moderators (low, mean, high) does not record negative values, except for the last row in the table, the last level, which is not significant. As can be seen, the effect decreases for Mod1(W) (expected results of cooperation for sustainability) with increasing values for Mod1(W). At the same time, the effect increases with increasing values for Mod2(Z) (interest in sustainable cooperation). The degree to which the impact of recent crises has been felt is higher for a low level of expected results from sustainability collaboration.

It can be concluded that the lower the impact of crises, the higher the level of expected results from collaboration for sustainability. For a medium level of crisis impact, the level of expected results from collaboration decreases. At the high level of crisis impact, they are almost on the same line.

The results recorded and analysed are significant, which is confirmed by the Bootstrap results (Appendix, Table A1). After checking the Bootstrap results, it can be seen that the Bootstrap confidence intervals do not contain 0 → the main result is checked (main result the interaction form that is the three-way interaction). Therefore, a final check is performed on Interaction 4 (where $ICa_8 : [-0.130; -0.092]$), which does not contain zero in the Bootstrap confidence intervals, which confirms that there is a significant moderated moderation.

To clearly express the significant result recorded by the model, Figure 6 is created to visualize the conditional effect of the focal predictor.

These results are consistent, and it can finally be observed the existence of a significant moderated moderation relationship, which confirms and supports Hypothesis 3 (H3) – the existence of a moderation effect of the expected results of sustainability cooperation, moderated by the interest shown in sustainability cooperation on the relationship between the impact of crises and the age of the firms included in the market research.

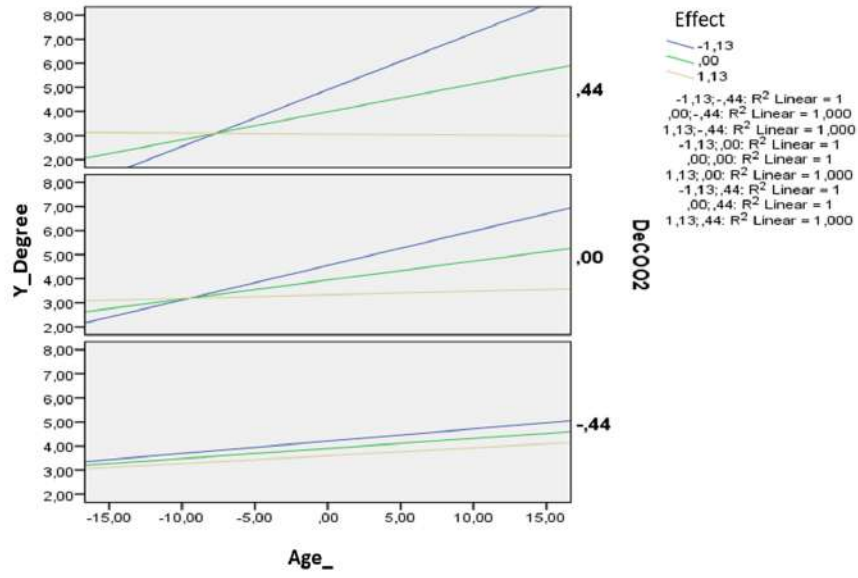


Figure 6. Graphical representation of the moderation effect

5. Discussions

The main purpose of the study was to assess the interest of Romanian SME managers in collaborative arrangements for sustainability in the context of recent crises.

The first objective of the research was to analyse the impact of these crises on the main areas of activity of the firms included in the study. The results showed a significant impact on the most important areas of activity of the SMEs investigated, Finance, Logistics, Human Resources and Sales, confirming the first hypothesis of the study. The findings are supported by other research which has shown that the main problems these firms have faced in recent years have been related to financial constraints (Hoang et al., 2022), declining sales (Fairlie et al., 2022), human resource management (Carnevale & Hatak, 2020) and supply chain management (Hoek, 2020).

The second objective of the research was to examine SME managers' concerns about the application of sustainability practices. The results reveal a high percentage of managers interested in implementing a sustainability strategy in the firm they manage. The findings are confirmed by other studies in the literature, which show that awareness has increased among SMEs about the importance of making sustainability commitments to counteract adversities generated by crises, particularly in the post-pandemic period (Jasińska-Biliczak, 2023). Although translating sustainability principles into business practice is a challenge for the management of small and medium-sized enterprises, more and more managers of these companies understand the importance of this approach in overcoming severe adversity and maintaining competitiveness in the market. This finding is confirmed by recent research that highlights the need to adopt sustainability principles in SME practice as a way to counteract the negative impact of various crises on business activities (Aristei & Gallo, 2024). Moreover, most respondents show interest in collaborative arrangements for sustainability, which is explored in the third research objective. Most of the managers surveyed intend to engage in collaborative activities within a time horizon of 1-3 years, with the areas of interest being technological innovation, environmental protection, sustainable HR practices, sustainable marketing, sustainable management and leadership. Concerning the collaborative benefits that the surveyed managers expect to achieve, the research results confirmed a link between firms' interest in collaborating with other stakeholders for sustainability and the benefits recorded in the four areas of activity analysed, thus validating the second hypothesis of the research. The results are supported by other studies, which have highlighted the positive effect of collaboration for sustainability on companies' sustainability efforts (Govindan et al., 2016). Collaborative arrangements for sustainability can bring long-term benefits to the organisations involved that are reflected in sustainable economic growth (Das & Rangarajan, 2020), sustainable supply chain management (Dania et al., 2018), sustainable human resource management (Macke & Genari, 2019), sustainable business practices (Colaner et al., 2018). A better understanding of the collaborative benefits of sustainability helps companies and their managers to better address the challenges and turbulence of crisis periods associated with global change and disruption, as other studies show (Belitski et al., 2022).

To test the third hypothesis of the research, the relationship between the age of the firms included in the research and the degree to which they felt the impact of recent crises was examined, a relationship moderated by the variable expected results from collaboration for sustainability, a moderator moderated by concern for sustainable cooperation. The data from the moderation analysis show that the level of expected results from collaboration for sustainability increases the lower the impact of the crises on firms' activities. For medium

and high levels of crisis impact, the level of expected results decreases. One explanation may be that during major crises, such as the COVID-19 pandemic, firms are primarily focused on survival and less on approaches to business sustainability and collaborative sustainability initiatives. Small and medium-sized enterprises in particular, lacking sufficient financial resources and subject to the adversities of an uncertain and turbulent external environment, focus all their efforts on keeping their business in the market. The collaborative arrangements, if any, are focused on mutual support and aid to overcome critical times, as other studies show (Kang et al., 2021). Conversely, when the negative impact of crises diminishes, interest in sustainable business development, and thus in engaging in collaborative arrangements with other sustainability stakeholders, increases, leading to a high level of expected results from collaborative actions. The results indicate the existence of a significant moderated moderation relationship, thus confirming the third hypothesis of the research (the existence of a moderation effect of the expected results from collaboration for sustainability, moderated by the interest in cooperation for sustainability, on the relationship between the impact of recent crises and the age of investigated firms).

6. Conclusions

The current economic context is forcing SMEs to go beyond their limits and find effective solutions to stay competitive in an era of multiple crises. This research provides a detailed analysis of SMEs' interest in sustainability and collaborative practices for sustainability as an appropriate way to respond to current challenges. The research results showed that the interest of these companies in collaborative actions and the level of results expected from collaboration for sustainability decreases as the impact of crises on their business increases.

The research has theoretical and practical implications. The study contributes to the flow of knowledge by improving understanding of how SME activity has been affected in the context of recent crises. The paper is of interest because it brings into discussion the concerns of managers of these enterprises for collaborative arrangements for sustainability, as the amount of empirical research exploring this topic is limited. Therefore, this study attempts to bridge the research gap on how managers of small and medium-sized enterprises manage business sustainability in the context of recent crises by examining their openness to collaborative initiatives with different stakeholders for sustainability. The model proposed by the authors can be used by other researchers to further investigate companies' concern for collaboration for sustainability, highlighting elements that can strengthen collaborative advantages in the context of an external environment marked by complex disruptions and challenges. Among the implications of the research is that it contributes to raising awareness among managers of small and medium-sized enterprises about the role of collaborative action in sustainable business development. Furthermore, our findings may draw the attention of policymakers to the need to adopt financial support measures, grants, and fiscal incentives to encourage SMEs to integrate sustainable practices into their business activities, which could enhance their ability to withstand crises. These measures must be accompanied by the simplification of bureaucratic requirements for enterprises making efforts in the field of sustainability, as well as by training and education programs for SMEs focused on implementing sustainability measures and understanding the role of collaboration in this context. Ensuring a supportive framework for collaborative initiatives in the field of sustainability, through the promotion of public-private partnerships that encourage the involvement of SMEs in sustainable projects, significantly contributes to achieving national sustainable development goals.

The authors consider several limitations in interpreting their results and consider future research directions. Firstly, the findings are limited by the fact that the results are representative only at the level of the sample investigated, and the non-probability sampling method was used. The limitations of the research are also related to the fact that the research focused only on SMEs in Romania. These limitations do not invalidate the value of the research but underline the importance of awareness and management of these issues to ensure the validity and relevance of the results obtained. Future studies may consider a larger number of organisations and the collection of additional data on SME involvement in collaborative activities for sustainability, including through the use of mixed quantitative and qualitative research methods. Future research could also extend the analysis to large and very large companies to get an overview of all categories of companies and identify differentiated solution packages by category of company. Also, further investigations could explore how organisational culture or business areas may influence collaborative actions for sustainability.

Funding

This research was supported by Transilvania University of Brasov, Romania.

Author contributions

Conceptualization, A.Z., C.C.D., R.G.A., and T.F.; methodology, A.Z., C.C.D., R.G.A., and T.F.; software, A.Z.; validation, A.Z. and T.F.; investigation, A.Z., C.C.D., R.G.A., and T.F.; resources, C.C.D., and R.G.A.; writing – original draft preparation, A.Z., C.C.D., and R.G.A.; writing – review and editing, A.Z., C.C.D., and R.G.A.; visualization, A.Z.; supervision, T.F.; funding acquisition, R.G.A. All authors have read and agreed to the published version of the manuscript.

Disclosure statement

Authors declare not have any competing financial, professional, or personal interests from other parties.

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APPENDIX

Table A1. Bootstrap results for regression model parameters (source: authors based on research results)

	β	BootMean	BootSE	BootLLCI	BootULCI
Constant	17.121	17.090	1.263	14.557	19.560
Market age of the companies (A)	–0.865	–0.864	0.069	–0.996	–0.728
Expected results of collaboration for sustainability (B)	–3.077	–3.071	0.310	–3.666	–2.450
Interaction 1 (A*B)	0.207	0.207	0.016	0.175	0.238
Concern for sustainable cooperation (C)	–7.04	–7.033	0.649	–8.304	–5.780
Interaction 2 (A*C)	0.48	0.483	0.042	0.400	0.563
Interaction 3 (B*C)	1.532	1.530	0.160	1.218	1.842
Interaction 4 (A*B*C)	–0.111	–0.111	0.010	–0.130	–0.092

The questionnaire statements

Questionnaire

Hello! Please have the kindness to answer a few questions, which you can view in the questionnaire below. This questionnaire is part of scientific research conducted by teachers from the Faculty of Economic Sciences and Business Administration, Transylvania University of Brasov. The purpose of the questionnaire is to analyse the opinions and attitudes of SME managers in Romania on the application of collaborative sustainability practices in the context of recent crisis periods. We assure you that your answers are especially important for this

study. Your participation is voluntary, and you can withdraw at any time. We mention that all the information collected is confidential and will be used strictly for statistical purposes. No e-mail addresses or other personal data are collected.

Thank you for your contribution and for your time!

1. Please mention which of the crises below have had a major impact on the activity carried out within your company?

☐ The COVID-19 pandemic
☐ The energy crisis
☐ The military conflict in Ukraine
☐ The financial crisis

2. How do you assess the level of impact felt? *(please mark the level corresponding to your opinion*)

1	2	3	4	5
Not significant at all	*Not significant*	*Neither significant, nor unsignificant*	*Significant*	*Very significant*

3. Please indicate the degree to which you have felt the impact of periods of recent crisis felt for the business areas mentioned in the following table (*please mark with X the level corresponding to your opinion, considering the distances between the levels of the scale equal, where 1 – least felt, 5 – most felt).*

Business areas	1 – least felt	2	3	4	5 – most felt
Finance					
Human Resources					
Logistics					
Sales					

4. Do you know the sustainable development principles?

☐ Yes
☐ No

5. Are you interested in implementing sustainable development practices in your company?

☐ Yes (*proceed to question 6*)
☐ No (*skip to question 7)*
☐ I do not know (*skip to question 7)*

6. Please indicate what type of sustainable initiatives you have implemented/want to implement? _____
_____
_____

7. What is the level of importance you give to the application of sustainability practices within the business? (*please mark the level corresponding to your opinion)*

1	2	3	4	5
Not at all important	*Unimportant*	*Neither important, nor unimportant*	*Important*	*Very important*

8. To what extent are you open for a possible cooperation for sustainable development? (*circle the level that matches your opinion)*

1	2	3	4	5
Very little extent	*Little extent*	*Neither little extent, nor large extent*	*Large extent*	*Very large extent*

9. How important do you think partnerships are for the sustainable development of the company? (*circle the level corresponding to your opinion)*

1	2	3	4	5
Not at all important	*Not important*	*Neither important, nor unimportant*	*Important*	*Very important*

10. What is the time horizon in which you intend to initiate collaborative partnerships that support the sustainable development of the company?

- ☐ In the following 6 months
- ☐ Between 6 months and 1 year
- ☐ Between 1–3 years
- ☐ Over 3 years

11. What are the areas of interest in which you would like to initiate collaborative partnerships for the sustainable development of the company? (please choose only one answer option)?

- ☐ Technological Innovation
- ☐ Environmental Protection
- ☐ Sustainable HR Practices
- ☐ Sustainable Marketing
- ☐ Sustainable Management and Leadership
- ☐ Other. Which one? _____

12. What is the level of expected results from collaboration for sustainability in the 4 areas mentioned below? *(please indicate a level between the two limits, considering the distances between the scale levels to be equal)*

	1 – very little	2	3	4	5 – very large
Economic growth					
Sustainable HR Management					
Efficiency of supply chains					
Sustainable trade practices					

Identification Questions

13. What's your gender:
☐ Male
☐ Female
☐ Prefer not to answer

14. Your age falls within the range:
☐ Below 20 years
☐ 20–34 years
☐ 35–44 years
☐ 45–54 years
☐ More than 45 years

15. Please mention how long the company has been on the market.
_____

16. Current number of employees in the company:
_____

17. Please choose the company's field of activity.

☐ Manufacture of food products
☐ Manufacture of textiles
☐ Manufacture of electrical equipment
☐ Manufacture of furniture
☐ Construction of buildings
☐ Specialised construction activities
☐ Wholesale trade, except of motor vehicles and motorcycles
☐ Retail trade, except of motor vehicles and motorcycles
☐ Warehousing and support activities for transportation
☐ Accommodation
☐ Food and beverage service activities

Electronic Commerce Research (2025) 25:4159–4191
https://doi.org/10.1007/s10660-024-09879-6

Behavioural differences and purchasing experiences through online commerce or offline within mall-based retail structures

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Accepted: 10 July 2024 / Published online: 18 July 2024
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Abstract
Due to the economic changes in recent decades, the purchasing behaviour of consumers has significantly shifted. Buyers are no longer just seeking a place to shop but also experiences to live through. This study aims to conduct an in-depth analysis of the differences in behaviour and shopping experiences in online versus offline environments, specifically within malls. To achieve this, a quantitative marketing research was conducted, collecting data from a sample of 1030 respondents. The study results indicate that respondents perceive both online and offline commerce to evolve concurrently. These commerce modes will be strongly influenced by various factors, including technological advancements, which are considered to impact both forms of commerce. Among the study's conclusions, there is the confirmation of behavioural differences between online and mall shopping. The outcomes can be beneficial for improving the activities of retailers by offering new shopping experiences and developing new communication methods with customers.

Keywords Buying behaviours · Online commerce · Retail commerce · Shopping Experiences · Mall

1 Introduction

Because of the increasing number of malls, consumers tend to be more selective [1], and that is the most powerful reason for the managers to find the appropriate ways of attracting and retaining the customers.

From a retailer's standpoint, the major factor that has always dominated modern retail has not changed at all, and this remains: *the location*. Other essential facilities are

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accessibility [2], security [3], climate comfort, and an attractive physical environment [4]. One study about Romanian shopping malls [5] identified as the most important elements for customer satisfaction inside malls: the assortment, the price, communication, décor, and service. But all these aspects are no longer sufficient to work efficiently.

Today's retail tenants need well and clearly defined strategies for: tenant mix, marketing strategies, but also various activities for spending the time, without the immediate necessity to shop. Examples include: sophisticated leisure activities, appealing gastronomy concepts, exceptional event planning, and extraordinary brand attractiveness) [6].

Due to the changes of the last decades (online sales, growth of urbanization, aging population, people's need to socialize), shopping malls have to change the role they play in people's lives. Buyers are not only looking for a place to shop, but also for experiences far beyond traditional commercial. Therefore, shopping malls must incorporate value-added items like concerts, art centres, spas, fitness clubs, farmers' markets, dining venues, places where to spend quality time with friends and family.

The study of Venkateswarulu & Uniyal [7], shows that the appeal of a mall depends of factors such as: convenience, amenities, ambiance, personnel, parking, and seating.

This study sets out to analyse the differences in shopping behaviours and experiences both online and in person in malls before and after COVID-19. To this end, the authors have undertaken a quantitative marketing analysis.

The four objectives of this research were identified by reviewing the relevant literature. The study continues with presenting the methods used, including detailed explanations of the project's components: Questionnaire development, Data collection, location of the survey and sample, and Data Analysis Techniques. The fourth section of the work presents the results and discussion, grouped by the research objectives. Principal component analysis (a multivariate data analysis technique), which draws conclusions and introduces the two new variables. These have been generically named by the authors 'Respondents' preference for buying from the online environment represented by a series of advantages' and 'Barriers in respondents' preference for choosing online shopping'. This analysis is extremely important as its results confirm once again the behavioural differences researched here.

The article ends with a conclusions and implications section that includes the study's limits and future work.

The current study is an important step to a more thorough understanding of the evolution of shopping behaviours and preferred buying experiences of the consumers. In particular, the study is unique in presenting the effect of the COVID-19 pandemic on these aspects.

2 Literature review

To be successful, any organization must adopt a strong marketing strategy. Since the late 1990s, a growing emphasis has been laid on customer experiences, as value-added to the sold products. Mastering the concept and execution of exceptionally good customer experience is a real challenge, but an essential one in today's rapidly changing business environment [8, 9]. According to Oxford

English Dictionary, experience means 'to gain knowledge or skills by doing, seeing, or feeling things; something that happens to you, that affects your feelings; something that you have to do with, that happened to you or that you felt [10]. 'Experience' is the key to success.

The innovative retailers have recognized the value of experiential marketing. For this reason, the trend is to create an engaging environment for the buyer. Also, for the same reason, a host of product options are offered that cater to a wide range of buyers and their lifestyles.

So, we can say that customers are no longer just interested in buying goods, they want experiences. It becomes essential for mall owners to keep up with the continuously changes, to maintain the enthusiasm of customers, and to adapt to their needs.

Customer experience comes from a set of interactions between the client and product, a company, or a part of its organization, which causes a reaction. This is strictly personal and supposes the client's involvement at different levels (rational, emotional, sensory-physical, and spiritual) [11]. Memorable experiences can change the client and this kind of moment cannot be replicated because they are personal and powerful. Experience marketing has as its main purpose the strengthening of the emotional connection between the customer and the brand, thus managing to lead to the loyalty of buyers. Sometimes, the commercial experience is closer to a journey, as in the case of a 'story' [12].

To create notable experiences for the company, four elements are important, such as the process of achieving the experience, the employees, the company performance, and the possibilities to create these experiences. The most memorable customer experiences involve interaction with the employees; they are simply the custodians of customer experience [13].

The achievement of these experiences can be discussed from two standpoints. The first one refers to the client's participation in the experience. In this situation, the client's participation can be passive, in which case the consumer should not affect the performance of the products and services. Furthermore, customers can actively participate in the created experience. The second dimension of the experience describes the relationship with the environment, which introduces the client into the event and into the achieved experience [14].

New technologies are opportunities for engaging consumers throughout the decision-making process of purchase. Through the trend registered by the spectacular growth of technology (through social networks but also digital interactions), customers have come to put pressure on companies to create competitive experiences for them [15].

In this article, the authors have set out to study the differences in shopping behaviours and experiences both online and offline in mall, before and after COVID-19. The study follows the four objectives set after reviewing the literature, as follows:

- **O1**. Identifying offline shopping behaviours and analysing the motivations behind visiting malls.
- **O2**. Identifying online shopping behaviours and the reasons behind choosing this particular type of commerce.

- **O3**. Determining the differences between online and offline shopping experiences.
- **O4**. Identifying the differences in shopping behaviour before and after the COVID-19 pandemic.

2.1 O1. Identifying offline shopping behaviours and analysing the motivations behind visiting malls

As shown previously, consumers do not visit malls simply to shop, but seek various additional experiences to enrich their time spent in these spaces. Srinivasan [16] shows that while marketing experiences are open to all clients, their assimilation is deeply personal. They depend on not only the wishes and needs, but also the self-image, social objectives, latent emotions and the values and deeply rooted wants of the consumer. The same author shows that an important element in creating an experience is the brand's identity, because the consumer pays not for the product or service, but for the experience.

This is why commerce specialists must devise more attractive shopping experiences for the visitors of malls [17].

As Flavián [18] states, one of the research topics in the field aims to identify the way in which these experiences have evolved over time and their influence on the consumers' behaviour. These studies have shown that positive experiences resulted in emotional responses like enthusiasm, fun, escapism [19] and determined what makes customers loyal to a brand or a retailer [20].

Kim et al. [21] suggest that the motivation for offline shopping is to reduce the perceived risk and make better purchases through obtaining more information and sharing the experience. Consumers consider that the information gained directly from shop clerks is more genuine than that available online, associating a higher risk and incertitude with online shopping [21].

Based on their study, Mittal & Jhamb [1] have concluded that there are four dimensions to the sixteen attributes of a commercial centre/mall's attractiveness: (1) Merchandising, (2) Variety and selection, (3) Method and facilities and (4) Convenience.

2.2 O2.Identifying online shopping behaviours and the reasons behind choosing this particular type of commerce

The pandemic, as we have all seen, caused a portion of purchases to migrate online, given the restrictions on the population's movement and that many people avoided offline shopping to prevent becoming ill [22–24].

Some studies [25, 26] elucidated that, in the USA, online shopping accounted for 10–15%, and Amazon held about 40% of these sales. In March 2020, Amazon clients spent 35% more capital on the platform compared to the same time of year in previous years to buy essentials. This droves Amazon to employ 175.000 more workers to meet demand.

In Sweden, Gardshol [27], determined that in the second term of 2020, the volume of online purchase increased with 49% compared to 2019, especially for foodstuffs, which rocketed to 119% higher. In Italy, 2020 was projected to bring a 26% increase in online shopping compared to the previous year, but in reality, this increased by 56%, according to Digital4 [28], (2020).

Online shopping offers access to a large variety of products and simply the delivery process, which led to an increase in this type of purchases [29]. They are convenient for customers, and retailers should exert themselves to improve the online shopping experience [30, 31]. Alaimo et al. [32], suggests that other benefits include the option to compare more products that are not always found in stores and being able to access more information about products [33].

According to Kuoppamaki et al. [34], some of the most important drivers for online shopping include: age, education, access to technology, perception about the benefits of online shopping, and the customer's attitude and trust towards online purchases.

As Rita et al. [35], state, the challenge for online retailers is to offer and maintain client satisfaction, which requires a strategy focused on services. One necessary step towards this goal is the creation of a good quality website, with excellent information and electronic services [36]. The same idea is underlined by the study of Saha et al. [37], which shows that the intention to shop is increased by client satisfaction and prior experiences. This is why online retailers need to find strategies to make online shopping as pleasant as possible.

Bajdor [38] analysed the relationship between client experience of online shopping and variables such as the speed and interactivity of the purchasing process, the access to products/services traditionally unavailable and to sales and offers, how intuitive and transparent the ordering process is, the convenience, the level of satisfaction and whether it is beyond expectations. The study's results show that online shopping meets the customers' needs.

One of the aspects that prevents some customers from shopping online is how retailers process customer data. The study of Gouthier et al. [39], showed the importance of a fair and transparent relationship between companies and online consumers.

2.3 O3.Determining the differences between online and offline shopping experiences

As early as 2004 Browne et al. [40] identified that in spite of the similarities of online and offline shopping, there are some major differences between the two.

Previous studies identified one of the differences between the experience of online and offline shopping as the time and cost of collecting information about the products to be purchased [41]. These studies show that consumers prefer searching for information online because it reduces the time and cost of the search (no time lost in traffic to reach the shops, prices can be compared between more products in a shorter time, the availability of reviews from other customers) [42–44]. The lack of tactile information that can only be obtained offline is compensated by a surplus

of information about the product online. Despite this, some customers feel the need to consult with the shop clerk about some specific aspects of the products when they decide to shop (placing a high level of trust in the shop clerk, but also a need to socialise).

Another difference that was identified was that when customers shop offline, they immediately have the product at their disposal, while if the purchase is made online, they have to wait a while until the product arrives. It was also determined that younger customers have a stronger desire to have access to the product immediately [45].

At the same time, the price can be different. Usually, offline prices are higher than the ones displayed online. If this difference is significant, customers might decide to make the purchase online [46].

However, more and more customers combine shopping online with making purchases offline to minimise cost and increase benefits [47].

2.4 O4.Identifying the differences in shopping behaviour before and after the COVID-19 pandemic

It is known that the COVID-19 pandemic led to an unprecedented increase in online shopping, in particular for basic items, and produced major changes in the customers' shopping behaviour [48].

Mainly, there have been marked changes in the way in which the internet is used and the activities that are undertaken in this medium. In a study by Chmielarz et al. [24], it is shown that the most popular uses of the internet were: social media use, watching movies and TV series online, and listening to music online (19% each, respectively). After COVID-19, the ranking has changed to: online shopping (13%), searching for information on the Internet (13%), and telemedicine visits (over 8%). The highest increase (11–12%) could be observed in searching for information on the web and online commerce.

Sheth [49] identified eight immediate changes in shopping behaviour due to the pandemic: (1) hoarding behaviour (consumers stock essential products for daily use, which leads to shortages and the items being out of stock); (2) improvising (consumers learn to improvise when met with shortcomings. Existing habits are abandoned and new ways to consume goods are invented); (3) adoption of digital technologies (due to pure necessity, consumers have adopted more and more new technologies and applied them); (4) discovering new talents (with more time at home to spend in flexible ways, consumers have experimented with recipes, exercised their talents and discovered new ways to create and play music, to share their learning process and buy online in a more creative way); (5) restrained demand (in times of crises and incertitude, the general tendency is to postpone the purchase and consumption of products or discretionary services); (6) Shops relocate to homes (due to strict lockdown rules, stores must be brought into the consumer's home, just like work and education. This reverses the balance between work, education, health, purchases and consumerism; (7) blurring the lines between work and personal life (consumers are confined to their homes, with limited space and too many discrete activities like

work, learning, shopping and socialising); (8) reunions with friends and family (the COVID-9 pandemic led to a desire to contact estranged friends and family, both to check on their wellbeing, but also to share stories and experiences).

Some of these changes could develop into habits which could have long term effects [49, 50].

3 Research method

The authors performed a study that is part of quantitative marketing research by using a survey. The data was analysed to discover opinions, attitudes and behaviours in relation to shopping. The overarching aim of this research is to detect the characteristics of online versus offline (particularly in malls) shopping behaviours.

3.1 Objectives and hypotheses

The main objective of this marketing research is to identify perceptions, behaviours and attitudes in relation to shopping and the differences between online and offline purchasing experiences. Given the work's focus, the following objectives were outlined:

- **O1.** Identifying offline shopping behaviours and analysing the motivations behind visiting malls.
- **O2.** Identifying online shopping behaviours and the reasons behind choosing this particular type of commerce.
- **O3.** Determining the differences between online and offline shopping experiences.
- **O4.** Identifying the differences in shopping behaviour before and after the COVID-19 pandemic.

The following hypotheses were formulated:

1. *Hypothesis 1 (**H1**)* There is no correlation between the respondents' income and the frequency of visiting malls during sales;
2. *Hypothesis 2 (**H2***. There is no correlation of the respondents' gender and the increase in online orders with the number of online orders placed after the COVID-19 Pandemic.

3.2 Questionnaire development

To fulfil these objectives, the data was collected through a survey created after a thorough review of specialist literature and existing studies, with the addition of the author's professional experience (specialists in different interdisciplinary domains).

Before the questionnaire was distributed to the pool of participants, an initial test was performed on a sample of 25 respondents. This was done to identify and

eliminate all possibilities of ambiguity. The final version of the questionnaire, developed after the results of the pre-testing, consists of 32 multiple choice questions grouped into multiple sections that thoroughly cover the study's focus and fulfil the objectives. The last set of questions (Q27–Q32) aim to provide a profile of the respondents (gender, age, income etc.), while the other questions (Q1–Q26) seek to fulfil the study's objectives. The link between the questions asked in the survey and their respective objective are presented in Table 1.

3.3 Data collection, location of the survey and sample

For data collection, the Computer assisted web interviewing (CAWI) technique was employed. This method involves displaying the questionnaire on a web page, with respondents providing direct responses within their web browser. The data collection period spanned from August to September 2023, and the completion of the questionnaire took an average of 15–20 min.

The targeted respondents were individuals residing in Romania who had visited a mall at least once and had made at least one online purchase both before and after the pandemic. The questionnaire commenced with two filter questions regarding mall visits and online shopping. In cases where respondents selected the 'no' response, the questionnaire was terminated.

Participant selection was based on the assumption that these individuals were most capable of providing relevant information. A panel of 1030 respondents was interviewed, consisting of individuals who had visited a mall at least once and had placed an online order before and after the pandemic (excluding respondents who answered negatively to the initial 2 filter questions). To address the research question accurately, the authors employed convenience sampling, deemed most suitable and commonly utilized in practice. Given the non-random nature of this sampling method, the data cannot be extrapolated to the whole population. The demographic breakdown of respondents included in the sample is reproduced in Table 2.

As evident from Table 2, the majority of respondents exhibit a prominent demographic concentration among young individuals, aged between 18 and 35, comprising 79.6%. This underscores that they are the most dedicated visitors and consumers of malls. This finding aligns with the observations made by Kuruvilla [51] in their study, asserting that malls are substantially reliant on the patronage of young visitors, who also constitute the highest spenders.

3.4 Data analysis techniques

The obtained data were processed using the SPSS software program, employing various data analysis methods. The authors meticulously orchestrated and oversaw the entire research process, from the formulation to the implementation of the questionnaire data analysis.

A series of data analysis techniques were chosen to be consistent with the research objectives. To this end, the program IBM SPSS Statistics 20 was employed

Table 1 List of survey questions and the objective each one fulfils. *Source* created by the authors

	Questions	Objectives
Q1	Have you been to a mall at least once so far?	O1
Q2	Have you ever made an online purchase so far?	O2
Q3	How often do you visit a mall?	O1
Q4	What is the last mall you have visited?	O1
Q5	Do you go to the mall more during sales seasons?	O1
Q6	How do you prefer to do your shopping?	O3
Q7	Overall, how satisfied are you with the attractions on offer in malls?	O1
Q8	Please state your main motivation for visiting malls.	O1
Q9	What time of the week do you prefer to go to the mall?	O1
Q10	What part of the day do you prefer to go to the mall?	O1
Q11	How do you find the interior (image, atmosphere, ambiance) of the malls your frequent?	O1
Q12	What is the number of stores you visited in your last mall visit?	O1
Q13	What category do the commercial spaces that you visit in malls fit into?	O1
Q14	What is the approximate expense you made on your last mall visit?	O1
Q15	Please express your opinion on the following affirmations:	O1
	Visiting malls makes me feel important.	
	Mall visits are an exciting experience.	
	The mall is a dynamic place where interesting things happen all the time.	
	The mall is the definition of modern living.	
	The shopping experience in malls is like an adventure full of surprises.	
	Sometimes the crowds present in malls at peak times bother me.	
	I am happy with the level of security in malls.	
	I think I could spend a whole day in the mall without getting bored.	
	I always spend more money than initially planned when I go to the mall.	
	The atmosphere in malls is full of energy.	
	I am willing to pay more for products and services in malls because I know they are part of an experience.	
Q16	What experiences do you think are on offer offline, in malls, over the online shopping experience?	O3
Q17	During the COVID-19 pandemic, how did you prefer to purchase your essential items?	O4

Table 1 (continued)

	Questions	Objectives
Q18	Please express your opinion on the following affirmations:	O2, O3, O4
	The increase of what electronic commerce offers had a positive influence on me, leading me to place more online orders after the COVID-19 pandemic.	
	The convenience of online shopping made me place more orders	
	I believe that by placing online orders I avoid wasting time	
	The quick online search for products and the availability of offers are advantages of online shopping	
	The possibility of my order being damaged in transit made me pay careful attention to what types of products I ordered online	
	The online payment for ordered products represents a barrier that makes me careful when I place online orders	
	I know how to protect myself against cybernetic attacks and online payments	
Q19	After COVID-19, have you chosen to reduce the time you spent in malls?	O4
Q20	How did the COVID-19 pandemic influence your choices with regards to visiting malls?	O4
Q21	How did the COVID-19 pandemic influence your choices with regards to spending money, correlated with the number of visits you have made to malls?	O4
Q22	After the COVID-19 pandemic, meetings with friends at the mall have been...?	O4
Q23	What are the experiences you seek when going to the mall?	O1
Q24	Please express your opinion on the following affirmations:	O2
	I was able to easily find the products I needed on websites	
	I think apps for clothing/shoe shopping are beneficial	
	The products I received were adequately packaged	
	I have encountered situations in which the products I received were not the same as what I had ordered	
	I trust online clothing stores	
	I have had trouble with finalising transactions online	
Q25	What is the payment method you use most often for online shopping?	O2
Q26	What do you think will be the future of physical malls in rapport to online shopping?	O3
Q27	Your gender	Profiling question
Q28	Your age belongs to what interval?	Profiling question
Q29	Main activity	Profiling question
Q30	Highest level of completed education	Profiling question

Table 1 (continued)

	Questions	Objectives
Q31	Net income of your household	Profiling question
Q32	Background	Profiling question

for: estimating descriptive analysis and illustrating respondent characteristics; conducting analyses (χ^2, Kolmogorov–Smirnov); and performing Principal Component Analysis (a method within multivariate data analysis).

For descriptive and statistical indicators, the following measures were employed: the median, the mean, the frequency, one correlation matrix, and the Varimax rotation method [52–54].

In the Principal Component Analysis PCA, variables were measured using numerical scales with equal distances between levels (interval scales), each scale comprising 5 levels ranging from 5–total agreement to 1–total disagreement. The evaluated activities focused on characteristics related to changes in purchasing behaviour (online versus physical) after the COVID-19 pandemic and included 7 variables.

Based on these 7 variables, the aim was to identify 2 principal components (factors) that would synthesize the majority of information held by the respective variables and streamline the interpretation of the results.

4 Results and discussion

Results are presented and grouped by the study's objectives, and the analyses that were performed are presented in a logical succession which permitted the authors to obtain the relevant results.

4.1 O1. Identifying offline shopping behaviours and analysing the motivations behind visiting malls

The results obtained for Question 3 indicate that the majority of respondents (42.2%) visit malls on a weekly basis, while 32% do so on a monthly basis. Only 1% of respondents claimed to visit malls daily, and 24.8% occasionally. Based on responses to Question 4, the authors generated a map (Fig. 1) illustrating the distribution of malls visited by respondents. The majority are situated in Bucharest, the capital of the country (34.0%), followed by Brasov (11.7%), located in the central part of the country and a tourist area. Constanta (7.8%), with access to the seaside, and Prahova (7.8%), positioned near the capital, each accounted for an equal percentage. The results indicate a relatively homogeneous dispersion of the locations of malls visited by respondents.

Table 2 The sample structure. *Source* created by authors based on the results of the quantitative analysis

Criteria	Sample structure				
Sample (1030 respondents)	Men 25.7%		Women 74.3%		
Background	Urban 74.3%		Suburban 3.4%	Rural 22.3%	
Net income per household	0–500 euro 19.9%	501–1.000 euro 34.5%	1.001–1.500 euro 18.4%	Over 1.500 euro 27.2%	
Highest level of completed education	Secondary school 1%	High school/vocational school 48.5%	Undergraduate degree 31.6%	Masters degree 16.5%	Doctorate 2.4%
Main activity	Employed 59.7%	Entrepreneur 5.8%	Student 32%	Stay-at-home 1.9%	Pensioner 0.5%
Age	18–25 years old 47.1%	26–35 years old 32.5%	36–45 years old 11.2%	46–55 years old 8.7%	Over 55 years old 0.5%

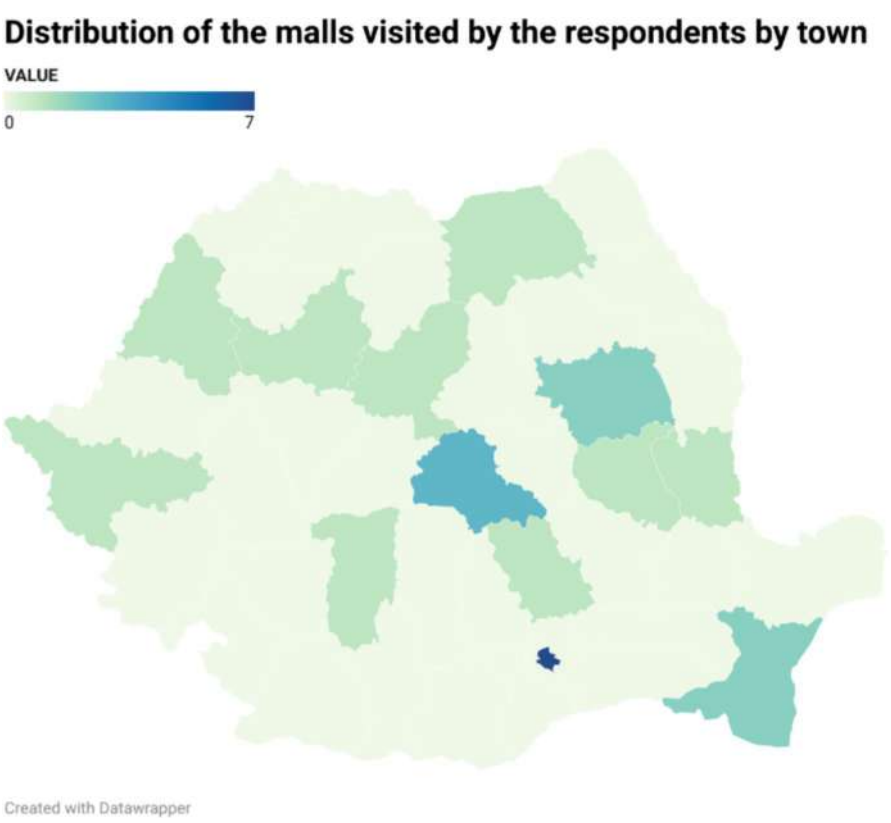


Fig. 1 Distribution of the malls visited by respondents. *Source:* created by authors based on the results of the quantitative analysis

The analysed sample members visited an average of 5.09 stores during their last mall visit, with the minimum recorded at 1 store/visit and the maximum at 30 stores/visit. This resulted in an amplitude of 29 stores, representing the difference between the maximum and minimum values.

To examine whether promotional discount periods influence respondent behaviour, Question 5 was posed. The recorded values are divided as follows: 49% of subjects provided negative responses, 36.4% affirmative responses, and 14.6% of respondents selected the response 'don't know/cannot pronounce.' The conclusion is that almost half of the respondents are not influenced by discounts to visit malls more frequently than usual.

Question 7 implemented a semantic differential scale (with scores assigned from 1 to 5 for each level, where 1 represents 'totally dissatisfied' and 5 'very

satisfied'). Frequency distribution indicates a high level of satisfaction regarding mall attractions. Approximately 70% of valid responses indicated that respondents are satisfied and very satisfied with mall attractions. The intermediate level (neither–nor) was indicated by 27.7% of those who responded to this question, while only 2.4% considered themselves dissatisfied with mall attractions. Response option 1 (very dissatisfied) did not receive any responses. In general, the conclusion is that respondents are satisfied and very satisfied with mall attractions.

The primary reason respondents visit malls is related to shopping, a motive that accounted for 69.4% of total responses. The least common responses were recorded for dining (3.9%), relaxation (8.3%), and event participation (0.5%). Under the 'other' category (registering 1.5%), respondents mentioned: free parking, information about products.

Respondents frequent malls at a rate of 55.3% on weekdays and the remaining 44.7% on weekends. Regarding the time intervals during which respondents visit malls (Q10), the majority (70.9%) prefer going between 3 and 8 pm, while 1% visit malls after 9 pm. A possible explanation for the received responses could be the operating hours of malls (usually open until 10 pm) and respondents' working hours (typically until 5 pm).

Through Question 11, the authors aimed to determine respondents' opinions regarding the interior aspect (image, atmosphere, environment) of the malls they frequent. The recorded responses, both in terms of median and mode values, confirm that the interior aspect of the mall is situated at level 4 (68.4%), representing the response option 'well-organized.' The mean for this question is 3.97 on a scale from 1 to 5. Fewer responses were recorded on the negative side of the scale, with only 3.4% of respondents considering the interior aspect of the mall not organized or poorly organized.

When asked 'What category do the commercial spaces that you visit in malls fit into?' (Q13), respondents had the option to choose multiple answers, resulting in a total of 3780 responses. The study results demonstrate that the main commercial spaces visited by respondents are: 25.8% clothing and footwear stores, 16.1% restaurants and fast-food establishments, and 15.8% supermarkets and hypermarkets. The least visited commercial spaces in malls are: 0.4% travel agencies, 1.3% children's play areas, and 1.9% flower shops and other gift stores or services.

Kuruvilla [51] reveals that young girls are inclined to visit stores, whereas young boys show a greater interest in recreational areas.

Regarding the amounts spent by respondents during their last mall visit (Q14), the majority of responses (50%) fell within the range of 100–299 lei (approximately 20–59.8 €). A percentage of 13.6% spent 0–99 lei (approximately 0–19.8 €) on their last mall visit, 37.4% spent between 200 and 399 lei (approximately 40–79.8 €), and 22.8% spent over 400 lei (approximately 80 €).

Question 15 aimed to identify subjects' opinions on various aspects and experiences related to physical commerce and malls (Table 3). Observations indicate that respondents do not feel important when visiting the mall (mean = 2.1 points on a scale of 1–5). Statements such as 'Mall visits are an exciting experience.' scored 2.89 points, 'The mall is a dynamic place where interesting things happen all the time.'—2.87 points, 'The mall is the definition of modern living.'—3.11 points,

and 'The shopping experience in malls is like an adventure full of surprises.'—3.01 points, all recorded averages at the neutral level 3, indicating a neutral opinion toward these statements.

One aspect that bothers respondents when visiting the mall during peak hours is related to congestion, with 84% of respondents agreeing or strongly agreeing, obtaining an average of 4.23 points on a scale of 1–5. Regarding satisfaction with security and safety measures in the mall, an average of 3.54 points was recorded, with most responses indicating agreement from respondents, accounting for 42.2%.

Respondents tend to spend more money in the mall than initially planned, with 32% of responses indicating agreement. However, they believe that they cannot spend the entire day in the mall without getting bored, with 61.7% of responses reflecting this sentiment.

Concerning the statement 'The atmosphere in malls is full of energy.' there were 380 responses, representing 36.9%, for a neutral response and 375 responses, representing 36.4%, in agreement with the statement.

The final statement, which pertains to paying a higher price for products and services in the mall as part of an experience, received mostly negative responses, with 50.5% of respondents disagreeing with sacrificing their budget for an experience. This statement obtained an average of 2.52 points on a scale of 1–5.

The primary experiences sought by respondents at the mall are related to the purchase of goods and services, as indicated by 54.6% of respondents, followed by going to the cinema (31.8%) and socializing (11.4%). Participation in events does not attract respondents, with only 2.2% expressing interest in this experience.

The authors employed the Chi-Square test (Table 4) to examine the presence of an association between respondents' income and the heightened frequency of visits to malls during discount periods.

Regarding Question 5, elevated frequencies for the negative response were observed across all income groups of respondents, except for the initial category with incomes ranging from 0 to 500 euros. It is evident that individuals within this income bracket exhibit greater sensitivity to pricing in comparison to their counterparts in other income groups. Further analysis is required to determine the significance of this observed difference.

It is noted that the critical ratio attains a value of 29.305, surpassing the theoretical ratio $\chi^2_{0.05;6} = 12{,}592$. This discrepancy implies a 95% probability that within the research population, disparities exist between the expected and observed frequencies. In conclusion, a discernible connection exists between respondents' income and the heightened frequency of visits to malls during discount periods. This assertion is reinforced by comparing the minimum level of significance to the value of 0.000, which is less than the predetermined threshold $\alpha = 0.05$.

Table 3 Summary of statistical results regarding the respondents' opinions on a series of affirmations. *Source* created by authors based on the results of the quantitative analysis

Affirmations	Response options					
	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Average
Visiting malls makes me feel important.	35.4	29.1	27.2	6.3	1.9	2.10
Mall visits are an exciting experience	13.6	17	40.3	24.8	4.4	2.89
The mall is a dynamic place where interesting things happen all the time	13.1	21.4	36.9	22.8	5.8	2.87
The mall is the definition of modern living	12.1	18	26.2	34	9.7	3.11
The shopping experience in malls is like an adventure full of surprises	11.2	16.5	40.8	22.8	8.7	3.01
Sometimes the crowds present in malls at peak times bother me	4.4	3.4	8.3	32.5	51.5	4.23
I am happy with the level of security in malls	4.9	5.8	33.5	42.2	13.6	3.54
I think I could spend a whole day in the mall without getting bored	41.3	20.4	22.3	9.7	6.3	2.19
I always spend more money than initially planned when I go to the mall	6.3	16.5	24.8	32	20.4	3.44
The atmosphere in malls is full of energy	8.3	9.7	36.9	36.4	8.7	3.28
I am willing to pay more for products and services in malls because I know they are part of an experience	27.2	23.3	25.2	18.9	5.3	2.52

Table 4 Critical report for the Chi-Square analysis. *Source* created by authors based on the results of the quantitative analysis

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.305[a]	6	0.000
Likelihood ratio	30.040	6	0.000
Linear-by-linear association	0.029	1	0.865
N of valid cases	1030		

[a]0 cells (0,0%) have expected count less than 5. The minimum expected count is 27.67

4.2 O2.Identifying online shopping behaviours and the reasons behind choosing this particular type of commerce

To facilitate the identification of respondents' motivation for ordering online, a series of statements were presented, and respondents were asked to express their opinions. The synthesis of the obtained results is presented in Table 5.

The analysis of responses highlights that among the analysed statements, the highest average is recorded for the statement 'The products I received were adequately packaged' (mean = 4 points on a scale from 1 to 5). Conversely, the lowest average is recorded for the statement 'I have had trouble with finalising transactions online '(mean = 2.7 points on a scale from 1 to 5). It can be concluded that logistics plays a crucial role, and the packaging used is effective. However, an issue arises concerning the online payment of ordered products.

Simultaneously, for the first four analysed statements, it is observed that the highest percentages are recorded for the agreement response, while for the last two statements, the majority of responses fall into the neutral category, representing neither agreement nor disagreement. It is evident that a significant portion of respondents (44.7%) holds a neutral opinion regarding the trust they have in online clothing stores.

The most frequent payment method for online shopping is online card payment for more than half of the subjects (51.5%), followed by cash payment upon delivery (48.1%). A small percentage of respondents (0.5%) prefer payment by money order. These results closely correlate with the responses recorded above for the statement 'I have had trouble with finalising transactions online.' This may represent a reason why a substantial portion of respondents does not prefer online payment.

To ascertain respondents' opinions regarding online commerce, a series of statements on the characteristics of online orders were presented, and the synthesis of the obtained results is outlined in Table 6.

From the analysis of responses, it is evident that the average for all statements is close to the level of 3, indicating a neutral stance. The lowest average (3.2 points on a scale from 1 to 5) suggests that online payment is a barrier for respondents. Additionally, for all analysed statements, the highest percentages are observed for the agreement response, emphasizing respondents' optimistic and positive orientation in their answers.

Table 5 Summary of statistical results regarding the respondents' opinions on a series of affirmations about motivations for choosing online orders. *Source* created by authors based on the results of the quantitative analysis

Affirmations	Response options					
	Strongly disagree (%)	Strongly disagree (%)	Strongly disagree (%)	Strongly disagree (%)	Strongly disagree(%)	Strongly disagree
I was able to easily find the products I needed on websites	2.4	6.8	28.2	40.8	21.8	3.73
I think apps for clothing/shoe shopping are beneficial	2.4	4.9	31.6	38.3	22.8	3.74
The products I received were adequately packaged	0.5	2.9	17	55.3	24.3	4.00
I have encountered situations in which the products I received were not the same as what I had ordered	10.7	21.4	23.3	27.7	17	3.19
I trust online clothing stores	2.4	12.6	44.7	29.6	10.7	3.33
I have had trouble with finalising transactions online	19.9	24.8	29.6	17	8.7	2.70

The findings from this study concerning the motives for online purchases align with the results of other studies on this topic. The crucial factors related to online product/service purchases are the optimal quality/price ratio (17% of opinions) and the best price and delivery costs (14% each), reflecting primarily economic factors [24]. Nigar & Miah [55] demonstrated that three factors positively impacting the online buying behaviour of Bangladeshi shoppers during the pandemic are celebrity approval, promotional tools, and online reviews.

Regarding customer satisfaction with online shopping, analysing two dimensions, namely the process and outcome dimensions, Alaimo et al. [32] reveal that the process dimension, linked to the ease of using online tools in the phases of search and online purchase, generates a higher satisfaction level than the outcome dimension measured in terms of service utility. In other words, online customer satisfaction is higher if they can easily access information, if the website is attractive and user-friendly, if customer services are good, and if customer security is enhanced [50, 56].

4.3 O3.Determining the differences between online and offline shopping experiences

A significant difference between online and offline commerce is identified in the swift online product search with the possibility of comparing offers, providing an advantage to online shopping. For this statement (Q18), the mean response is 3.88 points on a scale from 1 to 5. The recorded responses indicate that 41.7% of respondents agree, followed by 29.6% in complete agreement. A percentage of 19.9% marked a neutral response, neither agreeing nor disagreeing, and the options of disagreement and complete disagreement have low values (disagreement is indicated by 4.9% of subjects, while complete disagreement is mentioned by 3.9%).

62.6% of respondents stated that it is easier for them to find desired products on websites than to go to the mall. These responses correlate with those for the statement ‘I believe that by placing online orders I avoid wasting time’ with 68.9% of respondents answering in agreement or complete agreement.

The research has shown that another difference between online and in-store purchases concerns the possibility of receiving different or incorrect products than those ordered online. Responses indicate that 44.7% of respondents have encountered this situation, which may lead them to reconsider online purchases.

The online transaction payment, the occurrence of difficulties in completing transactions, or mistrust in the safety of online payment represent another aspect creating differences between the two types of purchases (online and offline), with some respondents being reserved about such transactions.

When respondents were asked to specify their perception of the future of physical malls in relation to online commerce, the majority, specifically 36.06%, believe that they will operate in parallel, much like they do now, and that malls will not be affected by online commerce because malls offer the advantages of socialization, product quality verification, and there are still consumers who prefer physical shopping. Negative opinions about the future of physical malls were mentioned

Table 6 Summary of statistical results regarding the respondents' opinions on a series of affirmations about the characteristics of online orders. *Source* created by authors based on the results of the quantitative analysis

Affirmations	Response options					
	Strongly disagree (%)	Strongly disagree (%)	Strongly disagree (%)	Strongly disagree (%)	Strongly disa-gree(%)	Strongly disagree
The convenience of online shopping made me place more orders	6.3	13.1	25.2	36.4	18.9	3.49
I believe that by placing online orders I avoid wasting time	3.4	6.8	20.9	39.8	29.1	3.84
The possibility of my order being damaged in transit made me pay careful attention to what types of products I ordered online	2.9	8.7	29.1	39.8	19.4	3.64
The online payment for ordered products represents a barrier that makes me careful when I place online orders	13.1	16	26.2	27.2	17.5	3.2
I know how to protect myself against cybernetic attacks and online payments	4.9	10.7	26.7	39.8	18	3.55

by 21.15% of respondents, who believe that fewer people will frequent malls, leading to a loss of popularity, as online commerce and VR and AR technologies gain momentum. Additionally, they consider prices to be higher in malls. At the same time, 19.71% of respondents envision an evolution in the future of physical malls because they provide experiences that online commerce cannot offer, and they do not consider it safe or trustworthy.

4.4 O4.Identifying the differences in shopping behaviour before and after the COVID-19 pandemic

During the COVID-19 Pandemic, research findings indicate that consumer behaviour involved visiting grocery stores, while opting to order other types of products online (49.5%). The response to choosing to order all necessary products online recorded 31.1%. Some respondents preferred not to make any online orders, opting to go to physical stores and adhere to the protective measures imposed by authorities (19.4%).

These results align with a study conducted by Truong & Truong [57], revealing that approximately 46.1% of respondents spent more on online purchases, 42.9% spent more on curb side pickup purchases, and 39.2% spent more on in-store purchases. The article indicates that this behaviour was primarily driven by two factors: health concerns, economic apprehension, as well as age, gender, race, income, and marital status. Another research by Meister et. Al. [58] and Eger et al. [59] indicates that during the pandemic, 13% of food product purchase options were replaced by online shopping. The study demonstrates that this increase is evenly distributed among groups with and without prior experience in online food shopping.

To identify changes in consumer behaviour after the COVID-19 Pandemic, the questionnaire continued with the question: 'After COVID-19, have you chosen to reduce the time you spent in malls?' (Q19). The recorded results show that more than half of the respondents did not reduce the time spent at the mall (55.3%), while 22.7% did reduce it following the pandemic. A relatively large percentage (17%) mentioned that they do not know, suggesting an undecided behaviour.

To further analyse consumer behaviour, the influence of the COVID-19 Pandemic on mall visitation behaviour is presented. It is observed that the majority of respondents (39.3%) reduced mall visits, followed by 29.6% who stated that the COVID-19 Pandemic did not influence their mall visitation behaviour. Some subjects (15%) mentioned that they visit the mall as before the pandemic but have nevertheless reduced the time spent there. A percentage of 12.1% of respondents chose not to frequent malls anymore, influenced by the challenging period of the pandemic. The lowest percentage recorded (3.9%) among respondents stated that they go to the mall more often after all the restrictions imposed by authorities.

A delicate yet crucial topic of discussion is the influence of the COVID-19 Pandemic on respondents' financial decisions correlated with the number of mall visits. Half of the subjects (50%) mentioned that it had no influence. A relatively high percentage of respondents (46.1%) decided to reduce expenses, while a small portion of them (3.9%) chose to spend more money.

Table 7 Calculated values for the Kolmogorov–Smirnov test. *Source* created by authors based on the results of the quantitative analysis

Test Statistics[a]		
		The increase of what electronic commerce offers had a positive influence on me, leading me to place more online orders after the COVID-19 pandemic
Most extreme differences	Absolute	0.146
	Positive	0.000
	Negative	−0.146
Kolmogorov–Smirnov Z		2.042
Asymp. Sig. (2-tailed)		0.000

[a]Grouping variable: Gender

Meetings with friends at the mall, from the respondents' perspective, were not influenced to any extent (41.3%) by the COVID-19 Pandemic. Similar percentages were recorded for meetings at the mall with fewer friends (27.7%) and meetings with the same number of people (26.2%). A relatively low percentage (4.4%) of respondents stated that they do not meet friends at the mall, and 0.5% mentioned that they have increased the group size. In the study by O'Meara et al. [60], it is shown that during the COVID-19 pandemic, many consumers (91.3%) reduced the number of outings in town for meals, while 75.8% of respondents said they preferred to cook at home or consumed more fruits and vegetables.

For the statement 'The increase of what electronic commerce offers had a positive influence on me, leading me to place more online orders after the COVID-19 pandemic' recorded responses show that most respondents remained neutral, marking the response option neither agree nor disagree. A percentage of 33% of subjects marked the agree option, and 15.5% marked the completely agree option. Lower percentages are recorded for disagree (12.1%) and completely disagree (4.9%). It is concluded that most respondents placed more online orders after the COVID-19 Pandemic.

The authors used the Kolmogorov–Smirnov test (Table 7) to determine whether there is a connection between respondents' gender and the increase in online orders after the COVID-19 Pandemic.

The value of $D_{calculating} = 14.6\%$, is compared with its theoretical value $D_{\alpha} = 136 * \sqrt{\frac{265+765}{265*765}} = 9.69\%$, for $\alpha = 0.05$. The calculated value is higher than the theoretical one, which indicates a difference between male and female respondents with regard to the increase in online orders after the COVID-19 pandemic.

4.5 Principal component analysis (PCA)

To identify simultaneous interdependencies among the 7 research variables, the PCA method was employed. The purpose of this analysis is to derive a reduced

number of components explaining respondents' attitudes toward changes in buying behaviour (online versus physical mall shopping) after the COVID-19 pandemic.

Based on the obtained means (Table 8), it is observed that respondents prioritize time savings through online orders and quick product searches online (considered an advantage). Positioned at the midpoint of the scale with a mean of 3.2, online payment is identified as a barrier for respondents.

After extracting the two factors representing the principal components in the proposed model, correlation coefficients between the analysed variables and the principal components are calculated in Table 9.

The first four variables (The increase in online offerings positively influenced me, resulting in more online orders after the Pandemic; The convenience offered by online prompts me to order more frequently; Through online orders, I save time in my Favor; Quick searching of products online is an advantage), along with the last variable (I know how to protect myself against cyber-attacks), strongly correlate with the first component. Meanwhile, preferences regarding the possibility that ordered products may not remain intact at home, making me choose product types carefully, and online payment is a barrier are strongly correlated with the second component.

It can be concluded that the first component is determined by (Table 10) online shopping behaviour, while the second component is particularly determined by preferences for physical shopping (in malls, in this case).

Results regarding the correlation coefficients between the analysed variables and the two principal components obtained after axis rotation using the Varimax method are presented in the table below.

It is observed that after axis rotation, there are no substantial changes in the correlation coefficient values compared to the previously presented situation (Fig. 2).

The purpose of reducing the analysed variables (the 7) to only two main components is to identify the existence of some connections between the components. Based on the average individual values of the variables included in each component, the 2 main components are created. Thus, the variable 'Respondents' preference for buying from the online environment represented by a series of advantages' was obtained, consisting of the positive influence of the increase in online offerings, the convenience offered by online orders, time saved through online orders, quick searching of products online, knowledge of protection against cyber-attacks, while the variable 'Barriers in respondents' preference for choosing online shopping' was obtained based on the other variables (the risk that ordered products may not remain intact online, respectively, online payment is a barrier).

Essentially, the findings highlight major differences between online and offline buying behaviour, emphasizing a significant impact of the COVID-19 pandemic on purchasing behaviour. Figure 3 presents the most relevant research results.

Table 8 The average of the 7 variables introduced into the model. *Source* created by authors based on the results of the quantitative analysis

Descriptive statistics			
	Mean	Std. deviation	Analysis N
The increase of what electronic commerce offers had a positive influence on me, leading me to place more online orders after the COVID-19 pandemic	3.42	1.044	1030
The convenience of online shopping made me place more orders	3.49	1.127	1030
I believe that by placing online orders I avoid wasting time	3.84	1.027	1030
The quick online search for products and the availability of offers are advantages of online shopping	3.88	1.013	1030
The possibility of my order being damaged in transit made me pay careful attention to what types of products I ordered online	3.64	0.984	1030
The online payment for ordered products represents a barrier	3.20	1.272	1030
I know how to protect myself against cybernetic attacks and online payments	3.55	1.055	1030

Table 9 Component matrix[a] . *Source* created by authors based on the results of the quantitative analysis

	Component	
	1	2
The increase of what electronic commerce offers had a positive influence on me, leading me to place more online orders after the COVID-19 pandemic	0.807	−0.214
The convenience of online shopping made me place more orders	0.847	−0.192
I believe that by placing online orders I avoid wasting time	0.836	−0.047
The quick online search for products and the availability of offers are advantages of online shopping	0.793	−0.119
The possibility of my order being damaged in transit made me pay careful attention to what types of products I ordered online	0.442	0.730
The online payment for ordered products represents a barrier	0.204	0.846
I know how to protect myself against cybernetic attacks and online payments	0.499	−0.052

Extraction Method: Principal Component Analysis

[a]2 components extracted

Table 10 Correlation between variables and factors after axis rotation. *Source* created by authors based on the results of the quantitative analysis

	Component	
	1	2
The increase of what electronic commerce offers had a positive influence on me, leading me to place more online orders after the COVID-19 pandemic	0.834	0.010
The convenience of online shopping made me place more orders	0.868	0.041
I believe that by placing online orders I avoid wasting time	0.818	0.178
The quick online search for products and the availability of offers are advantages of online shopping	0.796	0.097
The possibility of my order being damaged in transit made me pay careful attention to what types of products I ordered online	0.231	0.821
The online payment for ordered products represents a barrier	−0.030	0.870
I know how to protect myself against cybernetic attacks and online payments	0.495	0.083

Extraction method: Principal component analysis

Rotation method: Varimax with Kaiser normalization

Rotated component matrix: Rotation converged in 3 iterations

5 Conclusions and implications

On a global scale, retail conducted within mall-type commercial structures has been continuously evolving in recent years until the pandemic crisis, adapting to market changes and consumer behaviours. Prior to the pandemic, the global economy, in general, experienced growth, and population incomes increased, leading to higher demand for products and services. Retailers invested in malls and product diversification to meet consumer needs.

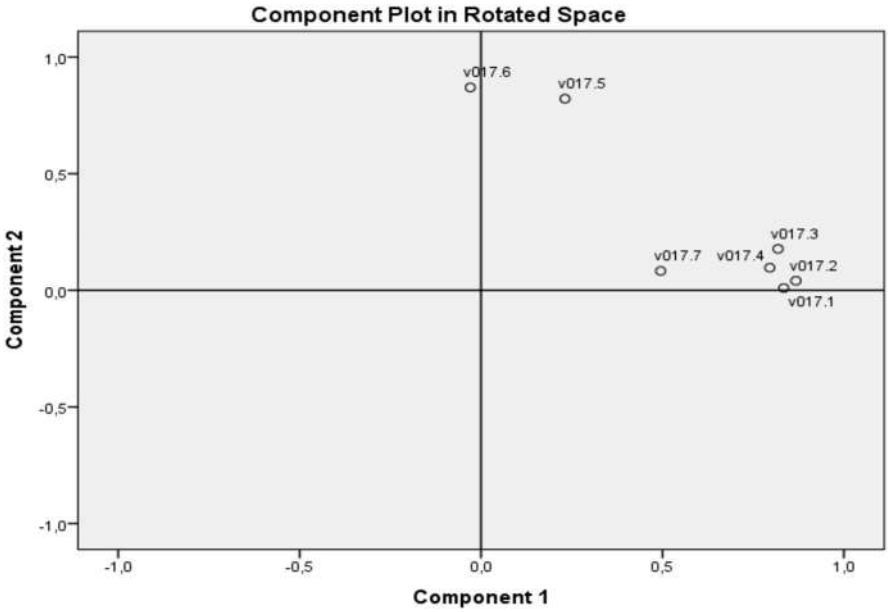


Fig. 2 Graphical representation of the correlation between variables and factors. Source: created by authors based on the results of the quantitative analysis, V017.1 = The increase of what electronic commerce offers had a positive influence on me, leading me to place more online orders after the COVID-19 pandemic, V017.2 = The convenience of online shopping made me place more orders, V017.3 = I believe that by placing online orders I avoid wasting time, V017.4 = The quick online search for products and the availability of offers are advantages of online shopping, V017.5 = The possibility of my order being damaged in transit made me pay careful attention to what types of products I ordered online, V017.6 = The online payment for ordered products represents a barrier, V017.7 = I know how to protect myself against cybernetic attacks and online payments

Simultaneously, another significant trend in retail is the development of online commerce, which has seen significant growth in recent years. Many retail companies have established online sales channels to reach various market segments and adapt to new consumer buying behaviours. Retail markets are dynamic and competitive, presenting good growth opportunities for companies that can adapt to consumer needs and preferences.

The entire context of the evolution of commerce in mall-type structures and online commerce, defined on the one hand by factors influencing demand (demographics, income, lifestyle, urbanization, etc.) and supply (retail concepts, innovation and technologies, infrastructure, etc.), was strongly affected by the pandemic crisis. The COVID-19 pandemic had a significant impact on the mall-type retail industry, altering consumer buying behaviour and affecting sales. The pandemic led to the closure of many physical stores in malls, severely impacting this type of commerce. At the same time, the transition to online commerce and home deliveries accelerated, resulting in a significant increase in online sales. Additionally, the pandemic increased online demand for essential products such as food, cleaning supplies, and medical products but had a negative effect on offline demand for

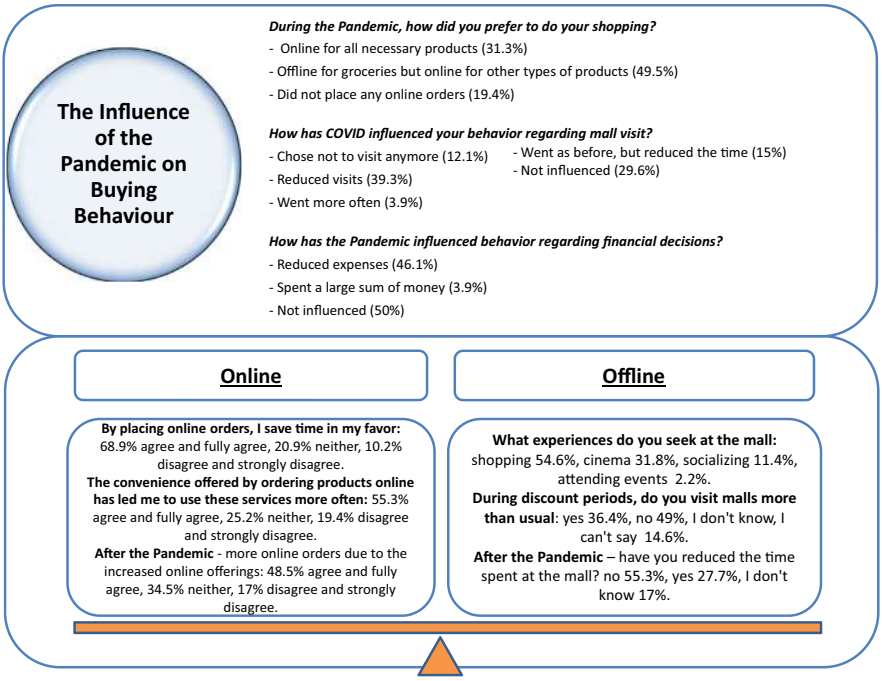


Fig. 3 Synthesis of the most relevant research results. *Source:* created by authors based on the results of the quantitative analysis

other products such as clothing, footwear, or cosmetics. However, the COVID-19 pandemic was a major factor that energized online commerce, as many consumers who were hesitant about online shopping during the pandemic were forced to learn to interact with online shopping.

Online and offline retail are two ways in which people can make purchases. There are advantages and disadvantages to both forms of retail, and the choice depends on various variables (demographic, socio-economic, psychographic, cultural, technological, ecological, etc.) that manifest in specific purchasing and consumption behaviours. Online retail has the advantage of being accessible from anywhere, at any time, with just a few mouse clicks or taps on a mobile phone. Additionally, online retail offers a wider range of products, making it easier to find rare or hard-to-find items compared to physical stores. Quick product searches and time savings through online ordering were the preferred responses of the surveyed subjects in the quantitative research conducted. Moreover, prices can be lower in online retail due to reduced inventory and transportation costs or other logistics costs. As for the disadvantages of online commerce, the research revealed issues such as receiving products that do not match expectations and a lack of trust in online payment methods from a significant portion of the respondents.

Despite the development of online commerce and the accelerated growth pace post-pandemic, offline retail in malls retains several advantages. For example, physical stores provide consumers with a sensory experience, allowing them to see, touch,

and test products before purchasing. Additionally, offline retail offers the opportunity, through specialized staff, to provide advice and recommendations, consultancy for those who need help in choosing the most suitable purchase solutions.

The study results also indicate that subjects appreciate that both online and offline commerce in malls will evolve in parallel, influenced by various factors. It is clear that technological evolution will impact both forms of commerce, but the strategies employed remain to be seen (there are companies that started as online startups and later added an offline component, such as eMAG, which created a network of showrooms).

The current study related to offline shopping shows that in Romania, most of the respondents visit malls weekly, mainly to buy products and services. Among the factors driving this type of shopping, the following have been identified: attractions in the mall, their organization (all types of stores are found in one place), the immediate entry into the possession of the product, actual product viewing, as well as the safety measures in place. Previous studies show that there are seven reasons why consumers visit offline stores: character, product, spending time, entertainment, photography, giving a gift and curiosity [61].

As this article shows, during the COVID-19 pandemic, online shopping has exploded, especially for food, cleaning and disinfecting products, and cosmetics. These results are consistent with the results of other studies such as: results of a study developed by The Food Industry Association (2020) [62] whose results found that approximately 77% of participants chose to buy food products online; The COVID-19 pandemic has made online grocery shopping a more popular and viable option, and this popularity has led to significant changes in transportation and supply chain management [63]; in the Lebanese society, during the COVID-19 pandemic a significant number of respondents started making fashion purchases online [64].

The results of the article show that for Romanian buyers, the main advantages of online shopping are the ease of finding and comparing offers, as well as saving time spent on shopping. A study conducted by by Kulkarni and Barge [65] found that convenience and instant satisfaction were the most influential factors for online shoppers. And the study developed by Chmielarz et al. (2022) [24] shows that during the pandemic, the structure of internet activities has changed, with the biggest increases being online shopping (11%).

This study, like others, is not exempt from limitations. A limitation is that it was impossible to perform random sampling. However, the mentioned limitation does not reduce the value of the research. Among the limitations of the study is the impossibility to assist and answer the respondents in real time (in case of possible erroneous interpretations of the questions in the questionnaire), but also the distribution of the questionnaire only in the online environment (there is a possibility that some may not be able to access the completion link of the questionnaire).

The exploration of concepts and components of experience design that online commerce will develop and how the mall, from an experiential design perspective, will respond constitutes a potential future research direction. It is noteworthy that many firms operating in malls are focusing on integrating offline and online

commerce, offering a holistic approach to meet the changing purchasing behaviours and needs, providing new shopping and consumption experiences.

Based on the above research, this paper provides a clear foundation for understanding the behavioural differences and shopping experiences in the online versus offline (malls in our case) environments.

The research conducted and presented in this article is current and highly important. From a managerial perspective, our findings can be utilized by managers in the retail industry to develop effective marketing strategies aimed at improving activity by offering new shopping experiences and developing new ways of online communication with customers, ultimately increasing customer satisfaction and contentment.

The present study highlighted the practical implications of the differences in shopping behavior and experiences of online and offline shopping in shopping malls, from a national level. Although the results are presented at the level of Romania, they can also be of real use at the macro level, where retailers can similarly establish their strategies. As can be concluded, the managerial implications indicate the priority of implementing differentiated business strategies, depending on the targeted environment (online and offline), to then shape marketing strategies adapted to the buying behavior. The most important detail that business owners must understand is related to the different motivation of the consumer depending on the type of trade targeted, but also to the major influences it can have (eg: periods of crisis, Pandemic, etc.). By knowing factors such as buying behavior, customer experience, modern technology that is experiencing spectacular growth, organizations can differentiate their marketing strategies that must keep pace with the continuous changes in the market, maintain customer enthusiasm and adapt to their needs. Finally, this investigation, correlated with other specialist research, can be useful to micro and macro factors interested in trade. Consequently, this study contributes to how retailers (both offline and online) must adapt to changes in consumer behavior, but also to the measures they must use to attract consumers.

Funding Universitatea Transilvania din Brasov

Declarations

Conflict of interest All authors state that there are no conflicts of interest.

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Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Electronic Commerce Research and Applications 59 (2023) 101264



Contents lists available at ScienceDirect

Electronic Commerce Research and Applications

journal homepage: www.elsevier.com/locate/elerap





Getting users out of the loop: Key factors to surpass the messy middle point

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ARTICLE INFO

Keywords:
Website touchpoints
Messy middle point
Consumer journey
Accessibility
Experience
Marketing
Technology

ABSTRACT

In a world dominated by technology, the consumer journey should not be a priority only for those who have the skills to understand the search engine optimisation factors or online stores' technological performances. It must be a priority for entrepreneurs, retailers, and marketing specialists, too. The customers might be won or lost depending on their experience, and the space between their choices is named the messy middle point. Considering this issue, the authors highlight the key factors necessary to exit the loop in the light of four dimensions, i) technology, ii) experience, iii) accessibility, and iv) marketing, aiming to identify and promote specific actions to create and maintain a non-interrupted experience. Based on data from 210 certified trusted online stores, the results generated 13 specific actions incorporated in the conceptualized TEAM model. Appealingly, unexpected outcomes were identified, highlighting the interconnected activities that online stores perform nowadays.

1. Introduction

In the last two decades, e-commerce transactions have skyrocketed around the world due to the development of Internet Technology, and research in this area is a *sine qua non* for academics and professionals. In this context, some key factors must be addressed. Generation Z lives in an inseparable world between online and offline, spending eight hours a day online. With a growing income set to reach a combined $33 trillion over the next decade, the earning potential of Gen Z by 2031 (THG, 2022) cannot be ignored when it comes to the future of electronic commerce. In 2020, over two billion people purchased goods and services online, and e-retail sales exceeded 4.2 trillion U.S. dollars worldwide. Forecast e-commerce share of total global retail sales by 2025 is estimated at 24.5% (STATISTA, 2022). Lately, the development of 4th generation mobile telecommunication technologies has stimulated the expansion of mobile commerce (m-commerce) worldwide, as an extension of e-commerce in which business activities took place in a wireless environment via mobile devices (Chimborazo et al., 2021; Puiu et al., 2022; Sharma and Madan, 2022; Vărzaru and Bocean, 2021; Vinerean et al., 2022). According to (Kleisiari et al., 2021; Sardjono et al., 2021; Schaefer and Figliozzi, 2021; Vărzaru and Bocean, 2021), the COVID-19 pandemic played a significant role in the growth of e-commerce websites; consumer habits shifted from physical stores to online, as the global confinement led to the closure of many businesses, increasing the number and the volume of activity of e-commerce websites.

Under such circumstances, consumers expect a successful journey (Rodrigues and Coelho, 2021), and plenty of factors influence it. A review regarding the consumer decision journey (Santos and Gonçalves, 2021) systemizes both classic and flexible decision models. As highlighted by the literature, a special interest was given to the consumer decision journey models, highly influenced by digital touchpoints expected to function excellently and not interrupt the purchase flow.

The existing factors for a purchasing-driven journey are countless in a world full of technology. With the possibility of conducting commercial transactions using wireless devices (Kumbhakar, 2021) and crossing borders through its features and facilities, e-commerce has accelerated the integration of the global economy (Chen et al., 2021; Murthy et al., 2021) with high-performant digital assets. For electronic commerce, the website is one of these assets and it has been named *the critical digital touchpoint* for the consumers' decision-making process. In a context where the purchase journey is defined by the messy middle point, it becomes increasingly complicated to manage users who can endlessly wander through unsatisfactory touchpoints along the journey until the moment they buy under the conditions that are expected.

This gap determined the authors to analyse the website performance considering digital touchpoints, as part of the messy middle point decisive elements. In this regard, the critical research question was "***How might a retailer get users out of the loop?"***. The loop is the

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https://doi.org/10.1016/j.elerap.2023.101264
Received 21 September 2022; Received in revised form 19 April 2023; Accepted 24 April 2023
Available online 29 April 2023
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representation of the non-linear journey users can have between the choice of searching for a product (the trigger) and the choice of purchasing it. Time spent for the evaluation (pre-purchase phase) can last until the customers are either won or lost, depending on the touchpoints they have met and whether they found what they were looking for. Through this paper, the authors draw attention to the online store's website, aiming to find the key factors that determine users to get out of the loop and move forward from evaluation to purchase stage, surpassing the messy middle point (Fig. 1). By using 15 Search Engine Optimisation factors, the authors intended to discover which of them contribute to accessibility, experience, marketing, and technology, as relevant touchpoints for a high-quality user experience during the consumer journey.

For this purpose, the authors have set objectives to (O_1) analyse the level of the online store's accessibility, (O_2) understand how well the online store guides the users between pages, and (O_3) determine the influence of the images' quality on the marketing dimension performance. The research was based on a case study, which allows investigating some complex, contemporary situations from real world (Patnaik and Pandey, 2019; Rashid et al., 2019).

The findings highlight the importance of researching new perspectives and opportunities for the ever-changing field of electronic commerce and contribute to the research knowledge field with an universally available framework for researchers from all over the scientific world. It is grounded in proposing 13 actions to improve the digital touchpoints related to the websites of retailers. Also, the study revealed that incoming links, headings, printability, meta tags, and page titles contribute to the expected user experience and to surpassing the messy middle point from the pre-purchase (evaluation) to the purchase stage.

After the introduction of the context, the paper presents the theoretical background, highly needed for the solid foundation of the study performed. It describes the current knowledge stage about touchpoints and consumer decision making, the messy middle point of the consumer journey, and the search engine optimisation and the messy middle point connection.

The next section presents the research design and hypothesis development, followed by analysis methods. The results are discussed according to the proposed combined model and the arguments for theoretical lens contribution, compared with previous research. The final part is allocated to conclusions section that highlight the managerial and theoretical implications, the limitations of the study, and future research.

2. Theoretical background

To understand the approach developed by the authors, three subsections of the theoretical background were designed. First, the literature on touchpoints and consumer decision-making was revised, followed by explaining the concept of messy middle point within the consumer journey. Finally, knowledge was linked to search engine optimisation.

2.1. Touchpoints and consumer decision-making

Lately, the importance of touchpoints has grown considerably, and not mentioning them in current studies would be a significant mistake (Chylinski and Heller, 2022; Hollebeek et al., 2022). The concept was introduced among the terms for modern contemporary communication from the new world (Seebacher, 2022) with applicability in many areas (Foya and Garikayi, 2022; Gao et al., 2021; Hassan et al., 2022) or at different stages of the consumer journey (Pham, 2022). A recent study demonstrates this fact through the use of touchpoints for funnel analysis using the knowledge space theory (Lin et al., 2022), and the examples can continue by easily searching for this keyword in prestigious databases.

A touchpoint has been defined as the place or the situation through which a consumer interacts with a business (Oxford Learner's Dictionaries, 2022) with a significant influence on the consumer journey (Koch and Hartmann, 2022). On this basis, several types of touchpoints (brand owned, outside the control touchpoints, third-party, etc.) and three decision-making process stages were unveiled (pre-purchase, purchase, post-purchase) (Towers and Towers, 2022). Because not all touchpoints are under the control of organisations, they must control well at least the ones they own. Many studies focused on search engine optimisation and websites performance as digital touchpoints (Bolton et al., 2022; Dominique-Ferreira et al., 2021; Koch and Hartmann, 2022; Maechler et al., 2016), that can be employed to control and optimise moments in the consumer decision-making process. The scientists highlighted the importance of website touchpoints and the influence of a positive perceived quality during the customer experience, especially for electronic commerce, an area where users expect an excellent experience (Darboe, 2022).

2.2. The messy middle point of the consumer journey

The path to purchase is littered with complicated touchpoints that can stop the consumers to move forward in case of dissatisfaction. The

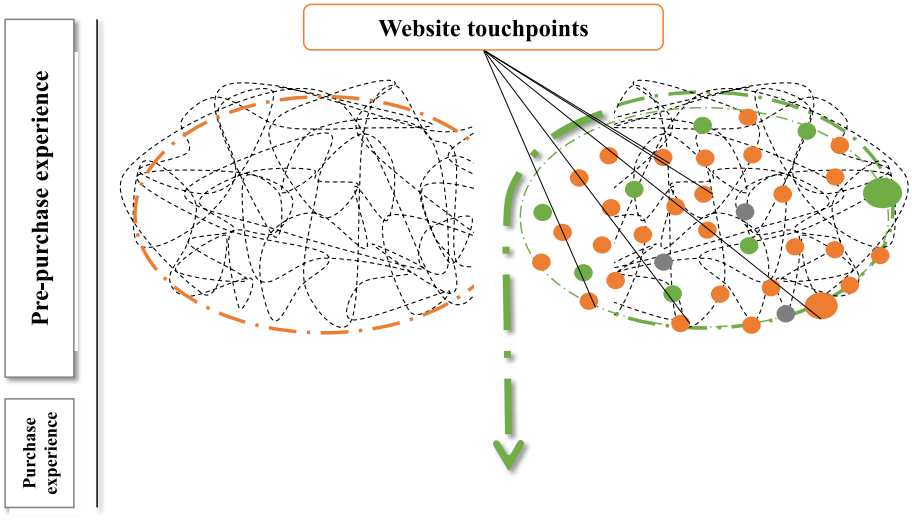


Fig. 1. The messy middle point and website touchpoints. Source: authors' conceptualisation based on the aim of the study.

increasingly complicated shapes of sales funnels provoke academics and the managerial environment in finding the most relevant solutions for meeting the high-demanding expectations of consumers.

Despite its worldwide application, electronic commerce is directly impacted by the *modus operandi* of consumers. Moreover, the use of Internet for purchasing disturbs, even more, the way they make decisions. The unlimited options and opportunities set by the technology advancements determine a sudden behavioural change. In this context, they are comparing everything, not only prices or products, causing emotional changes that remain unveiled by professionals. Therefore, the need to decode consumer behaviour is more pressing than ever. The full report "Decoding Decisions", published by Google (2022) (Rennie et al., 2020), presents the brief history of marketing models, from AIDA (1898) to ZMOT (2011), emphasizing the way of thinking and consumer perspective have changed. In the same sense, postgraduate research was performed to observe shopping behaviour for 310 different purchasing journeys across 31 categories. The results of the study introduced in the literature the most noteworthy concept that describes the mental mode of decision-making. It places the "messy middle point" in the centre of the purchase journey between two poles, namely, the triggers and purchase phase (Edwards, 2022; Gkikas and Theodoridis, 2022). Within the loop shape, the way out of the middle point leads the consumer to the product only if the consumer's journey is not affected by other factors.

2.3. The search engine optimisation and the messy middle point

The literature presents several web marketing methods that should be considered when making a website effective online, such as Search Engine Optimisation (SEO), Pay-per-click (PPC), Online Advertising, Email Marketing, Blog Marketing, Social Media Marketing, Online Public Relations, Multimedia Marketing, Mobile Marketing (Miller, 2010). Each one of these marketing tools plays a key role in business website marketing. Among the main two methods to achieve high rankings: SEO and PPC, SEO is the preferable marketing system for e-commerce-based websites (Kritzinger and Weideman, 2017).

Search Engine Optimisation (SEO) is the process of improving a site to increase its visibility when people search for products or services related to their business in search engines (Search Engine Land, 2022). The better visibility a page has in search results, the better the chances to garner attention and transform online visitors into effective customers. In marketing, the way a consumer takes note of a brand and interacts with it during the purchase process, measured as the totality of the touchpoints the customer has with a company, is called "the customer journey" (Search Engine Journal, 2022). The SEO strategy contributes to a productive customer journey. Through the study, the authors assumed that the way out can be stopped if some website particularities do not meet the expectations of the consumer. The hypotheses explained in the next section expose this assumption and show the context of the research.

Considering the increase in the number and expertise of consumers regarding the use of the Internet, they tend to have higher demands from websites, both in terms of their performance and content (Król and Zdonek, 2020). Consequently, the structure of websites is constantly changing which leads to a need of measuring these changes in terms of performance (Saverimoutou et al., 2019) and identify their strengths and weaknesses (Saeidnia et al., 2022). The quality of a website greatly influences e-loyalty and trust in that website (Aslam et al., 2020; Garcia-Madariaga et al., 2019).

Measuring website performance (influenced by a wide variety of factors and criteria) is extremely important for business development in a very competitive market (Ulutaş, 2019), the decrease in performance leads to a decrease in demand and a lower probability of website traffic conversion in firm orders (Gallino et al., 2018). The first access to a website is of particular importance in creating the consumer's impression, loading speed being crucial in this regard. The websites with a low loading speed have a clear competitive disadvantage (Muriyatmoko and Musthafa, 2022; Stringam and Gerdes, 2019).

However, a study conducted in the USA on apparel mobile commerce shows that "website information quality, website visual appeal, apparel visual appeal, and website security" have a greater impact on ensuring consumer satisfaction and less "response time and brand trust" (Chi, 2018).

During the process of creating a website, the principles of graphic design, the logic of its structure, and interactivity must be taken into account because they will outline the customer journey and will condition the time spent by them on that site (Lopriore, 2022), thus the quality of the website influencing "online impulse buying behavior" (Akram et al., 2018; Rita et al., 2019). Users must not detect any anomaly in the operation of a website because this can lead to losses for merchants or even fraud, identity theft, damage to brand image, and loss of consumers. Any technical inefficiency can irritate the user and make him leave the website (Dahiya and Duggal, 2018).

The factors that influence the performance of a website are "conversion rate, average session duration, and bounce rate" (Domazet and Simović, 2020), "high performance, better accessibility and usability" but also "mobile-friendliness", connection with social media and security (Kumar et al., 2021; Kwangsawad et al., 2019). Specialists consider that another key performance for website effectiveness is the bounce rate, which in turn is directly influenced by "unique pageviews, average time on page, entrance, and percent exit" (Idemudia et al., 2021).

The use of loyalty programs by an increasing number of companies makes their size influence website traffic (Sundjaja et al., 2022), strongly correlated to the degree of customer satisfaction with these programs (O'Connor, 2021). Studies show that the determining factors in the use of loyalty programs are "playfulness, affective commitment, and attitude toward them" (Sundjaja et al., 2022).

To maintain customers and give them an advantage and, at the same time, to increase the attractiveness of the products, online stores use gamification techniques even in loyalty programs (Sundjaja et al., 2022), studies showing that they lead to repeated purchases. The use of these techniques fosters an increased consumer engagement and profitability, the elements most used in gamification being "rewards, badges, and leader boards" (Azmi et al., 2021). To increase the level of perceived customer satisfaction when accessing websites, online retailers must adopt "specific semantic web technologies" which stand for more detailed product descriptions and information related to the importance of product features (Necula et al., 2018). In the current context marked by the continuous growth of the online market, it is very important for merchants to practice digital marketing through SEO and SEM, to make information more easily accessible (Sipayung et al., 2021), and to create a favourable positioning in search engines (Mendez Lobato, 2021; Verma et al., 2020).

3. Research design and hypothesis development

To accomplish the aim of the study, the research design (Fig. 2) was substantiated by the key concepts presented in the first part of the article.

The gap regarding how the purchase journey is managed and positively influenced by satisfactory touchpoints led the authors to address the complicated model of messy middle point, to find key factors that determine users to get out of the loop, and move forward from the evaluation stage, surpassing the point where it was possible to return and explore another solution (another retailer), in case of dissatisfaction.

The validity and reliability of choosing the website as a relevant factor for digital touchpoints are based on the Brand Touchpoint Wheel tool, that place the website as an asset for the pre-purchase experience, being used and mentioned in various studies over time (Hong and Hardy, 2022; Jevons, 2005; Lee et al., 2013). A literature review was carried out to select the most relevant research variables for the website analysis, which eventually revealed the most important priorities for e-

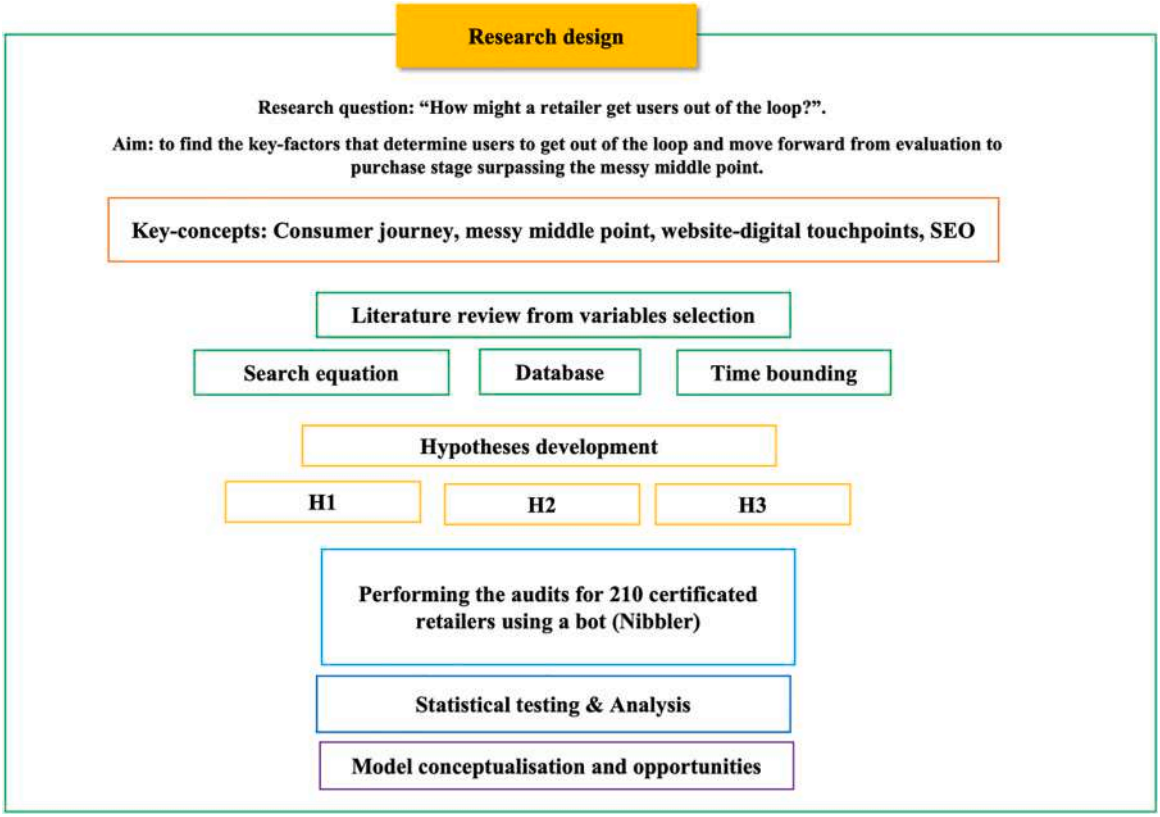


Fig. 2. Research design from aim to model conceptualisation and opportunities. Source: authors' conceptualisation.

commerce websites development: *accessibility* (how accessible the website is to mobile and disabled users), *experience* (how satisfying the website is likely to be for users), *marketing* (how well marketed and popular is the website) and *technology* (how well designed and built is the website). The literature review process was based on a combined approach based on practices in the field and studies published in internationally recognized databases. The authors created a document list with the keywords around the research question, and around the relevant elements of Brand Touchpoint Element Wheel for research. Among these are "pre-purchase experience", "purchase experience", "website performance", "messy middle point", "search engine optimisation", and "consumer journey". The databases consulted were Web of Science, Google Scholar, ScienceDirect and Springer. The authors' searches can be described as a process of a snowball, because from the initially found articles, information and concepts were discovered that led to the identification of other important scientific resources for the research topic (e.g., "digital touchpoints"). The search period for the documents lasted several weeks from June 2022 to August 2022, but the process was continued during the writing of the paper because supporting references were needed to compare the results of the study with previous similar research. After the process of identifying valuable documents for research, the literature review was written based on solid information for the formulation of four hypotheses. Each one is based on the specialized literature and practicing methods in the field, considering accessibility, user experience and visual components of online stores.

Web accessibility refers to the properties of the websites that allow people with incapacities to use the web. Accessibility is an essential characteristic in determining the success or failure of a digital business (Acosta-Vargas et al., 2022). Web accessibility has a direct effect on the e-loyalty, satisfaction, and trust of the consumers (Paștiu et al., 2020). Web Content Accessibility Guidelines (WCAG) cover a wide range of recommendations for making Web content more accessible (particularly for people with diverse types of disabilities or cognitive limitations).

The main principles that provide the foundation for web accessibility are the following: *perceivable* (content and user interface components should be presentable to users in ways they can perceive), *operable* (a website should be as intuitive as possible), *understandable* (the site should include legible elements, predictable in navigation), and *robust* (compatible with all browsers, operating systems, and devices) (Alsaeedi, 2020; Fernández-Díaz et al., 2020; Nietzio et al., 2014; Spyridonis and Daylamani-Zad, 2019; W3C, 2018). If any of these principles is not fulfilled, users with disabilities will not be able to use the web (Pelzetter, 2021). Vulnerable populations are those that are the most susceptible to being affected by crises, and the COVID-19 pandemic exacerbated the inequalities (Figliozzi and Unnikrishnan, 2021; Gartland et al., 2022; Jankowska, 2021; Sanchez-Diaz et al., 2021). Considering all these aspects, the researchers identified research opportunities. Thus, a first hypothesis of the study has arisen:

H_1: The accessibility of online stores is high, favouring the consumer experience.

In addition to accessibility features, e-commerce platforms are strongly aiming to enhance the overall user experience (Mantha et al., 2020), considering the widespread use of mobile devices and large connections to social media. Different facets of customer interactions in the online shopping process generate the online customer experience, such as the easiness to locate the website/app (Rennick, 2019), ease of use (Anaya-Aguilar et al., 2021; Lindh et al., 2020; Stafford et al., 2021) perceived usefulness (Grange and Barki, 2020; McLean and Wilson, 2019), hedonic and utilitarian features (Karampournioti and Wiedmann, 2021; McLean et al., 2018; Riegger et al., 2021; Tyrväinen et al., 2020), perceived enjoyment (Kim, 2021), personalization (Karimi Mansoub et al., 2020; Raufi et al., 2019), social interactions and multi-device compatibility (Bilgihan et al., 2016). Therefore, in addition to accessibility, user experience was considered for formulating the second hypothesis:

H_2: The online stores' pages guide the users properly for a good shopping experience.

As the perceived utility, ease-of-use, visual attractiveness, and interactivity of the website/app, the perceived enjoyment, and satisfaction of the user increase, having a positive impact on buying behaviour and on website loyalty (Bilgihan et al., 2014; Do et al., 2020; Rauwers et al., 2020; Soares et al., 2022). People's shopping experience can also be optimized by improving the usability and efficiency of websites in interface design (Cheng, 2019). Positive attitudes and shopping experiences among online customers can be attracted by perceived value and trust in online shopping, which proved to be the result of well-designed websites, information design, navigation design, and visual design (Ijaz and Rhee, 2018).

Customised and personalised offerings and influential visual designs on the online platforms contribute to a greater extent to the customer experience than purchasing experience itself, and the amount of time a person spends on the online platform critically matters for customer satisfaction and loyalty (Ertemel et al., 2021). Based on the information provided by the literature review on this topic, the authors underlined the third premise:

H_3: The quality of the images influences the marketing performance of online stores.

The research design was created based on the case study method substantiated following the stages proposed by Yin (2009). The first phase was to "define and select the cases for study" when 225 websites were identified. The second one consisted in "using multiples cases as part of the case study". At this point 210 eligible websites were selected. Finally, "strengthening the evidence used in the case study and analysing the case study evidence" was performed and widely described in the section of analysis methods. The selection of the cases included in the research is motivated by the certified high trust that online stores have at the time of the study. At the level of online stores, trust and credibility are factors of utmost importance (Guerrero et al., 2023), their lack causing barriers and affecting purchases (Dogra and Kaushal, 2023). Thus, users' trust was a selection criterion for the sample of the study, a criterion that is found in recent studies to research electronic commerce (Dang et al., 2023; Özdemir, 2022; Yang and Ngo, 2023). Of course, sample could be used if they did not compound websites without trademark, but the existence of other papers where mentions of certified online stores with the trusted mark (Burlea-Schiopoiu et al., 2022) offered the authors a strong precedent for reliable effectiveness of the selection method. In addition, the standards that online stores must meet to obtain certification are aligned with the aim of the study. In total, websites must comply with a total of 35 requirements to be marked as trustworthy (TRUSTED.RO, 2023). This fact ensure that all aspects related to legality, commercial transparency and good practices are respected before addressing the research question regarding the exiting the loop after technological issues are surpassed.

The initial sample (Fig. 3) was represented by 225 websites through which Romanian retailers operate and which obtained the Mark of Trust certification through the National Program for the Certification of Online Stores (TRUSTED.RO, 2022).

After a preliminary analysis, 210 of them were considered eligible for the study due to their compatibility with the Nibbler platform (Nibbler, 2022), the software used to perform the audits. Nibbler is a bot, a free tool for website analysis providing fifteen key areas for the four priorities for electronic commerce. By using the domain of each retailer included in the study, it was possible to evaluate up to five pages for each and collect the scores (Fig. 4).

Besides the scores, the authors collected the issues for every contributing test, creating a large database, which favoured the performance analysis for fifteen areas and main priorities for website improvement, issues, to improve, awarding, and adiaphorous (neither good nor bad).

4. Analysis methods

To analyse data, five methods were applied, namely, descriptive analysis, reliability of the model analysis, factor analysis, analysis of covariances, compared mean analysis, and bivariate analysis.

However, the first step was to establish the structure of the model and clearly understand the technological factors (touchpoints) that

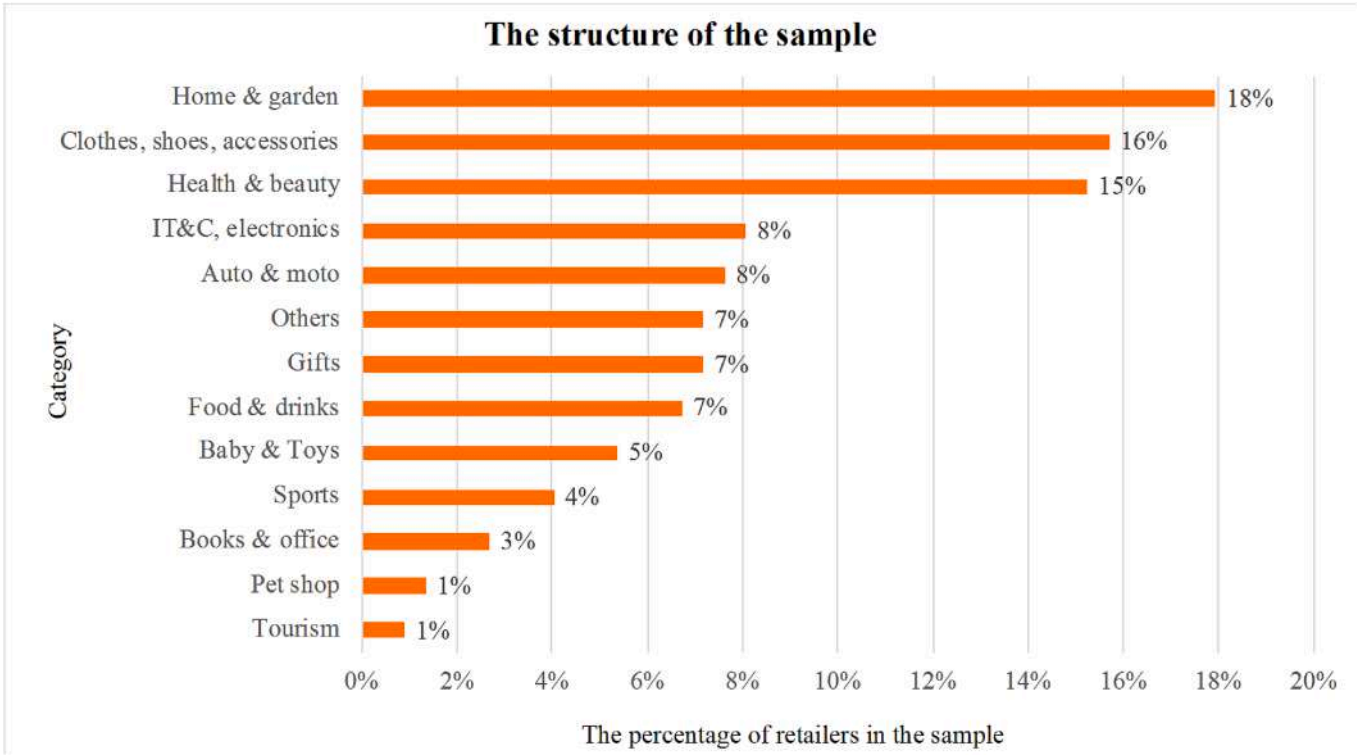


Fig. 3. The structure of the sample. Source: author's conceptualisation based on collected data.

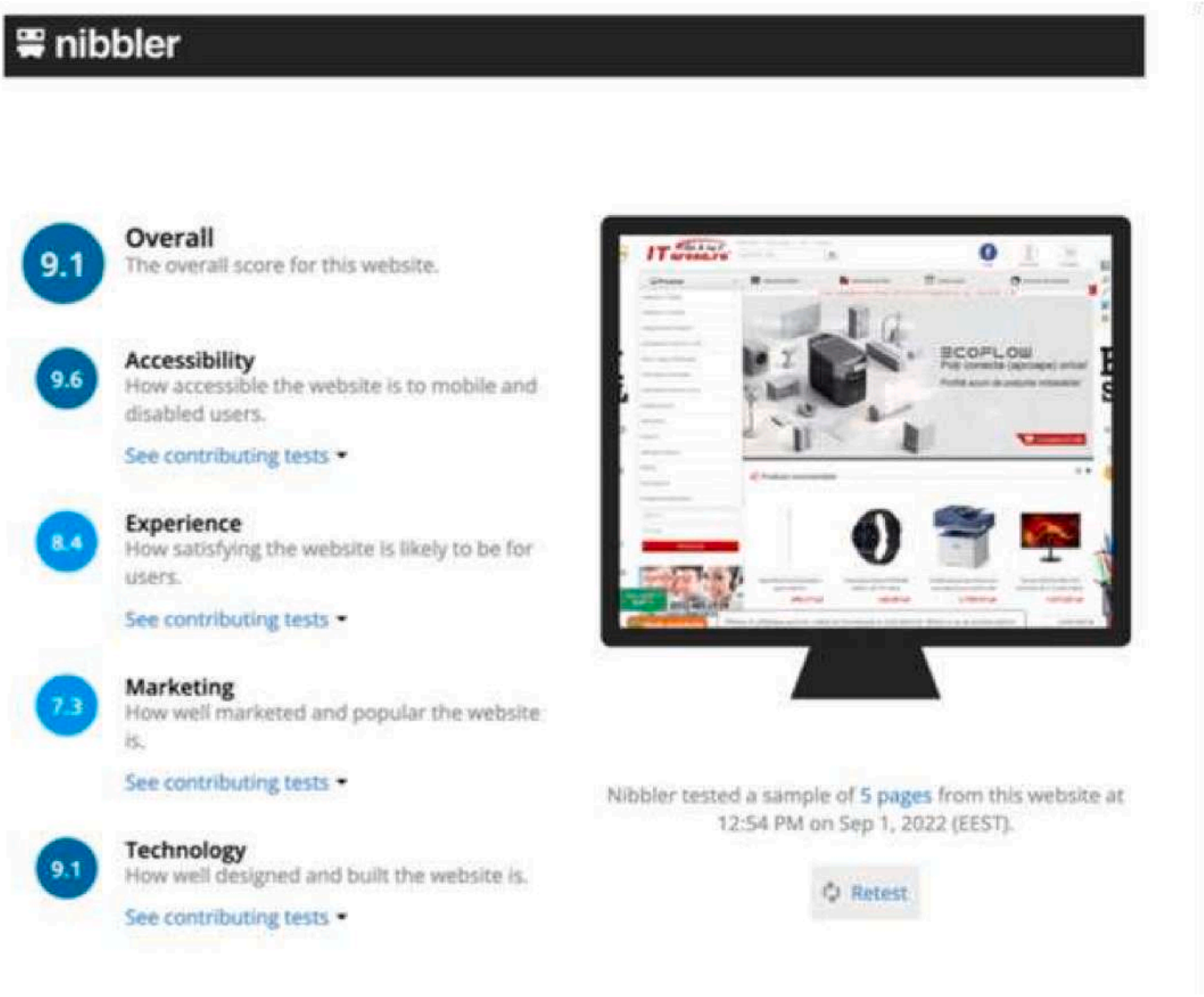


Fig. 4. Test demo for one of the retailers. Source: screenshot from Nibbler running software.

influence the overall score of the websites. Because the fifteen technological elements are common for more than two main components (Fig. 5) and they cannot be easily measured directly with high reliability, the researchers appealed to a data reduction technique, thus enabling the investigation process.

After the descriptive analysis, the factor analysis was applied. Using this method, 210 certified online stores with the trusted mark were analysed from the perspective of the four main components, for the overall performance of the websites (accessibility, experience, marketing, and technology), each one being analysed with fifteen different contributing tests.

Although the Nibbler platform highlights contributing tests for all the four components, factor analysis facilitates discovering the latent elements hidden behind the raw data, due to the possible variables related to one another and associated with the same factor. The authors used the principal component analysis, to identify the underlying factors and reduce the set of variables to a smaller one, more meaningful, by looking for clusters of variables that share variance. For such purpose, the size of the dataset was reduced with the factor function from SPSS 20.

5. Results

The results allowed the authors to discuss the key factors identified, but not until the reliability of the model was assessed. Therefore, based on the factor analysis results, multiple linear regression was used to test if the high loading technological element significantly predicted the overall performance (OP). In the final, compared mean analysis was performed, to test if there are significant differences between online store categories.

5.1. Reliability of the model

First, to ensure the relevance of the approached model, the reliability test run shows internal consistency (Cochran's alpha: 0.765). Thus, the model can be approached furthermore.

5.2. Factor analysis

After processing the model reliability, the exploratory factor analysis was run. In this regard, fifteen technological elements were used to analyse the relationship between the variables and to identify the structural latent factors with varimax rotation. The null hypothesis

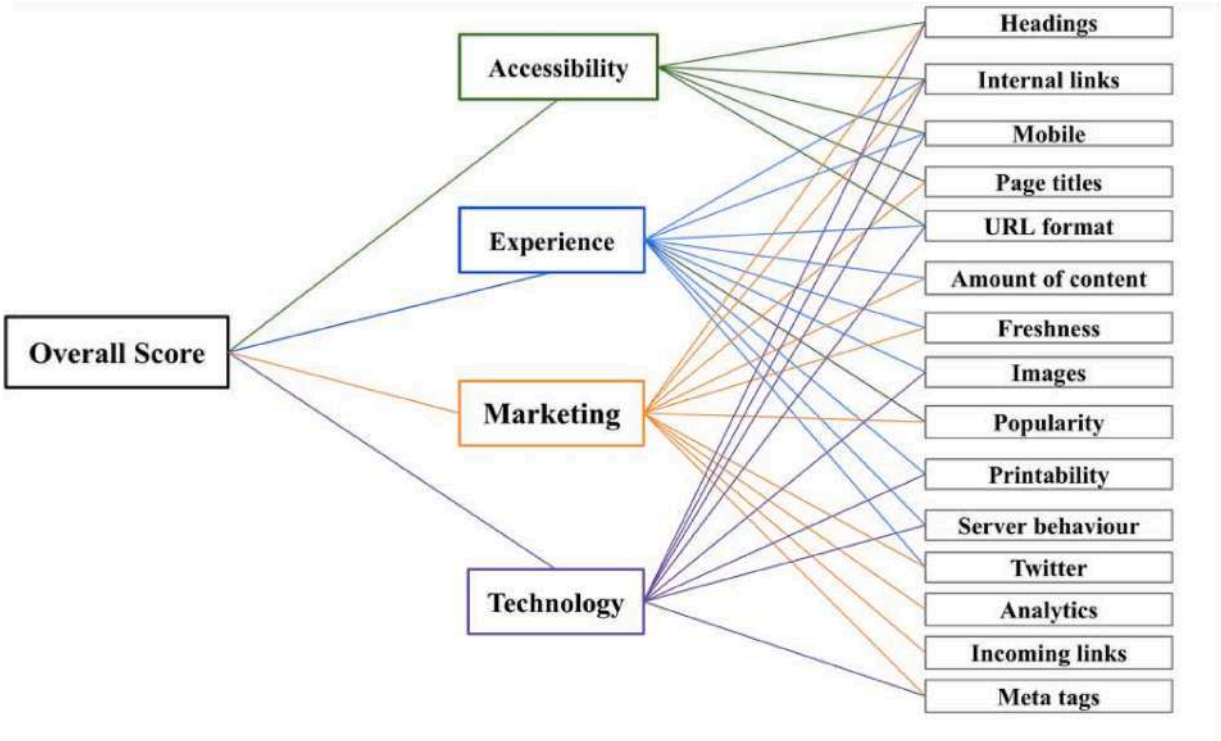


Fig. 5. Technological elements proposed in the model. Source: authors' conceptualisation.

stated that four numbers of factors (one for each principal component for OP) are enough to capture the full dimensionality of the dataset. The Kaiser-Meyer-Olkin test of sampling showed that the sample size is adequate for analysis and Barlett's test of sphericity demonstrated the relevance of correlations for factor analysis (KMO: 0.5, $\chi^2 = 188{,}994$, df $= 105$, $p < 0.001$). Using both the scree plot and the eigenvalues > 1, the extraction sums of squared loadings after rotation show six factors (a significant amount of variance in the dataset with maximized loading of each of the chosen variables) explaining 56.54 percent of the variance. Due to the mathematical grouping of the variables, it was easier to

	COMPONENT					
	1	2	3	4	5	6
Incoming links	0.696					
Popularity	0.692					
Mobile	-0.521					
Freshness	0.471					
Headings		0.652				
URL format		0.645				
Twitter		0.457				
Printability			0.747			
Images			0.638			
Meta tags				0.852		
Amount of content				0.681		
Server behaviour					0.765	
Analytics					0.723	
Page titles						0.721
Internal links						0.676

Fig. 6. Rotated component matrix. Source: authors' conceptualisation.

present the categories (Fig. 6).

Factor 1 was labelled IPMF (according to its components) because of the high loadings of the popular technological element. The first factor explained 11.66 percent of the variance after rotation. The justifications for labelling the other factors are exhibited in Table 1.

The overall regression was statistically significant ($R^2 = 0.74$, $R^2_{adjusted}$ F (6, 203) = 40.922, $p < 0.000$). It was found that incoming links (IL) ($\beta = 0.369$, t(208) = 7.499, $p < 0.000$), headings (H) ($\beta = 0.103$, t(208) = 7.342,$p < 0.000$), printability (PRINT) ($\beta = 0.041$, t (208) = 6.337, $p < 0.000$), meta tags (MT) ($\beta = 0.082$, t(208) = 7.201p < 0.000), and server behaviour (SB) ($\beta = 0.118$, t(208) = 4.762, $p < 0.000$) significantly predicted overall score. Otherwise, it was found that page titles (PT) did not significantly predict overall score ($\beta = 0.78$, t (208) = 1.627, not significant (ns)).

To show the effect of the independent variables without covariates, ANCOVA was applied to analyse the OP, by removing the effect of page titles independent variable. Levene's test and normality show the assumption of the equal variances as $p > 0.05$ and the residuals are normally distributed. By adjusting the PT variable, there was a significant difference in mean OP between the high loading technological elements (SB:F(31,29) = 3.492, p = 0.001; MT:F(5,29) = 19.701, p = 0.000; PRINT:F(6,29) = 12.502, p = 0.000; IL:F(28,29) = 6.981, p = 0.000; H:F(33,29) = 7.181, p = 0.000).

The partial Eta squared value shows the effect size. Comparing it according to Cohen's values, one may say that for IL, MT, and SB, the effect size is moderate (0.33, 0.586, 0.690 respectively). The smallest effect is for PRINT (0.18) and the largest is for H (0.740). The values describe how much of the variance is explained in overall performance by the independent variables.

By controlling the covariate "PT", it was possible to interpret the estimated marginal means for each important technological element. Thus, it was easier to understand the online stores' OP.

Server behaviour (SB): For the group evaluated with 10 (maximum score), the mean overall score is 8.46. The situation of the groups with OP having lower scores than 8.98 is even more worrisome due to lower scores than 7.8. For very few cases, a high OP score also means high scores for SB. Concluding, many OP means above eight are for the online stores with low performance in terms of SB.

Meta Tags (MT): the highest OP means showing the maximum score for MT is 8.698. MT scores are included in the range [2–10], for the OP given by the scores between [7.850–8.690].

Printability (PRINT): unfortunately, the group of online stores with the fourth average OP = 8.247 presents a score of 0 for printability. The scores of PRINT are included in the interval [0–10], and the maximum OP score for 10 is the group of the mean OP = 8.557.

Incoming links (IL): The scores for IL are included in the range [1.20–10]. None of the OP scores of 10 is included in the range, which denotes the poor performance of online stores with a score above 8.580 in the case of this technological element.

Headings (H): The range of scores for H is [1–10], and no score above 8.50 is included in this range.

To understand the issues and the improvements necessary for the most significant factors, descriptive analysis outcomes are presented in Fig. 7. Also, awarding actions and adiaphorous were illustrated as touchpoints placed within the loop, for a better overview of the concept.

Table 1
Factors labelling.

Factor number	Label	High loading technological element	% of variance after rotation
1	IPMF	Incoming links – IL (0.696)	11.66
2	HUT	Headings – H (0.652)	21.05
3	PI	Printability – P (0,747)	30.01
4	MAC	Meta Tags – MT (0,852)	38.95
5	SA	Server behaviour – SB (0,765)	47.83
6	PIL	Page titles – PT (0,721)	56.54

5.3. The robustness of the multiple linear regression

The assumption of non-zero variances was tested, and the analysis of standard residuals showed that the data contained no outliers (Std. Residual Min = -3.04, Std. Residual Max = 2.02). Also, regarding the assumption of collinearity, tests indicated that multicollinearity is missing (IL: tolerance = 0.928, VIF = 1.07; H: tolerance = 0.947, VIF = 1.05; PRINT: tolerance = 0.988, VIF = 1.012; MT: tolerance = 0.989, VIF = 1.011; SB: tolerance = 0.957, VIF = 1.045). To see if the correlation between residual terms is missing, the Durbin-Watson test was run, and its value met the assumption of independent errors (DW = 1.859). Regarding homoscedasticity and linearity, the histogram and normal P-P plot of standardised residuals illustrate all the points close to the line. Along with the scatterplot, the model met the assumption of homogeneity of variance and linearity (Fig. 8).

5.4. Compared mean analysis

The online stores were analysed according to the membership in a specific category, and the authors considered it relevant to perform a test of homogeneity of variances regarding the five influential technological elements for OP. The results show homogeneous variances for IL, PRINT, and SB. Therefore, ANOVA concluded that significant differences exist between online store categories due to MT and H only (SB:F(14,195) = 1.459, ns; MT:F(14,195) = 1.852, p = 0.034; PRINT:F(14,195) = 0.993, ns; IL:F(14,195) = 0.981, ns; H:F(14,195) = 2.021, p = 0.18).

6. Discussion

The scientific contribution that the authors bring to the knowledge field entails multiple gaps centred on the consumer decision journey model and the outcomes of the study unfold the dilemma of finding solutions for the current challenges and the life span of knowledge in electronic commerce. The applicative aspect that the paper renders locate the retailers who should consider the potential of the infinite journey that a user can experience in searching process for the desired product. Electronic commerce is constantly changing, thus, understanding concepts such as *loop* or *touchpoints* will lead to providing the necessary framework for a good shopping experience, from a technical point of view. For a crystal-clear overview of the study's findings and its effectiveness for the knowledge stage, the discussion was divided into two different sub-sections. The first one has recalled the concepts used to improve the theoretical lens with TEAM model and the second part sequentially presents the arguments for the contribution to theory as a subject of discussion in the context of previous studies.

6.1. The TEAM combined model

Retailers need to assess the results of their assets evaluation performed by users, as an opportunity to adapt to the new requirements of the digital environment. The website is the medium where users meet retailers' image and resources, and the Brand Touchpoint Wheel shows it as an important element during the pre-purchase experience. Thereby, the website-based touchpoints and SEO factors should be considered to untangle the messy middle point and help users continue their journey to purchase action.

Analysing all SEO factors simultaneously is arguably impossible in one single research paper, but an evaluation of few separate components through artificial intelligence (using a bot) allowed the authors to reflect on four dimensions relevant for e-commerce website optimisation (technology, experience, accessibility, and marketing) (Fig. 9). By aiming to connect the loop and messy middle point to the four dimensions, the authors discovered which factor should be considered with priority and to which dimension it belongs to.

Extracting data and organising the outcomes, five key factors, namely, meta tags, incoming links, headings, server behaviour, and

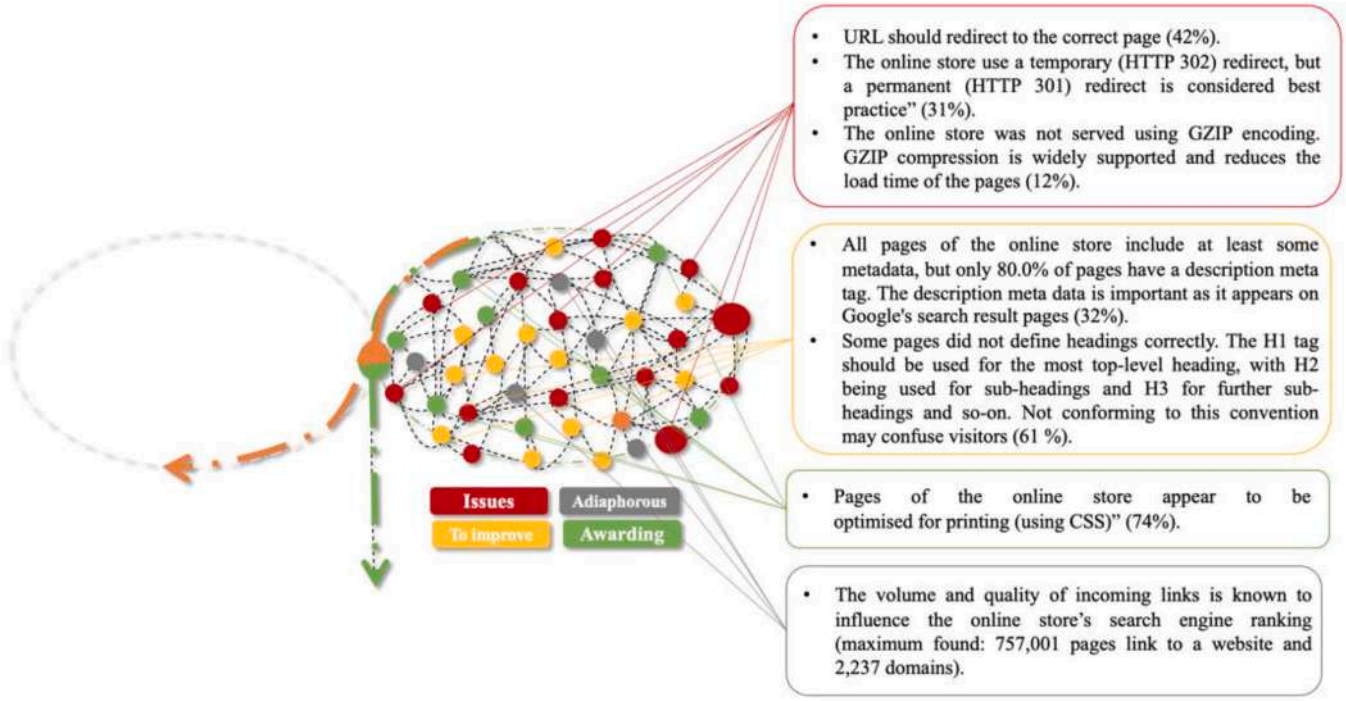


Fig. 7. Results of the analysis (issues, to improve, awarding, and adiaphorous outcomes). Source: authors' conceptualisation.

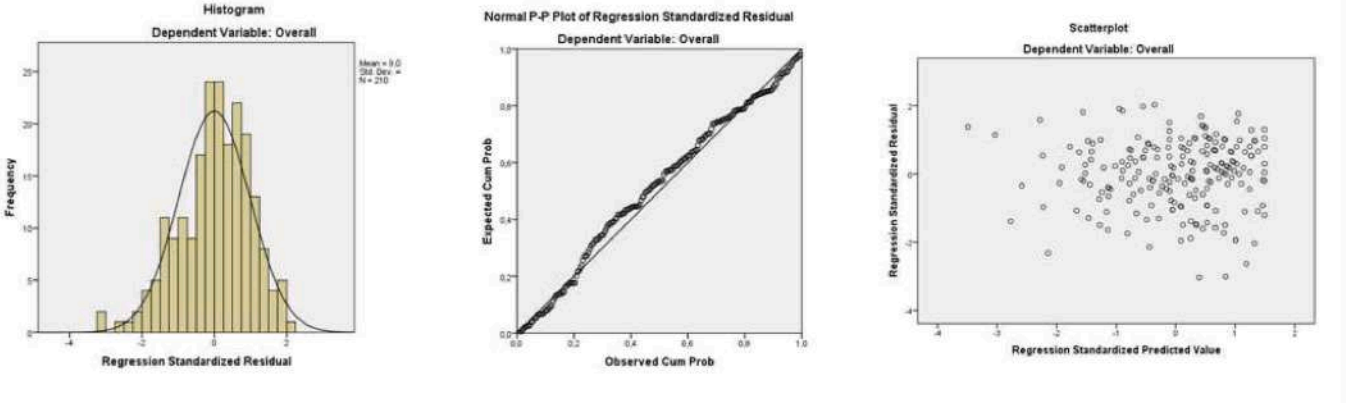


Fig. 8. The homoscedasticity and linearity of the proposed model. Source: SPSS outcomes.

printability were identified as catalysts for passing the messy middle point. Each of them exhibits several opportunities, summing up to 13 actions for the e-commerce strategy when considering a better consumer journey in the pre-purchase experience. The specific actions were presented as part of the TEAM model (acronyms of dimensions) and defined the core priorities for getting users out of the loop through the online store's website optimisation (Fig. 10).

At first impression, some results that revealed the five factors seemed totally irrelevant for achieving the balance between the current challenges and the development of e-commerce in the future. A good example is the printability factor, which in terms of consumer decision-making process, would seem very little relevant for the continuation of the consumer journey. Practically, the first thought would be that there are not many users who would print the pages with the images of the products they want, right? But studying more deeply and understanding the fact that printability technical capacity of website's pages optimisation by using CSS for screen-based stylesheets means this is a key-factor to offer users virtual mediums with good user experience conditions. Due to this type of aspects, several arguments for the applicability and the effectiveness of the TEAM model were explained further.

6.2. *Arguments*

The contribution to theory presents multiple approaches that support the answer for the research question. First, the scientific value of the paper derives precisely from the researched nexus between three concepts, as follows: i) the loop and messy middle point of the consumer journey, ii) the website (and its touchpoints), and iii) the SEO factors. Placed together, the big picture of the findings illustrates the necessity of engaging teams and managers from different departments or fields to share efforts in empowering the retailer to handle the customer experience and the demanding user requirements. Previous studies showed the necessity of creating a mixed-combined algorithm. Moreno and Martinez (Moreno and Martinez, 2013) introduced the high relevance of web accessibility, considered an indicator of high quality. As critical

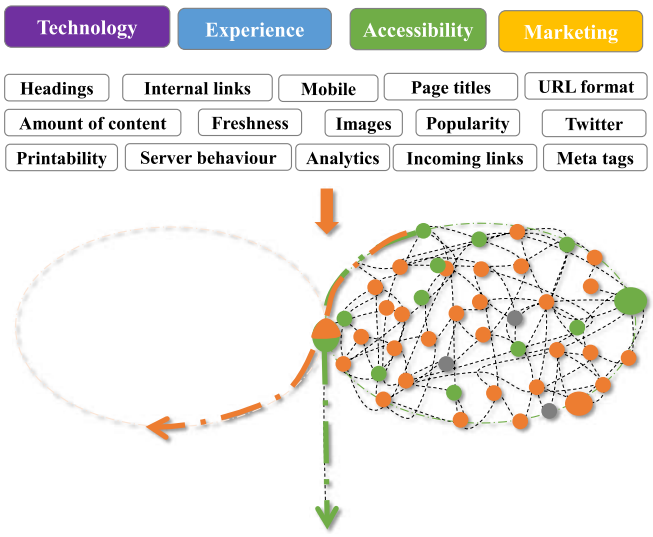


Fig. 9. The four dimensions, 15 SEO factors on the messy middle point.Source: authors' conceptualisation.

digital touchpoint for the consumers' decision-making process, the website, as part of a flexible model, needs constant optimisation and current alignment for customer journeys (Darboe, 2022) and because SEO is the preferable marketing system for e-commerce-based websites (Kritzinger and Weideman, 2017), the algorithm is founded on solid scientific arguments and comparable with existing literature. When it comes to SEO, studies show a concern with the content (Confetto and Covucci, 2021; Nagpal and Petersen, 2021) or similar schemes addressed in this study, such as redirecting pages (Wu, 2011) or trust by usability (Downing and Liu, 2011), but the results of this research expand the area of applications, conducting the managers and academics to different perspectives, presented as the second contribution to the theory. The aim of understanding how retailers might get the users out of the loop was fulfilled, by unveiling five SEO key factors and 13 technical actions that online stores' websites must attend. At first sight, the simplicity of the results may be presumed due to the accepted influence of search engine optimisations factors on the websites, but upon a closer look, new perspectives can be described as follows.

Starting from the research question, the authors intended to achieve three objectives related to the accessibility, the guidance between online stores' pages, and the influence of images used for marketing performance. For each objective, one hypothesis was formulated, and the findings highlights two unexpected results (Fig. 11).

Trying to understand if the online stores' accessibility is high, the results determined the authors to refute the first hypothesis. The findings show that optimising headings is more significant for the marketing dimension than for the accessibility. For this purpose, the authors proceeded to analyse the incoming links which conducted them to achieve the first objective. By reason of refuting the H_1, the authors highlight the alarming situation of existing more than half of retailers selling products on a website that loads empty headings or incorrectly defined. Framing this fact into the scenario where the online shops display the trademark of trustworthy, the authors can affirm that the experience customers embrace at the first time is not synchronised with their expectations and the customer journey is in danger. A decrease in demand and a lower probability of website traffic conversion might cause real challenges for retailers. This fact can affect the pre-purchase experience and might determine the user to continue searching without getting out of the loop. This consequence will lead the users to a possible endless searching journey. Worse, if shortly afterwards they find another provider who will satisfy their demands, they will remove the initial brand from the perception map when they buy again. In case they will not forget the brand, they will recall that pain produced when they did not find the correct or well-defined information on that website and will avoid it. The unexpected result obtained from this research action is that the first objective was correlated to the link building initiative. The authors expected to find the outcomes for this SEO factor close to the accessibility dimension, not to the marketing. However, the effect of this result place the link building activity as priority in marketing strategies, especially

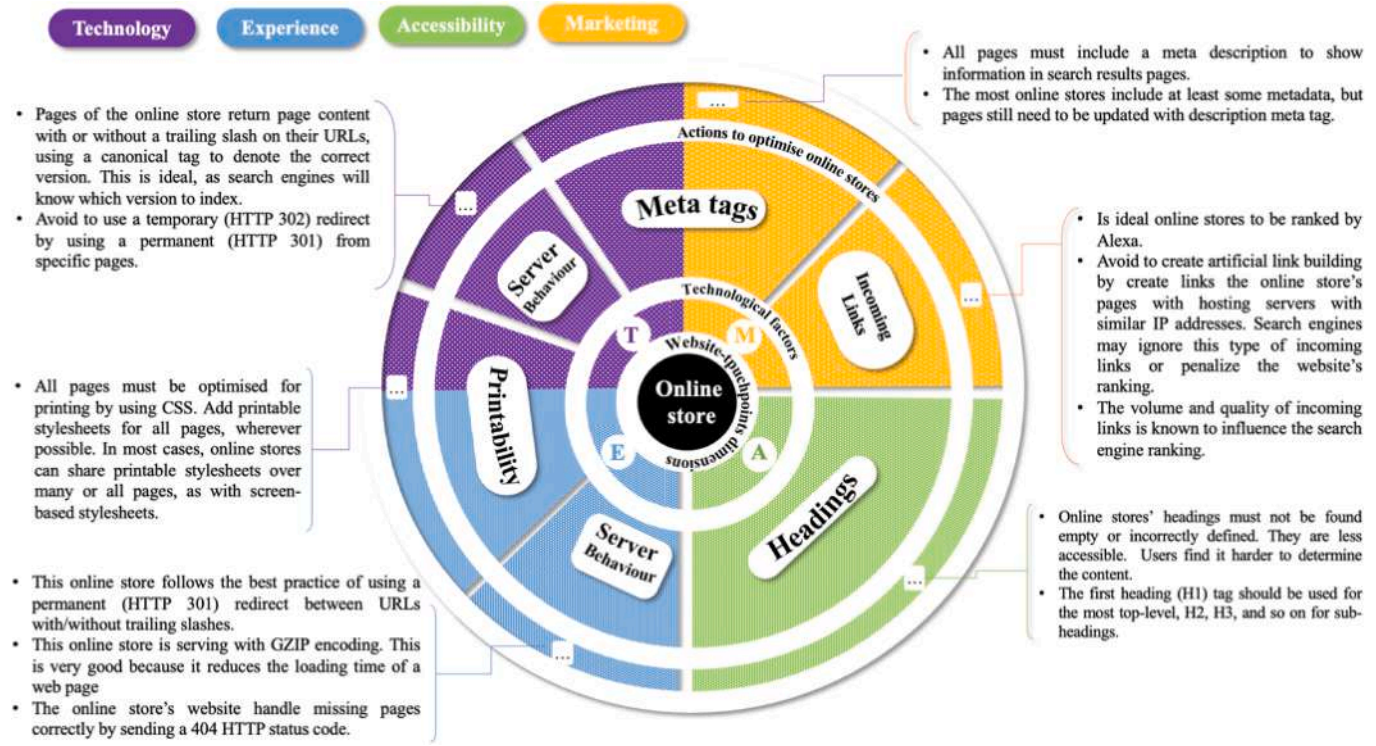


Fig. 10. The TEAM model proposal.Source: authors' conceptualisation.

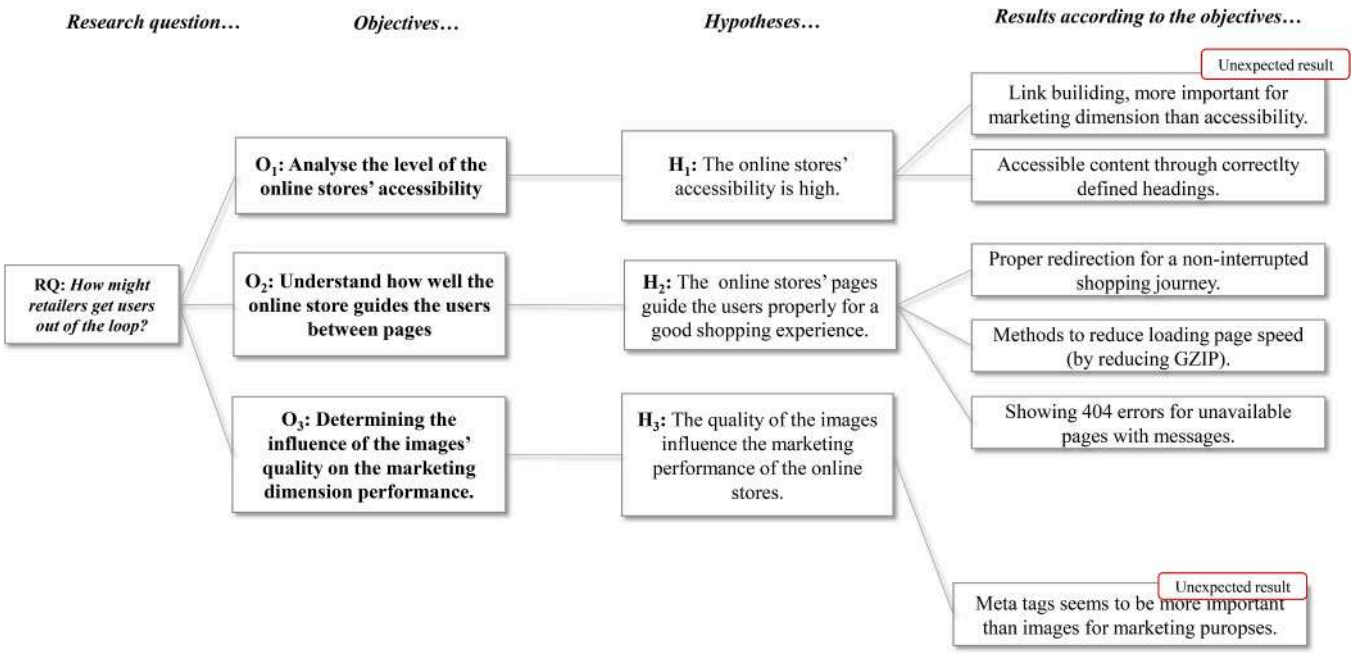


Fig. 11. The overall structure of the research in terms of objectives and results. Source: authors' conceptualisation.

when SEO is required.

The second objective of understanding how well the online store guides the users between pages determined the researchers to analyse the technical performance. The findings place the refutation of the second hypothesis and revealed that necessary improvements are to be made for guiding the user to the correct pages of the online store. In particular, in the case of certified online stores, with transparency ensured by the required standards, increased attention on right redirections is a must for a non-interrupted shopping journey. Most of them (42%) should try to lead to a requested webpage available instead of returning an error page (404), thus helping visitors interact with the desired product and move on to the purchase experience. The third hypothesis was not confirmed either, because the analysis showed that the influence of image quality on the marketing performance is not higher than the influence of meta tags and the actions on the organic link building. If this fact is known, artificial link building can be avoided, and the overall performance of the online store can be improved for a better user experience. Even so, the third objective was achieved and the connection of images on marketing performance was refuted and the influence of a different factor than images being demonstrated.

Finally, the authors intersected the technological issues and proposals for optimisation with business aims, which can be considered a major contribution to the electronic commerce knowledge field and applications because it enriches the literature with changing sales funnels. This is the first study that creates a connection between the messy middle point, the concept of the loop, the digital touchpoints and the vital collaboration between marketing professionals and information technology specialists within a single model to flourish the trust which the website influence (Aslam et al., 2020; Garcia-Madariaga et al., 2019).

7. Conclusions and implications

The authors' approach highlights several concepts that substantiate the way retailers should address user experience in relation to their online stores. By introducing the TEAM model for surpassing the messy middle point and getting users out of the loop, from pre-purchase experience to purchase, they intend to find a balance between the current state of mind of retailers, entrepreneurs, and marketing specialists, and the changing knowledge in the field of e-commerce. One top priority for the online store of the future should reflect on a highly requested need of adapting capabilities to a continuous and non-interrupted consumer experience, thus having effective touchpoints. This is highly dependable on human resources showing the openness to understand and deploy modern concepts, combined with classic principles to achieve customer satisfaction.

The managerial implications are particularly unique because the study combines basic elements of SEO with the modern model of the loop, seeking to address the user experience. The retailers who are concerned about continuous optimisation of the online store are searching for methods that bring results, and most often, implementing outdated solutions can be harmful.

The findings indicate which factors are the most significant for the online store performance and describe specific actions for optimisation. Moreover, the conceptual framework of the TEAM model sets priorities for the department responsible with managing the model components. An extremely interesting fact regarding the server behaviour factor was revealed, which involves the collaboration between the Technology dimension and Experience. The managers might consider that people responsible for optimizing the experience should not have a close relationship with those who must ensure the optimal technical conditions for online purchases. Such a fact becomes even more clear when it is spoken or written, as technology is needed for the functionality of the online store. However, the role of certain consumer experience components might have been overlooked so far. For example, the analysis revealed that the quality of the printed pages influences the customer experience, to a greater extent than images.

External factors can also share their influence. Once the mobile device displays the images correctly, it does not bother the consumer anymore. However, when there is the need to print pieces of content, the users lose interest due to the lack of functionality. This fact underlines the need for people who manage the online stores to understand and address these issues. The loop and the messy middle point are not simple concepts that can be addressed by the website admins only, as the entire team should work together to understand and respond to the user's digital demands. For this reason, the authors consider that the target audience for this paper should not be limited to the fields of Information Systems or Computer Science due to the technological components

addressed. The electronic commerce field must also be of interest considering that managers, entrepreneurs, IT and marketing specialists need to be more and more aware of their shared efforts, all off these determining high managerial implications.

The theoretical implications can be extended to several layers. Firstly, the study proposes a new conceptual framework based on four dimensions, which arguably influence the existence of the online store. Secondly, the paper generates valuable knowledge on how electronic commerce is conducted in a very dynamic and changing manner, which determines the importance of a multi-perspective approach in academic. The methods of research applied, along with the fields addressed to elaborate the research ensure the multi-perspective view of a qualitative user experience. Finally, the study contributes to the existing literature by providing a fresh perspective on topics such as consumer journey, user experience, touchpoints, and search engine optimisation, all applied in the e-commerce field.

Limitations and future research show that complementary research should be addressed. A first limit is derived from the tool used to generate the primary data, a bot that limited the extension to other SEO factors. This can generate a first research perspective for the academic environment, that is to include more factors within the TEAM model, by using other online store performance analysis software. The second limitation of the study derives from the analysis of two hundred and ten online stores certified with the trust mark, which hardly can be considered a representative sample for the researched population.

However, to ground the theoretical foundation, the results are relevant for the scaled future study based on quantitative methods. Also, the qualitative analysis might enable the TEAM model validation in practice, by performing survey-based quantitative research to understand the attitudes and necessary assets of retailers (managers, IT specialists, and marketing specialists) and to optimise the online store by relying on collaboration between all four dimensions. Finally, the TEAM model is a concept conditioned by the evolving changes that take place in terms of SEO. This fact conditions everything we know and define at this moment. That's why the TEAM model can be relevant nowadays, but without constant monitoring and updating according to the constantly changing field, its relevance would decrease. From this, the enrichment of the TEAM model with the recently appeared practices represents a future research direction. A good example for this case would be the addition of artificial intelligence, at the beginning, but undoubtedly with a resounding impact on the future regarding the way search engine optimisation would be done. As a takeaway statement, the authors affirm that more research is needed to bridge the initiatives related to technology, user experience, accessibility, and marketing, all in the current context in which the online stores operate.

CRediT authorship contribution statement

Eliza Nichifor: Conceptualization, Methodology, Software, Writing – original draft, Writing – review & editing. **Gabriel Brătucu:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision. **Ioana Bianca Chiţu:** Conceptualization, Writing – original draft, Writing – review & editing. **Ovidiu Mircea Ţierean:** Conceptualization, Methodology, Software, Writing – review & editing. **Adriana Veronica Litră:** Conceptualization, Writing – original draft, Writing – review & editing. **Alexandra Zamfirache:** Conceptualization, Writing – original draft. **Daniela Roxana Vuţă:** Conceptualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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The Use of Technology Assisted by Artificial Intelligence Depending on the Companies' Digital Maturity Level

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Abstract: Major companies in the global market have made significant investments in artificial intelligence-assisted technology to increase the value of their products and services, which gives the implementation of artificial intelligence an extremely important role. Starting from these premises, the authors set out to evaluate the transformation level of companies in terms of adopting technology based on artificial intelligence according to their level of digital maturity. For this purpose, qualitative research was used by deploying the inductive method, which allowed five distinct categories of companies with unique characteristics to be identified, generating an interval scale that illustrates the level of digital maturity and the ability to adopt and implement viable solutions based on artificial intelligence technology. This paper, in addition to identifying the digital transformation level of companies, offers solutions and recommendations for addressing the challenges encountered by the business environment, thus contributing to the understanding and development of strategies adapted to each situation that may appear on the market.

Keywords: artificial intelligence; digital maturity; companies; digital marketing agencies; business strategies

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Citation: Brătucu, G.; Ciobanu, E.; Chițu, I.B.; Litră, A.V.; Zamfirache, A.; Bălășescu, M. The Use of Technology Assisted by Artificial Intelligence Depending on the Companies' Digital Maturity Level. *Electronics* **2024**, *13*, 1687. https://doi.org/10.3390/electronics13091687

Academic Editor: George Angelos Papadopoulos

Received: 14 March 2024
Revised: 18 April 2024
Accepted: 23 April 2024
Published: 26 April 2024

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1. Introduction

Major players in the global market have invested in artificial intelligence (AI)-assisted technology to improve their products and services. Notable examples include companies such as Google, IBM, Amazon, Tesla, Meta or Microsoft, Netflix, and Airbnb, which have implemented AI-based solutions within the actions related to the optimization of internal processes and up to the commercial strategies applied to offer innovative products and services on the market. Considering the tone set by large companies operating globally, the authors raised the issue of implementing solutions aligned to the 5.0 society to other companies of different sizes, medium or small, to which the trends and exigent requirements of consumers dominated by the typology of digital informers bring, for the most part, only challenges that are difficult to manage.

In this context, the authors intended to find out how ready companies are to adopt technology assisted by artificial intelligence. This aspect led to the formulation of the research question around which the entire paper was built. Starting from the premise that the importance of small- or medium-sized companies (SMEs) is crucial [1] for the digital development of society [2], this research aimed at identifying which companies are ready to use AI, as well as which companies are being pressured to adopt AI. The authors intended to build a theoretical framework aimed at evaluating companies readiness to integrate AI-assisted technology, with a particular focus on marketing agencies, based on their digital maturity level. Their objective was to address existing concepts and models to develop a tool for measuring readiness in this context. To achieve this goal, the

authors employed a qualitative research approach, specifically utilizing inductive research methods, to capitalize on existing models and relevant observations to their research topic. Consequently, an explanatory model was formulated, delineating five distinct categories of companies characterized by varying levels of digital maturity.

This research makes a significant scientific contribution to the specialized literature by not only advancing the theoretical understanding of the topic but also by providing practical solutions to the challenges that companies encounter in implementing artificial intelligence solutions based on digital maturity level. The objectives stated to this end were to (O1) classify companies in terms of digital maturity level, (O2) identify activities that can become more profitable through artificial intelligence, and (O3) highlight the challenges, limits, and opportunities for companies regarding the implementation of solutions based on artificial intelligence.

Carrying out the research allowed five typologies of companies to be determined, each of them being described in detail according to the explanation of the challenges and limits they present in relation to the adoption of technology based on artificial intelligence. In essence, the authors' work fills a crucial gap by providing a holistic perspective on the interplay between digital maturity and AI adoption readiness, thereby empowering organizations to make informed decisions and devise strategic plans to deploy technology for competitive advantage.

Considering the premises presented, the authors organized this paper into four main sections: a review of the existing literature, an explanation of the research methodology, an analysis of the obtained results along with supplementary discussions, and a final section comprising conclusions and suggestions for future research directions.

Literature Review

Artificial intelligence (AI) has attracted increasing interest recently, being considered by specialists and representatives of the business environment as a technology that will have an unprecedented impact on human development [3]. AI should not be seen as a single technology, as it represents a combination of technologies used in several industries which can improve the performance of companies in these fields [4]. The use of AI can lead to optimization of the structure of management processes [5] and to improvement of "the operational and business processes of organizations" [6].

AI can be a tool for building sustainable business models and innovative processes, leading to important economic, social, ethical, and legislative changes [7]. The implementation of AI imposes the need to analyze the specifics of each organization and the stage at which this implementation process is situated [8], creating favorable conditions for cultivating implementation, information, and understanding by managers and staff and studying both positive and negative aspects [9].

While concerns about bringing AI into business are not new, there is still a gap regarding the understanding of how AI can drive business value [10], of the concrete way success factors can have an impact on the adoption of AI [11], and the implications for environmental sustainability [12]. There are also negative aspects of artificial intelligence, such as the lack of control, the poor quality of data, and the insufficient training of personnel, that can generate inefficiency in the activity of companies and are studied too little by specialists [13]. Studies show the importance of employees' knowledge and understanding of AI processes, the need to create "sociotechnical capital", and the implementation of "AI socialization" to successfully integrate AI systems with employees [14,15]. Previous research has highlighted a number of issues that need to be resolved regarding the integration of AI, namely the modification and rethinking of the organizational structure, the skills required of employees and the education of the future workforce, ethical and legislative issues regarding data protection and defining the role of robots in society, and how these innovative tools can lead to predictions for future development [16]. The effective integration of these technologies indicates the digital maturity status of both a company and, at a broader scale, a country [17]. Specialists consider digital maturity as a pivotal factor

bridging the digital orientation of companies and their financial prosperity [18]. Also, the main goal of the digital transformation of companies is to rethink the business model to improve productivity and reduce costs [19].

The massive role artificial intelligence is playing in reshaping society cannot be denied. Beyond the undeniable opportunities it brings to development and progress, from economic and social points of view, AI is to a significant extent fraught with risks, at least in terms of privacy, transparency, and discrimination. Ethics in AI refers to a framework of moral values and methodologies designed to steer the ethical deployment of artificial intelligence, with the aim of safeguarding human welfare [20].

The first ethics guide in the field of AI was the Principles of Artificial Intelligence signed by governments in 2019—OECD [21]. In parallel, a code of ethical instructions in the field of AI was developed by the European Parliament [22], which underscores concerns regarding the ethical, legal, and economic dimensions linked with AI, impacting essential human rights and liberties. These concerns encompass the effects of AI and robotics technologies on employment, such as job displacement due to automation. There are also demands for evaluating the influence of algorithms and automated decision-making systems on safety and trust levels. Furthermore, considerations extend to digital currencies and transaction systems facilitated by networked computers, such as blockchain technology and the propagation of disinformation (fake news), as well as the potential military applications of algorithms (autonomous weapon systems and cyber security). Continuing these trends, UNESCO generated the first global standard in AI ethics "Recommendation on the Ethics of AI", recognizing that AI systems have the potential to bring privileges, to constitute a threat to human rights, to contribute to the degradation of the environment, etc. [23].

The most pressing ethical issues when considering AI in organizations' interaction with the human factor can be extracted from the literature. AI systems can perpetuate, by taking in a massive amount of data, the biased approach that is embedded in previously practiced social norms. If the algorithms are not unbiased or unrepresentative for all categories, the results generated by them may exclude minority categories [24]. Discrimination brought by algorithms can also be the result of wrong or biased input data or caused by the mathematical architecture of the algorithm [25]. Moreover, AI can limit autonomy to the extent that it provides predefined choices, and there is a risk of replacing interpersonal relationships when communication tends to take place exclusively through AI-generated assistants [26]. In some studies, transparency and responsibility are issues that appear as a priority in AI-related ethics, being assimilated to the concept of trustworthiness [27]. Relevant information provided to participants can help them make an assumed and agreed decision [28].

If, in the case of an artist making a work, they can assign copyright, when a digital work is generated with the help of AI, by an individual or an organization, given that the AI systems were generated by others, it is questioned which of the two parties is more entitled to being attributed the result [29]. Moreover, AI algorithms have the capability to produce misinformation, manipulate public sentiment, and exacerbate social divisions. AI systems multiply the ability to use personal data that can harm individual interests, through the ability to process data at an impressive level of power and speed [30]. AI systems may collect data that are not necessarily required, or even prohibited by the privacy policy, without users being notified. The extensive collection of data and their transfer can impact the confidentiality and privacy of individuals [31]. Simply obtaining consent does not solve the problem of ethics in AI [32]. As AI systems evolve, automation has the potential to replace human labor, creating unemployment and exacerbating social inequalities. Even with the development of new branches based on AI, the emergence of new jobs requires professional conversion measures and economic support for the transition of the workforce involved.

Organizations willing to implement AI systems face several difficulties, conceptual as well as practical. The challenges of using AI are divided, according to the study by

Mökander [33], into ethical, legal, and technical challenges. Another recent study [34] was able to categorize the barriers to AI adoption into three major areas: technological, organizational, and cultural. The same study demonstrated that the majority of the decision makers interviewed (91%) faced challenges in all three areas, citing the following major barriers: laws and regulations (which hinder innovation and learning because compliance is costly and restrictive); lack of employee experience in AI implementation; lack of understanding of AI, both in the organizational environment and among customers; resistance to change.

A challenge with their significant major impact on organizations is the very high costs of deploying and sustaining AI solutions [35]. Additional barriers identified in this paper include a lack of comprehension and confidence in AI, as also referenced in the literature [34]. Challenges highlighted encompass data quality and connectivity, involving the integration of data from diverse sources like suppliers, customers, and internal systems. Furthermore, there is the task of integrating AI into existing processes and workflows. Issues related to data quality and management, including concerns over data privacy and security, pose additional challenges. Moreover, inadequacies in IT infrastructure, reliance on external AI providers, and cultural and organizational barriers compound the issues faced. In order to be aware of the challenges in implementing AI and to propose strategies for managing and mitigating the risks associated with adopting AI in business, organizations need to develop deep business-wide analyses. These analyses start from evaluating the vision of the organization, the staff, the transformation of the processes and technologies used, and the availability of data [36]. At the same time, the major implications of managerial decisions [37] and different risk management assessment methodologies, as well as cyber security concerns, must be mentioned.

The data privacy barrier starts from the fundamental notion that having more data allows AI systems to become better. The strategic solution provided by [38] is the implementation of a data-sharing policy in the company, a method by which the need for data duplication is reduced. Related to the establishment of the AI team, a possible strategic managerial option (other than hiring dedicated staff) is to improve the skills of existing employees (by participating in dedicated development programs, training, experts who can make practical presentations within companies, etc.).

The study of Hopf [39] proposes a model that identifies challenges, tensions, and tactics in implementing AI in organizations. Among the tactics developed in the model, the following are mentioned: establishing verification tools on what AI can and cannot do, calling on external experts to start AI projects, training managers and establishing appropriate indicators, and creating bridges between AI and IT. From the specialized literature point of view, the optimal option regarding the personnel involved in the adoption of AI by companies has not yet been identified, each company having to carry out its own analysis and apply the personnel strategy considered appropriate.

2. Materials and Methods

In the initial phase of the methodology, the authors aimed to build a theoretical framework focused on evaluating companies' readiness to integrate AI-assisted technology, particularly within marketing agencies, based on their digital maturity level potential. This concept can be described as highlighting a particular level of social and economic consciousness that empowers businesses to adeptly deploy digital technologies in pursuit of their objectives [40]. In recent times, experts have concentrated on devising models to evaluate the digital maturity of small- and medium-sized enterprises (SMEs), outlining the stages they need to trace to realize their digital transformation aspirations [41] At the same time, there is the issue of proactively developing employees' skills and their mentality so that they can control digitization and see it as an opportunity [42]. A company is fully digitally mature when it uses technology in all activities and operations that take place within it, being, however, different from the level of digitization (since the latter refers to digital technology usage within systems, processes, and activities related to the company's services and products). This aim drove the authors to address existing concepts and

models, employing a qualitative research approach, specifically utilizing inductive research methods [43] based on existing models and observations identified as highly useful for the research topic, capitalizing on existing models and observations relevant to the research topic. Through this approach, the authors aimed to classify companies according to their digital maturity level, identify key activities for enhancement through artificial intelligence, and elucidate the challenges, limits, and opportunities surrounding the implementation of AI solutions. Subsequently, this research led to the determination of five typologies of companies, each meticulously described in terms of the challenges and limits they face in adopting AI-based technology. Each category was placed into a scale to be easier for practitioners and theorists to evaluate. Thus, the study contributes significantly to bridging the gap between digital maturity and AI adoption readiness, equipping organizations with the insights needed to make informed decisions and strategic plans for leveraging technology to gain a competitive edge.

The motivation behind this choice was the possibility to formulate some specific observations that turned into general ideas, making it possible for the authors to use a "bottom-up" method [44] and to develop a theoretical, explanatory model on the topic of the utilization of AI-assisted technology according to the digital maturity level of companies.

According to the evaluation tool originally developed for assessing non-profit organizations, and later developed for other organizations, the authors were able to develop an explanatory model that draws the boundaries of the levels and promotes, in the foreground, the status of five typologies created in accordance with the potential of using AI-assisted technology.

To reach the intended objective, the authors have structured this section into three parts. The first of them presents the methodology of digital maturity assessment and the creation of typologies that this model claims. The second part refers to the understanding of the classification of tasks performed by AI, mentioning and explaining three types of tasks, and the last one presents the motivation for choosing the case study of marketing agencies.

2.1. Digital Maturity Assessment Methodology and the Outlining of Typologies

To be able to build a measuring scale to analyze the level of digital maturity and AI-assisted technology integration for digital marketing agencies, the researchers utilized a standard questionnaire, developed by [45], which comprises 17 cross-referenced skills categorized into five stages of digital maturity. This questionnaire allowed researchers to assess digital marketing agencies' potential across various dimensions, providing insights into their digital maturity levels.

The questionnaire was structured around four key areas: attitudes and foundations, people, skills, and processes, systems and information, and outcomes and experiences. Through the respondents' answers, authors considered a percentage representing the level of digital maturity for each evaluated company, ranging from 0% to 100%. Based on the responses from the 2077 participants to the digital maturity study, the distribution of digital maturity assessment results across different areas was determined, as illustrated in Figure 1.

This analysis provided a comprehensive understanding of the digital maturity landscape, which was used for the marketing agencies case study because of its validity. Furthermore, research was elaborated into the classification of tasks performed by AI, categorizing them into banal tasks, formal tasks, and expert tasks. By elucidating the characteristics and examples of each task category, the authors aimed to facilitate a deeper comprehension of how AI can be applied across various processes and activities within this type of organization. Finally, they conducted a case study focused on digital marketing agencies to exemplify the practical implications of research findings. Through a rigorous analysis of specialized literature and identification of activities that can be made more efficient through AI implementation, the potential impact of AI on digital marketing processes is highlighted and presented in the next section.

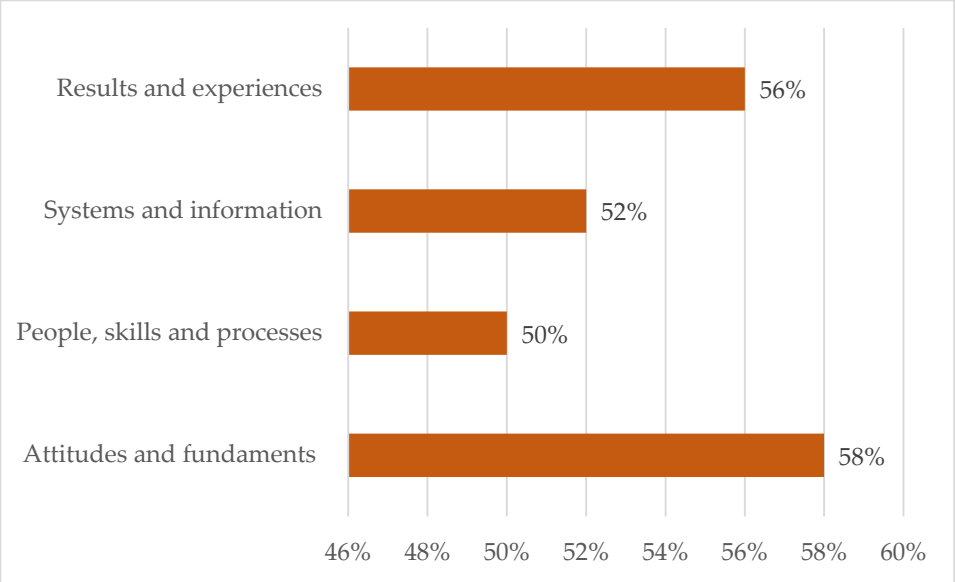


Figure 1. Distribution of digital maturity assessment results by area for 2077 companies: 0–29% (level 1); 30–49% (level 2); 50–69% (level 3); 70–89% (level 4); 90–100% (level 5). Source: (Digital Maturity, 2023).

2.2. Understanding the Classification of Tasks Performed by AI

Tasks performed through AI are divided into the following categories: banal tasks, formal tasks, and expert tasks [46–48]. For each type of classification there are examples of ways in which AI can be applied to facilitate various processes or activities. For example, in the category of banal tasks, AI can be implemented for operations related to computer vision or speech (related to perception), natural language processing (language generation or translation and understanding), or robotics (through interventions on locomotion). On the other hand, formal tasks are related to disciplines such as logic, mathematics or geometry, verification, and often proving a theory. Finally, expert tasks belong to scientific analysis, financial analysis, creativity, or even medical diagnosis. For humans, thanks to perception, speech, the use of language, and locomotion, banal tasks are the easiest to learn, followed by formal ones, the most difficult being those of expertise. In the case of technology, the advancement and implementation of certain very complex algorithms have meant that expert tasks can be handled easily. A relevant example is the use of AI in performing scientific analysis through the Cognos online application, created by IBM. Nowadays, it has become easy to generate graphs, tables, or conclusions about the questions that a researcher raises based on a file containing the raw data required for a complicated analysis, where it is even necessary to highlight some unexpected results.

Aspects were highlighted for an easy understanding of the category of tasks that AI performs to review that category needed in the development of the explanatory model, through which it was possible to answer how ready companies are to use AI-assisted technology.

2.3. Case Study of Digital Marketing Agencies

In focusing on marketing agencies, the authors recognize a crucial aspect of contemporary business operations [49]. Marketing agencies play a pivotal role when it comes to shaping brand perception, driving consumer engagement, and influencing purchasing decisions in the current digital landscape. [50,51]. As such, understanding the readiness of marketing agencies to embrace AI-assisted technology is paramount for several reasons.

Firstly, marketing agencies operate at the forefront of technological innovation [52], constantly seeking ways to optimize their strategies and deliver good results for their clients. The integration of AI into their operations has the potential to revolutionize marketing practices, enabling agencies to analyze vast amounts of data, personalize customer experiences, and streamline campaign management processes [53].

Secondly, marketing agencies serve a diverse range of clients across various industries, each with unique needs and challenges. Assessing the readiness of marketing agencies to adopt AI technology provides valuable insights into the broader trends and opportunities within the marketing industry. It offers a glimpse into the evolving landscape of marketing practices and the emerging technologies shaping the future of the industry. By uncovering the challenges, limitations, and opportunities associated with AI adoption in marketing agencies, this study offers good practices and actionable insights for marketers, business leaders, and industry stakeholders alike. It prompts discussions on the strategic implications of AI integration, the ethical considerations surrounding data-driven marketing approaches, and the skills and capabilities required to thrive in an AI-powered marketing ecosystem. By focusing on marketing agencies, the authors addressed a critical sector at the intersection of technology and business, offering valuable insights into the readiness of organizations to embrace AI and paving the way for future advancements in marketing practices.

Furthermore, as AI continues to reshape marketing practices, it becomes increasingly crucial for organizations and their decision makers to cultivate a culture of innovation and adaptability, equipping both employees and leadership with the skills and knowledge needed to harness the full potential of AI technologies in their day-to-day work. The specialized literature presents the theory of replacing manual tasks with AI tasks, emphasizing its impact on digital marketing. Experts from various industries say that the impact of using AI in marketing processes will be strongly felt in the coming years, with company administrators and decision makers having to prepare both organizations and employees to implement AI-based solutions in their day-to-day work [54]. Following a rigorous analysis of the specialized literature, eight activities were identified that digital marketing agencies can make more efficient by implementing AI.

3. Results and Discussions

The findings of this research emerged after assessing digital maturity and delineating typologies. Through the utilization of an analytical tool to gauge the digital maturity level of companies, five typologies were discerned (refer to Figure 2), each delineating distinct attributes across 17 dimensions: culture, leadership, collaboration, budget, innovation, capacity, recruitment, learning, project management, technology, data, reporting, insights, communication, optimizations, service delivery, and internal systems.

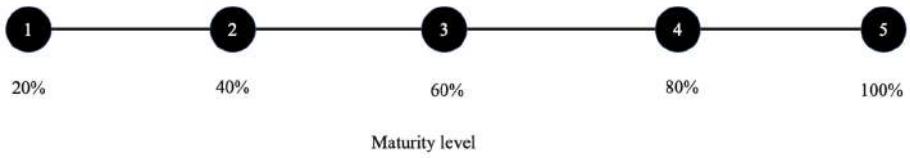


Figure 2. Interval scale of the digital maturity level of companies. Source: figure made by the authors.

The interval scale depicted in Figure 2 was established through a rigorous process of analyzing the convergence of response patterns determined from the survey's variants of responses. Rather than relying on explicit questions, the scale was derived from the intersection of various response variants provided by respondents, reflecting their inherent maturity levels within the assessed dimensions. By synthesizing these response patterns, the scale offers a detailed description for each individual level, providing insights into the nuanced progression of digital maturity within the studied context.

For ***Level 1***, the culture dimension describes this level as marked by staff who keep away from the digital domain and try to avoid it. At the management level, there is no orientation towards the digital approach, the company's budget covering only those basic aspects necessary for the activity, such as, for example, financing the hosting of the domain for the company's website. In companies at this level, innovation is not considered important or does not happen at all. In terms of work capacity, one person handles the

website and email. Also interesting is the fact that this person may not have a digital background or have a special skill set aligned to the field. Staff recruitment is carried out with an emphasis on technical skills only for the position aimed at website maintenance. In terms of the learning dimension, digital experts teach other employees on an ad hoc basis, and the budget allocated to training is very small. Another important aspect is that project management is performed differently for different projects. The existing systems within the company are limited and not integrated, not being secure. Data within the organization are scattered and mostly represent the company's offline activity. Performance indicators exist, but progress is measured ad hoc. Insights are collected but used inconsistently. The digital medium is used as a channel for communicating non-digital activity. Information is shared online, and traditional offline services are displayed on the website, with no will or budget to digitize systems or processes.

Level 2 of digital maturity is characterized by an organizational culture where employees are satisfied that specialists handle digital aspects. However, management sees the role of digital technology primarily as a tactical one, and the allocated budget supports the current setup without allowing for significant improvements. In terms of innovation, it occurs occasionally within existing projects, and basic digital skills are covered by experienced specialists. Recruitment includes specialized digital skills in specific roles that support engagement. There is a small budget for developing core digital skills in digital expert roles, and common principles are used in project management. Technological systems are not keeping pace with the needs of the organization, and data are considered important, improving their quality and use in various fields. Relevant KPIs are set and reported, but the lessons from these reports are not always put into practice. Insights from multiple sources are combined to build understanding, and digital advice is sought when deemed necessary. There is also some experimentation with service delivery using digital channels, but the availability and use of internal digital tools are irregular.

Level 3 of digital maturity is characterized by a deep understanding of digital value within the organization and its desire to learn more in this area. Management encourages the digital leader to take a strategic approach when time permits. The allocated budget allows for the testing of new ideas in priority areas, and there is an innovative reimagining of some aspects of the products or services. There is a core team of digital specialists, and extensive digital skills are required across all areas of the organization. Organizational training normalizes digital skills and projects heavily due to the structure and it being a very long process. The systems are stable and allow basic operations. There is a clear policy for data management, this being integrated and analyzed. Performance data are collected and linked, but access to them is difficult. Knowledge about people's identity is combined with behavioral insights. Digital technology is involved from the beginning in communication planning, and digital services are considered as important as traditional offline services. Good digital tools are available, and their support and integration are provided upon request.

Level 4 of digital maturity represents the stage at which digital technology is perceived to be key to success and are integrated into all aspects of the organization. There is a senior digital leader, and management is actively investing in digital technology. The budget is increasingly supporting digital ways of thinking and acting. There exists one or more teams, and digital opportunities are growing. Strategic digital skills are standard and included in job descriptions. Increasing digital skills represent a top priority for employees, with teams understanding their impact on digital changes. Project management principles and practices are used, with a launching, testing, and continuous improvement approach in place. Tools and systems bring improvements in efficiency. Quality and integrated data are used throughout the organization. Insights play a pivotal role in shaping both planning and delivery strategies. Communication strategies are predominantly designed with a digital-first approach. Providing online services is based on research and rigorous testing. Organizations prioritize investments in digital tools aimed at enhancing the overall work experience of their staff.

Level 5 of digital maturity highlights that digital technology is the primary way to reach the organization's mission. It is fundamentally integrated into the overall strategy, and digital leadership is present at all levels. A healthy budget for the continuous evolution of digital operations increases the impact of the organization. A structured innovation program creates transformative change. A very experimental digital leadership type exists across the organization, with effective teams. New hires present digital skills, and all job descriptions express a need for them. The learning function drives the development of digital skills and behaviors at all levels of the organization. Principles of digital project management are used consistently across all projects to improve efficiency and impact. Interconnected tools and systems provide a smooth and efficient experience for internal and external users. Real-time data are used across the organization to shape decisions and performance. Holistic performance data are always available and used strategically. All work is based on rich and constantly updated insights, being iteratively improved. The digital environment is used to create adaptive and integrated communications. Online services are iterative and integrated, generating impact and coverage never seen before. A large range of connected digital tools is used, with proactive staff support.

The characteristics of each level of digital maturity of the companies led not only to the description of the 17 dimensions according to each level but also to the outlining of related typologies (Figure 3).

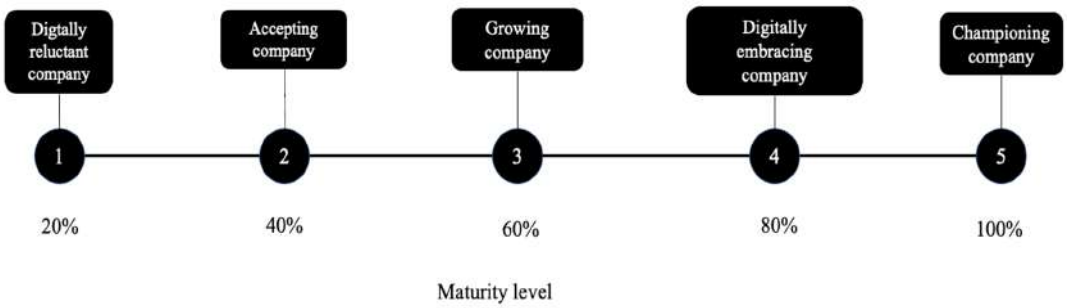


Figure 3. Interval scale of company typologies according to the level of digital maturity. Source: figure made by the authors.

The ***reluctant company*** typology shows that the organization is not convinced that digital technology can contribute to achieving its mission and goals. As a result, the digital environment is underrepresented and underfunded. Not only is the organization missing out on opportunities, but there is a risk that it will not keep up with trend alignment. Reluctant company workers prefer to do things the way they have always been done rather than experiment with new technologies, systems, and processes. A reluctance to evolve in line with the external environment makes the organization increasingly self-focused. In the case of this typology, it is necessary to change attitudes to establish bases in the digital field.

The ***accepting company*** typology shows that the organization's attitude towards the digital environment can be characterized as "accepting". In other words, the company has a good understanding of digital potential and allocates some resources to the basics. However, technology, systems, processes, and digital skills are disparate, and obtaining a budget for new digital projects is a difficult battle. The organization is open to considering innovative uses but has difficulty with adopting new and different ways of working.

The ***growing company*** typology and the ***technology-embracing company*** typology are actively using the digital environment to be more efficient and effective. It is not yet integrated in all aspects, but there is an organizational understanding that the digital environment is crucial to operations, culture, and the experience that customers have when interacting with the organization. Digital staff are supported and encouraged. Resources do not always match ambitions, meaning that people, systems, and digital processes are occasionally under pressure. In the case of this typology, simplification and improvement will increase efficiency, effectiveness, and well-being.

In the case of the ***champion company*** typology, digital maturity can be characterized as "promoting" or "championing". Individuals employed within the company perceive the digital environment as the primary means to actively engage with current and potential supporters. Digitalization serves as a central component for operational and engagement activities, encompassing a diverse array of functions including strategic leadership and communications planning, brand experience, user engagement, supporter services, program or service delivery, and technology development and maintenance, as well as innovation endeavors.

All these characteristics related to the activities that digital marketing agencies can make more efficient by implementing AI led to the highlighting of the challenges, limits, and opportunities presented in Table 1.

Table 1. Activities of advertising agencies made more efficient through AI according to the typology of the company regarding the level of digital maturity.

Activity	Description	Opportunities Depending on the Level of Digital Maturity *
1. Target audience segmentation and identification	By applying AI algorithms for advanced data analysis and identifying behavioral patterns, they allow marketing specialists to refocus their efforts on more relevant audience segments and deliver personalized content. Precise segmentation of the target audience using AI-based solutions can be achieved with the help of specific clustering and/or classification techniques. Also, through this technology, applied machine learning models can be used to identify consumer patterns and behaviors but also to use the information obtained in personalized marketing campaigns [55–57].	**For level 1.** Using basic tools for simple audience identification and segmentation.
2. Personalized recommendations	In the scope of this aspect, the operation of AI recommendation systems, in the form of collaborative filtering algorithms or neural networks, and how they are used to anticipate user preferences, but also to evaluate and optimize the performance of recommendation systems, were identified [58,59].	**For level 1.** Providing simple, generic recommendations based on basic data.
3. Automation of advertising campaigns	Analysis of different techniques and optimization of the process of making pay-per-click campaigns by allocating the budget in real time to maximize the effectiveness of digital marketing campaigns. Machine learning algorithms adapt to changes in user behavior and the data-driven online environment [60].	**For level 1.** Implementing simple automations in advertising campaigns.
4. Content creation	On this topic, the use of AI refers to the application of language generation models, such as recurrent neural networks (RNNs) or generative adversarial networks (GANs) and how they are used to produce relevant and engaging content. Also, for content creation, AI can be applied in operations related to the analysis of the quality and originality of the content generated in the context of the needs and preferences of the target audience [61].	**For level 2.** Using AI to generate simple and personalized content.

Table 1. *Cont.*

Activity	Description	Opportunities Depending on the Level of Digital Maturity *
5. Sentiment analysis and receiving feedback	Interpreting and analyzing user feedback and feelings about brands or products through AI technologies such as natural language processing (NLP) and sentiment classification algorithms. Around this topic, there are also discussions regarding ethics and the correct interpretation of collected sentiments and how this information can influence marketing strategies [62,63].	**For level 2.** Using AI to analyze feedback and sentiment from customer interactions
6. Search engine optimization	AI algorithms are used for search engine optimization purposes by identifying search trends and optimizing content for increased search engine visibility. Through specific techniques such as semantic analysis or machine learning, specialists can more efficiently create more relevant content [64].	**For level 3.** Implementing advanced search engine optimization strategies with the help of AI.
7. Customer support and assistance	With the help of the technologies that are the basis of the functionality of chatbots, namely natural language processing and dialog models, it is possible to provide automated assistance and personalized interaction with customers [65–67].	**For level 3.** Using AI to provide customer support and assistance through a more complex system.
8. Advanced forecasting and analyses	Through machine learning algorithms and predictive models used for marketing purposes, user behavior can be anticipated, and through advanced data analysis techniques it is possible to provide essential information for making strategic marketing decisions [68].	**For level 4.** Use of AI for predictive analyses and advanced analyses in various areas of business interest.

* **For level 5:** The mentioned activities are integrated into almost all operational and strategic aspects of the organization, including all the mentioned activities at lower levels, but using a varied and complex range of AI techniques to achieve advanced and integrated results. In other words, each level encompasses not only the specific tasks outlined for that level but also includes the activities listed at lower levels. This integration ensures a progressive and comprehensive approach to digital maturity, wherein the capabilities and techniques introduced at lower levels serve as foundational elements for the advanced and integrated results achieved at higher levels.

4. Discussions and Conclusions

The authors' study addresses a critical gap in the existing literature by offering a comprehensive understanding of the relationship between companies' digital maturity levels and their readiness to integrate technology assisted by artificial intelligence. While previous research has recognized the importance of digital maturity and AI adoption separately, there remains a lack of cohesive insight into how these factors intersect and mutually influence each other within organizational contexts. To bridge this gap, the authors developed a theoretical model that illuminates the preparedness level of companies in adopting AI-assisted technology based on their digital maturity. Drawing on insights from established models, empirical observations, and specialized literature, the authors synthesized a framework that harmonizes digital maturity assessments with AI adoption strategies. Notably, they established a nuanced interval scale, shaped by the convergence of answer variants within their questionnaire, to offer a detailed depiction of each digital maturity level.

Through this approach, the authors presented a comprehensive framework that not only evaluates companies' digital maturity but also guides strategic decision making concerning AI implementation. By effectively addressing this gap, their study contributes to both theoretical advancement and practical implications for organizations navigating the complexities of digital transformation in the AI era, whereas the scientific novelty of the work results from the evaluation tool of companies from the point of view of the level of digital maturity in relation to the use of technology assisted by artificial intelligence, outlining five typologies that describe the stages of digital adaptation of organizations, es-

pecially digital marketing agencies. This study's focus on marketing agencies is significant not only due to their pivotal role in the digital landscape but also because they serve as early adopters and trendsetters in the application of innovative technologies, such as AI. As pioneers in digital marketing, these types of agencies are at the forefront of deploying AI to enhance their operations and deliver superior results for clients. By examining the readiness of marketing agencies to embrace AI, the authors provided valuable insights that extend beyond individual firms to the broader marketing industry. Their research contributes to a deeper understanding of the challenges and opportunities associated with AI adoption in marketing, paving the way for the development of strategies and best practices that can drive transformative change across the sector.

The authors' research significantly advances the discussion on digital maturity levels and their implications for organizational readiness to adopt AI-assisted technology, especially for marketing agencies. While existing studies provide valuable insights into digital maturity assessment and its applications across diverse sectors [69–71], this study stands out for its focused investigation into creating an interval scale methodology and scrutinizing 17 dimensions across five distinct levels of digital maturity, offering a nuanced understanding of organizations' readiness to embrace AI technology. Whereas previously mentioned research may have offered broad assessments of digital maturity or concentrated solely on technological aspects, this paper focuses on organizational dynamics influencing digital readiness. By identifying typologies, the authors provided actionable insights into the unique characteristics and challenges associated with each level of digital maturity, thereby enabling targeted strategies for AI adoption and digital transformation initiatives. Furthermore, our research not only advances theoretical understanding but also provides practical guidance for organizations seeking to enhance their digital capabilities. By furnishing a comprehensive framework for assessing digital maturity and informing strategic decision making, our study addresses a crucial gap in the literature, empowering organizations to leverage AI-assisted technology effectively for competitive advantage and sustainable growth.

This study's managerial implications underscore the imperative for organizational leaders, particularly those in digital marketing agencies, to proactively instigate strategic shifts toward valuing the benefits of technology assisted by artificial intelligence. Leaders must adapt their approaches and refine their leadership models to cultivate a favorable environment for innovation and adaptation to new technological demands. Crucially, developing and implementing a robust HR strategy assumes paramount importance in this digital transformation journey. Cultivating an organizational culture that encourages continuous learning and adaptability is crucial in this digital transformation process. Moreover, integrating AI into management practices requires solid and transparent ethical approaches, as well as effective risk management to ensure appropriate and sustainable adoption of the technology within organizations. This study highlights the pivotal role of organizational leadership in driving the successful adoption of AI-assisted technology. By embracing proactive strategic changes and encouraging a culture of innovation and adaptability, leaders can position their organizations for successful digital transformation.

In terms of theoretical implications, this study presents the evolving landscape of artificial intelligence-assisted technology, offering valuable insights for researchers and theorists. By deepening existing models, a new theoretical paradigm was discussed to understand the foundation and deep implications of the application of AI in digital marketing areas. Additionally, the interval scale generated from this research holds relevance across diverse disciplines such as philosophy, psychology, cognitive science, computer science, and mathematics, all of which contribute to the development of fundamental theories underpinning AI. From mathematical models and learning algorithms to theories of consciousness and ethics, theoretical research seeks to explore and answer the fundamental and conceptual challenges involved in the development and use of AI, providing solid foundations for future progress and its implications in various fields of activity.

Qualitative research and inductive analysis are methods that have produced valuable results, but they also present certain limitations and challenges. One of the main limitations of qualitative research is the subjectivity involved in the process of data collection and interpretation. Being based on observation and interpretation, qualitative research can be influenced by the subjectivity of researchers. This may lead to different conclusions or varying interpretations of the same data, which may affect the validity and reliability of the results. Another limitation of qualitative research is the impossibility of generalizing the results. Because qualitative research focuses on in-depth study, it is difficult to extend results to the entire study population. These limitations do not invalidate the value of qualitative research or inductive analysis but emphasize the importance of awareness and management of these aspects to ensure the validity and relevance of the results obtained.

Following the results and findings obtained from the assessment of digital maturity and the outlining of typologies within companies, it is possible to identify some directions for future research, namely understanding how organizational culture influences the adoption and use of digital technology. Future research can explore how organizational cultures can be shaped to encourage greater responsiveness and adaptability to change regarding technological innovations. Further research could aim to clearly evaluate the effectiveness and impact of digital technology adoption in different business areas. This could include identifying and measuring specific performance indicators that are relevant to different levels of digital maturity, as well as assessing long-term benefits. Another direction could be to develop and test different strategies and approaches to increase the level of digital maturity in companies. Research could explore specific tools, methods, or programs to support organizations in their transition to higher levels of digital maturity, adapting to the specifics of each company.

Author Contributions: Conceptualization, G.B., E.C., I.B.C., A.V.L., A.Z. and M.B.; software, E.C. and A.Z.; validation, G.B., E.C., I.B.C., A.V.L., A.Z. and M.B.; formal analysis, E.C.; investigation, G.B. and E.C.; resources, I.B.C.; data curation, G.B. and E.C.; writing—original draft preparation, G.B., E.C., I.B.C., A.V.L., A.Z. and M.B.; writing—review and editing, I.B.C., A.V.L., A.Z. and M.B.; visualization, E.C.; supervision, G.B.; project administration, G.B.; funding acquisition, G.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Transilvania University of Brașov.

Data Availability Statement: Data are presented in the main text.

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

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electronics

Article

Extending the Frontiers of Electronic Commerce Knowledge through Cybersecurity

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Abstract: As technology becomes more sophisticated so do cyber-attacks. The resilience of electronic commerce organisations represents a critical point nowadays because it influences consumer and digital business behaviour. In this context, the cybersecurity and electronic commerce knowledge were reviewed as a unit. The main aim of this paper is to support researchers and managers in understanding the theoretical framework and to provide a knowledge-based model. To achieve this aim, the authors performed an analysis of 14,585 papers from the Web of Science Core Collection that generated two visualized networks, analyzed with the metrics mean silhouette, modularity, betweenness centrality, and citation bursts in the context of digital resilience. The mapping process results show that the human factor represents the central junction with the fear of cyber-attacks and the perception of online shopping as risky. The adoption of electronic commerce and mobile commerce are two challenging research lines in the global economic resilience. Their adoption enabled by big data, artificial intelligence, machine learning, and even blockchain technology can strengthen resilience even when cybersecurity education is needed.

Keywords: electronic commerce; cybersecurity; digital resilience

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Citation: Vuță, D.R.; Nichifor, E.; Țierean, O.M.; Zamfirache, A.; Chițu, I.B.; Foris, T.; Brătucu, G. Extending the Frontiers of Electronic Commerce Knowledge through Cybersecurity. *Electronics* **2022**, *11*, 2223. https://doi.org/10.3390/electronics11142223

Academic Editors: Claudiu George Bocean, Adriana Grigorescu and Anca Antoaneta Vărzaru

Received: 27 June 2022
Accepted: 14 July 2022
Published: 16 July 2022

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1. Introduction

The entire world faced an unprecedented situation in 2020, the COVID-19 pandemic [1], which led to another major series of changes. For example, in Singapore, cybercrime accounts for almost half of the total crimes reported, and the number of ransomware attacks rose by 154% [2]. A recent study [3] demonstrated that European countries develop different sensitivities to cybersecurity issues. The Craigen et al. study revealed the definition of cybersecurity as "the organization and collection of resources, processes, and structures used to protect cyberspace and cyberspace-enabled systems from occurrences that misalign the jure from de facto property rights" [4]. In addition, this topic is the subject of national interest because the United States consider cyber offence and cyber defence as "vital elements of security strategies", these being more related to national policies and defence strategies [5]. Digitization and cybersecurity play a key role in the NGEU (Next Generation EU), which are two of the main drivers of sustainable development [6]. The purpose of the NGEU is to support the sustainability-resilience relationship and the importance of cybersecurity is highlighted in this way. It becomes necessary to protect the information and data of citizens and companies (this paper highlights the need for new studies in the context of electronic commerce [3]. All of this generates a positive relationship between information systems, sustainability, and resilience [3].

All of these challenges have decisively influenced various areas, especially electronic commerce and digital business—both company and consumer behaviour.

Contrastingly, the study of Dirgantar et al. [7] brings forward the importance of the information system for electronic commerce organisations, whereby their results confirmed that system characteristics such as quality, information quality, or service quality, influence the level of use and user satisfaction of customers. An information system refers to the process of collecting, processing, storing, and transmitting relevant information to assist decision-making and foster operations in any type of organization [8]. It involves a set of interconnected components such as hardware, software devices, human resources, and networks that contribute to improving organizational productivity, efficiency, and effectiveness while ensuring business survival and resilience [9,10]. In the absence of a resilience mechanism to overcome interruptions in business, as usual, activities in electronic commerce could no longer function [11]. Resilience may be analyzed from the perspective of cyber threats to the information system, as cyber resilience can help organizations to anticipate and manage them [12,13]. At the same time, increasing resilience in electronic commerce can be achieved using Artificial Intelligence, which can contribute to 'readying supply chains to reduce their risk of disruption' [14]. To combat threats, function accordingly, and take on challenges, information systems must adapt through structural and operational resilience techniques [15]. So, to prevent companies from losing important components of their information systems, cybersecurity is the key to success [16,17].

Contrastingly, the COVID-19 pandemic forced 'late' consumers to reduce the digital gap, directing them to electronic commerce platforms [18], but it also demonstrated the resilience of consumers increases [19–21]. Digital resilience is not a new concept, its definition has existed in literature for many years [22]. It is "the ability for an organization to rapidly adapt to business disruptions by leveraging digital capabilities to not only restore business operations but also capitalize on the changed conditions" [23]. Contrastingly, cyber resilience is the capacity to protect data and electronic systems from cyber-attacks, but also, to rapidly resume business operations in the case of a successful attack event. [24]. Knowing these aspects, the digital resilience of electronic commerce was ascertained [25], as was the importance of long-term planning, and the need for strategic skills to make the right decisions for traders [26]. Electronic commerce is a vital element in worldwide economic resilience [27] and the adoption of digitisation and digital platforms is an 'escape hatch' in the development strategy and resilience of organisations [28–30]. Even though there are still potential consumers who perceive online shopping as risky [30], it is concerned about both the resilience of the retailer's information system and the security of personal data [31,32].

All of these facts have revolutionized people's lives and influenced users' buying habits, and the way that companies sell their products or services [33]. As such, information system security became a major challenge for modern organisations, which has led to a growing interest from academia and researchers in information security knowledge. [34].

To better understand the context regarding electronic commerce, cybersecurity, and digital resilience, the authors illustrated Figure 1.

In this context, the authors tried to find resilient opportunities for electronic commerce, by aiming to analyse the research knowledge fields, respectively. The study was performed with the method of visual network analysis with Java technology by constructing and observing the connections between the scientific resources.

The results were conducted to relevant outcomes for proposing a new conceptual model by including all relevant key concepts regarding the knowledge fields included in the study. (The Resilience Right Decisions for Electronic Commerce and Cybersecurity Model).

All the concepts existing in the literature, the methods used, and the results are presented in the subsequent sections. The article finishes with a discussion and conclusion section, followed by two sections that highlight the importance of the study and the its necessity to the scientific community.

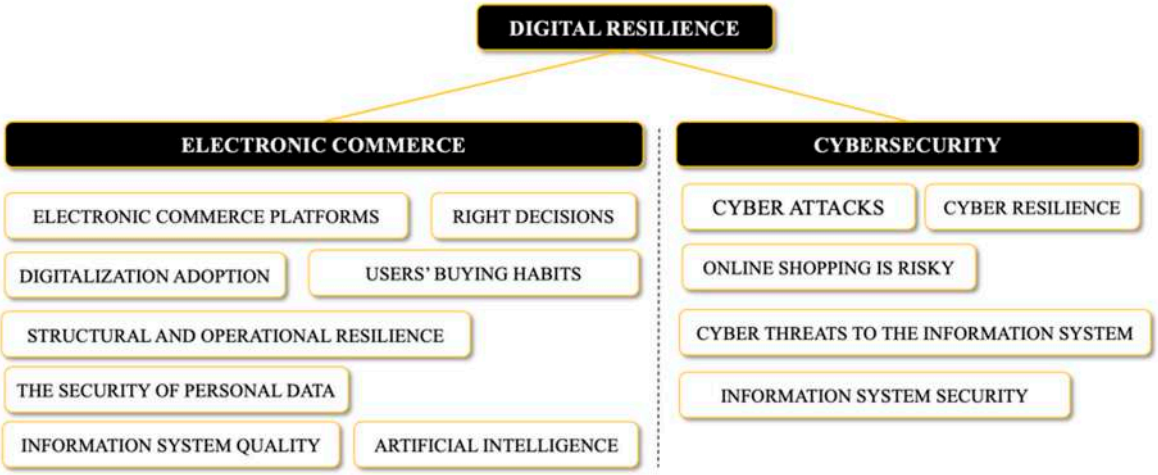


Figure 1. Literature review summary designed by authors.

2. Materials and Methods

Due to the complexity of the materials and method used, this section is presented in three parts. The first one is allocated to data collection, followed by project configurations, whereas the final part introduces details about the analysis method. For a better understanding, Table 1 introduces the abbreviations used before any methodological considerations.

Table 1. List of abbreviations.

Abbreviation	Meaning
Q	Modularity metric
LLR	Log-likelihood ratio
S	Mean silhouette

2.1. Data Collection

Following the framework guidelines published by Mukherjee et al., 2022 [35] and Donthu et al., 2021 [36], the authors created a comparative narrative report based on three areas of knowledge, respectively. The primary source for the dataset was the Web of Science. Using the basic search of the database, bibliometrics such as topic or keyword were applied to the timespan between 2000 and 2022. The analysis started by inserting the keyword in the search field for the following terms related to the topics of interest: electronic commerce, cybersecurity, and digital resilience.

This action was performed first because the authors were interested in mapping the network and visualizing the connections between all research publications related to these fields. The basic search found only two results (papers), which was an astonishing surprise as the authors discovered the potential of the research knowledge in these areas. Therefore, the study framework was supposed to analyse each field one-by-one, by creating individual databases with the scientific papers published. Firstly, "electronic commerce" was searched for, using the period between 2000 and 2022. The search generated 1579 results from the Web of Science Core Collection. They were displayed by relevance, aiming to increase the quality of papers included in the study. Moreover, the authors observed and collected the number of citations of the most relevant published paper in the field. The same process was followed for each topic, resulting in a generous number of papers as follows in Table 2. Each of them were downloaded as plain text files and prepared in a data file for analysis.

Table 2. Basic search results for topics of interest in the timespan between 2000–2022.

Topic	Number of Results in Web of Science Core Collection	Citations of the Most Relevant Paper
Ecommerce	1570	10
Cybersecurity	10,388	8
Digital resilience	2627	14

2.2. Project Configuration

The network construction process was represented by configuring the time-slicing parameter from 2000 to 2022, and text processing by checking title, abstract, author keywords (DE), and keywords. After that, the network was set up with the default node type (cited reference). The selection criteria for all the items included in the study are represented by top N = 50, which means that the software selected the fifty most cited items for each slice to construct the network. In the same row, the top N% per slice was set up to 10%, indicating that the selection was made for 10% of the most cited items or most frequent items per slice. The selection criteria used for each slice are the modified g-index (the alternative for the older h-index) and the scale factor $k = 25$.

$$g^2 = \leq k\Sigma_{i \leq g} c_i,\ k \in Z^+ \quad (1)$$

where k is the number of publications and c is the number of citations.

2.3. Analysis Method

Several CiteSpace [37] features were used. The first one is a clustering function used to identify a specific theme, topic, or line of research. The second one is the metric modularity Q, which measures the extent to which a network can be discomposed into multiple components. Then, the mean silhouette highlights the overall structure of the network.

For example, the authors used this to show the homogeneity of the cluster. Its value ranges between -1 and 1, hence the higher the score, the more consistent the cluster members are. The labelling of the clusters process was performed to characterise the nature of identified clusters. The authors extracted the noun phrases from titles, keywords, and abstracts.

To find out where one may find the major areas of research, the authors set up the nodes and the font sizes, and the transparency of the links. After that, to see how these major areas are connected, the authors used the betweenness centrality indicator to highlight the nodes with high scores.

The burst detection process is supposed to use citation on burst indicator to find where the most active areas are in the field. The parameter provides information about the publications that attracted an extraordinary degree of attention during the time based on Kleinberg's algorithm [38]. To run the analysis, the selected node type was the keyword for a time span between 2000 and 2022, slice length = 1, and Top N = 100. Additionally, the citation burst history helped the authors to summarise the list of articles associated with citation bursts for each field.

Lastly, a cluster exploration was run to analyse the clusters in more depth and a timeline view was set up to position each cluster arranged on a horizontal timeline.

3. Results

The network mapping process generated the comparative outcome illustrated in Figure 2.



(**a**) (**b**)

Figure 2. Visualized comparative analysis: (**a**) Network for electronic commerce field of research; (**b**) Network for cybersecurity field of research, designed by authors. Note: The more obvious the color, the more recent the publications.

3.1. Electronic Commerce

Running the project for this knowledge field, 1570 references were included in the study and due to software criteria, in the final, 1559 were qualified records (2000–2022). To visualise some relevant groupings for this research area, the clustering process generated 280 groups with the top research lines labelled according to the dimension of each one. The authors characterised the nature of the groupings by choosing to select noun phrases from the titles and showing labels by the log-likelihood ratio (LLR). The cluster labels are shown as follows in Figure 2. The modularity Q (0.9559) and the mean Silhouette S (0.9806), the metrics that describe the structural properties of the network, show a high homogeneity of the clusters and dense connections between nodes within them. Therefore, the network is divided into five co-citations clusters (Figure 3) and the most relevant ones with their sizes and top terms are presented as follows in Table 3.

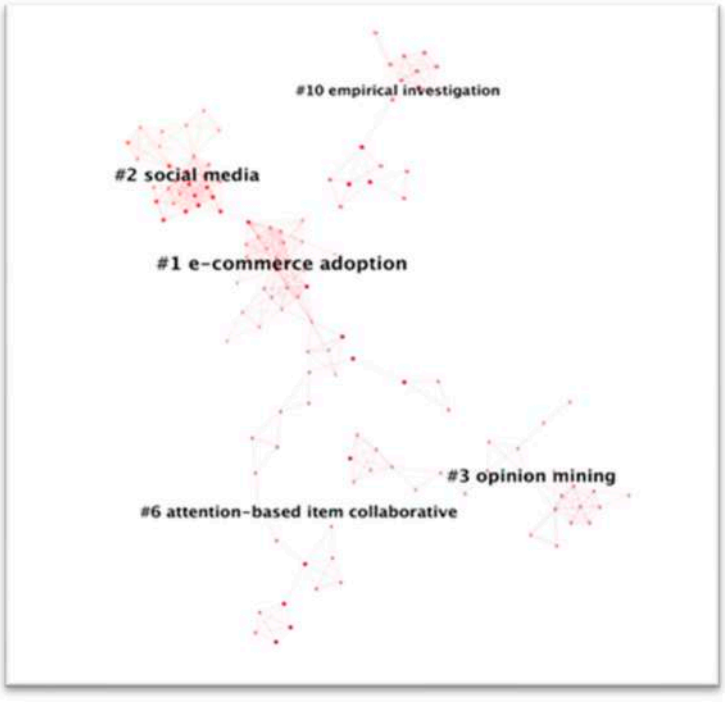


Figure 3. Labelled clusters for electronic commerce, designed by authors. Note: The more obvious the color, the more recent the publications.

Table 3. Top terms by cluster labels and indicators for electronic commerce.

Cluster ID	Size	Silhouette	Mean (Year)	Label (LLR)
1	31	0.962	2016	**e-commerce adoption** (18.1, 1.0×10^{-4}); **influencing beliefs formation** (15.79, 1.0×10^{-4}); **social commerce** (15.79, 1.0×10^{-4}); SME travel agencies (15.79, 1.0×10^{-4}); **mobile commerce adoption** (13.49, 0.001)
2	28	1	2012	**social media** (23.99, 1.0×10^{-4}); latent transition analysis (23.99, 1.0×10^{-4}); trip experience (23.99, 1.0×10^{-4}); tourism design (19.05, 1.0×10^{-4}); smart tourism development (14.18, 0.001)
3	27	0.985	2018	opinion mining (21.68, 1.0×10^{-4}); fuzzy logic (21.68, 1.0×10^{-4}); salient research topics (17.97, 1.0×10^{-4}); **analysing e-wom** (14.31, 0.001); stochastic dominance (14.31, 0.001)
6	22	0.978	2017	attention-based item collaborative (21.02, 1.0×10^{-4}); **fast shipping ecommerce** (18.33, 1.0×10^{-4}); case study (18.33, 1.0×10^{-4}); inbound logistics operation (18.33, 1.0×10^{-4}); **purchasing attitude** (15.65, 1.0×10^{-4})
10	18	0.978	2015	empirical investigation (22.2, 1.0×10^{-4}); big data perspective (22.2, 1.0×10^{-4}); online review helpfulness (22.2, 1.0×10^{-4}); specific word entropy (17.64, 1.0×10^{-4}); **purchasing behaviour** (13.14, 0.001)

To find what the most active areas in the electronic commerce field of knowledge are, a burst detection was performed. To do so, the reference node was selected to showcase the landmark's papers in this field by this indicator [39].

Another useful result is related to the centrality indicator that shows how the major areas are connected, presenting the paper with the highest centrality papers [40], Bastl M, 2012, INT J OPER PROD MAN, 32, 650, Bennett D, 2012, INT J OPER PROD MAN, 32, 1281, Cai SH, 2010, J OPER MANAG, 28, 257.

Therefore, the burst detection by keywords determined the authors to present the big picture of the topics of interest in the electronic commerce field (Table 4).

Table 4. Burst detection by keywords for electronic commerce.

Keywords	Strengths	Begin	End	2000–2022
social media	5.89	2016	2019	
online review	5.82	2020	2022	
destination marketing	5.59	2007	2011	
web service	4.93	2001	2005	
e-commerce	4.65	2011	2013	
social network	4.64	2015	2017	
sentiment analysis	4.58	2018	2022	
information search	4.34	2009	2014	
service	3.98	2019	2022	
web	3.97	2011	2017	
perceived risk	3.93	2018	2019	
data mining	3.72	2012	2015	
purchase intention	3.61	2019	2022	
online shopping	3.49	2014	2019	
experience	3.34	2017	2019	
electronic commerce	3.28	2008	2013	
tourism	3.18	2008	2017	

In generating the top keywords report, the authors wanted to discover more details relating to it, so a mapping of clusters (Figure 4) by keyword node was performed. The results exhibit 146 clusters for the same time span; the selection criteria are represented by the Top 10% per slice and 1.00% nodes labelled, without pruning (network, N = 18,325, E = 57,424, and density = 0.0003).

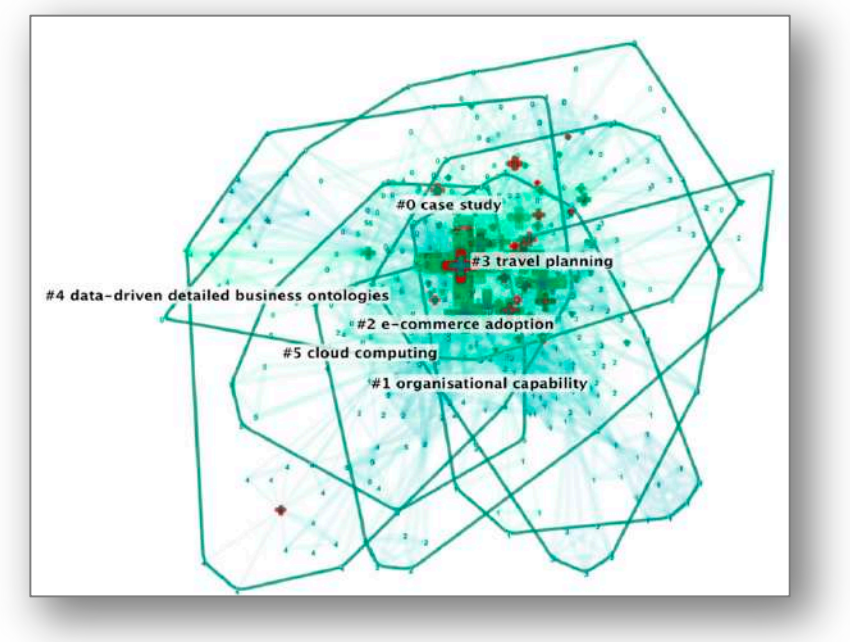


Figure 4. Cluster mapping by keyword node was performed (electronic commerce).

By title node, the electronic commerce research area is divided into thirteen co-citations clusters for 1559 qualified records. The timeline view illustrates the evolution of the main topics of research as follows in Figure 5. The generated data shows the most relevant topics in electronic commerce by clusters (Table 5).

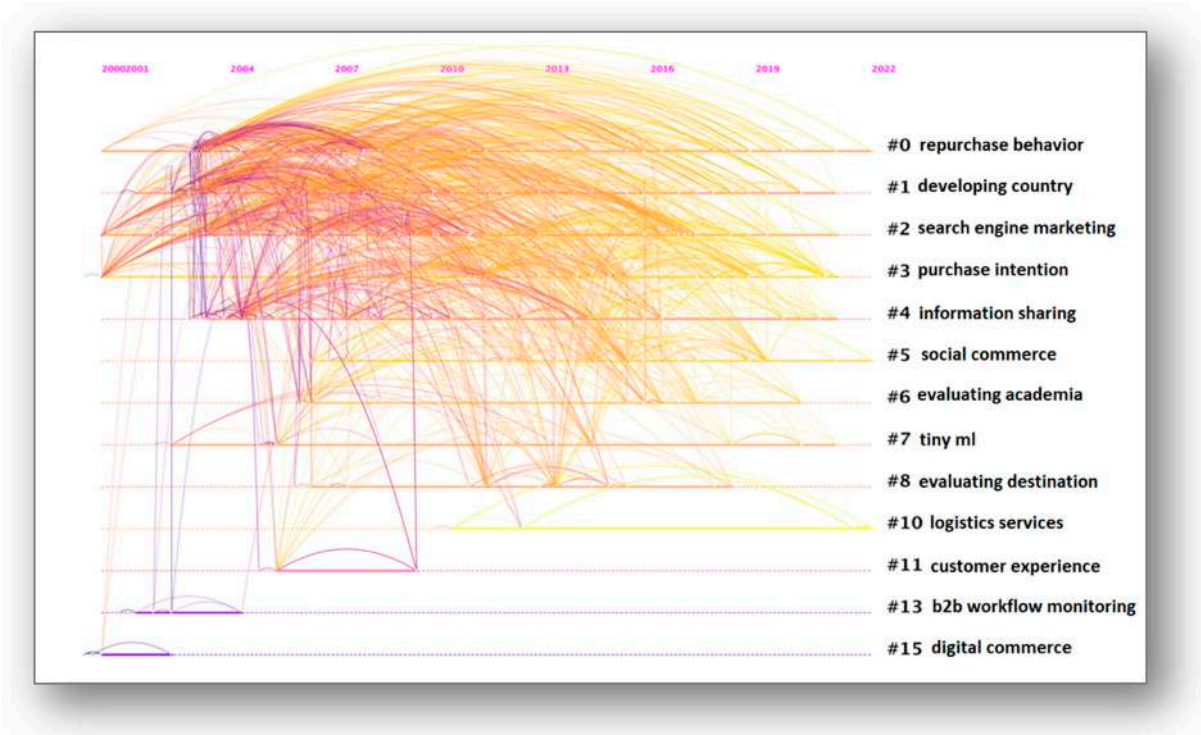


Figure 5. Timeline view for cluster labelling by title node.

Table 5. Most relevant topics in electronic commerce by clusters.

Cluster ID	Size	Silhouette	Label (LLR)	Year	The Most Relevant Topics
0	42	0.643	repurchase behaviour (144.12, 1.0×10^{-4})	2011	factors and performance impact of electronic business [41]
1	42	0.727	a developing country (327.66, 1.0×10^{-4})	2010	Electronic commerce adoption willingness and behaviour [42]
2	38	0.736	search engine marketing (255.83, 1.0×10^{-4})	2012	search engine use [43]
3	31	0.586	purchase intention (194.09, 1.0×10^{-4})	2015	Electronic commerce satisfaction [44]

3.2. Cybersecurity

The labelling process of the clusters for cybersecurity was based on 10,245 qualified records and generated 234 groups with high homogeneity (S = 0.9268). Table 6 shows that the size of each cluster is relevant enough to present the major research lines.

Table 6. Clusters of cybersecurity are labelled by major research lines.

Cluster ID	Size	Silhouette	Mean (Year)	Label (LLR)
0	99	0.92	2016	**human factor** (1038.26, 1.0×10^{-4}); **machine learning** (760.94, 1.0×10^{-4}); health care (678.93, 1.0×10^{-4}); scoping review (601.43, 1.0×10^{-4}); smart grid (593.5, 1.0×10^{-4})
1	95	0.915	2017	network intrusion detection (1797.74, 1.0×10^{-4}); **using machine** (933.96, 1.0×10^{-4}); objective comparison (863.01, 1.0×10^{-4}); IoT network (829.85, 1.0×10^{-4}); intrusion detection system (790.24, 1.0×10^{-4})
2	78	0.873	2016	**blockchain technology** (2099.46, 1.0×10^{-4}); smart cities (1690.93, 1.0×10^{-4}); **blockchain technologies** (928.62, 1.0×10^{-4}); IoT device (826.53, 1.0×10^{-4}); **using blockchain** (643.47, 1.0×10^{-4})
3	69	0.914	2015	adversarial machine learning (1756.66, 1.0×10^{-4}); adversarial example (1053.93, 1.0×10^{-4}); **deep learning** (861.22, 1.0×10^{-4}); **machine learning** (854.89, 1.0×10^{-4}); adversarial attack (660.04, 1.0×10^{-4})
4	65	0.884	2016	industrial control system (2556.12, 1.0×10^{-4}); in-vehicle network (1172, 1.0×10^{-4}); **attack detection** (894.82, 1.0×10^{-4}); case study (782.27, 1.0×10^{-4}); **behavioural model** (770.93, 1.0×10^{-4})
5	61	0.944	2014	**national cybersecurity** (682.86, 1.0×10^{-4}); **shared responsibility** (610.77, 1.0×10^{-4}); **global cybersecurity** (538.74, 1.0×10^{-4}); political economy (472.75, 1.0×10^{-4}); theorising cyber coercion (466.76, 1.0×10^{-4})
6	54	0.949	2012	load redistribution attack (1494.73, 1.0×10^{-4}); advanced metering infrastructure (747.5, 1.0×10^{-4}); power system adequacy assessment (741.01, 1.0×10^{-4}); power grid (656.86, 1.0×10^{-4}); 3d printing cybersecurity (656.86, 1.0×10^{-4})

To see how the major areas are interconnected (Figure 6), the betweenness centrality analysis was used. By the reference node, the item with the higher centrality (47) is associated with the process of attack detection using deep learning for IoT[] [45], which is ranked in Cluster #1.

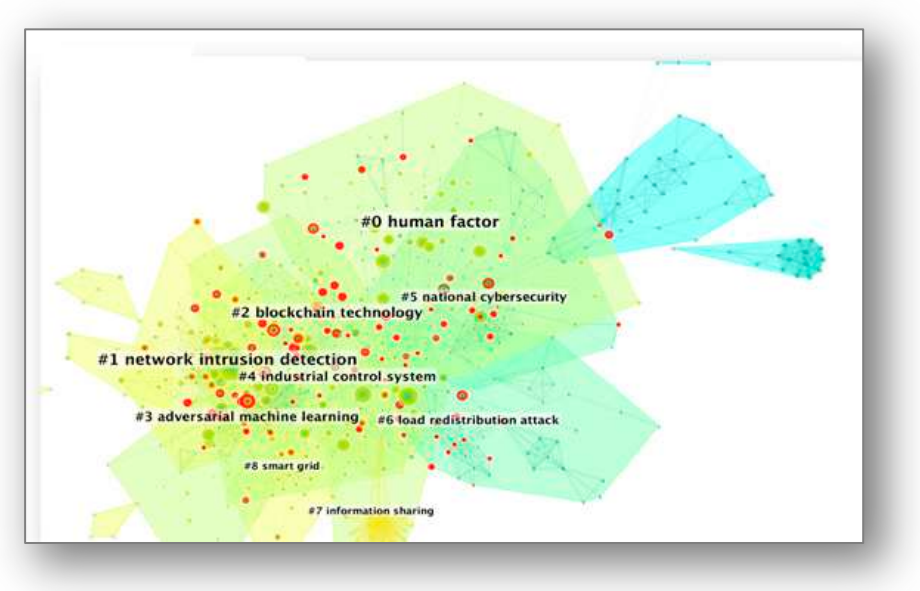


Figure 6. The interconnection of major lines for cybersecurity.

Afterwards, the authors discovered what the most active areas in cybersecurity are, with the help of burst detection for reference nodes. The results showed that three of the topics are related to the law applicable to Cyber operations [46] and cybersecurity in the Smart Grid (next-generation power systems) [47].

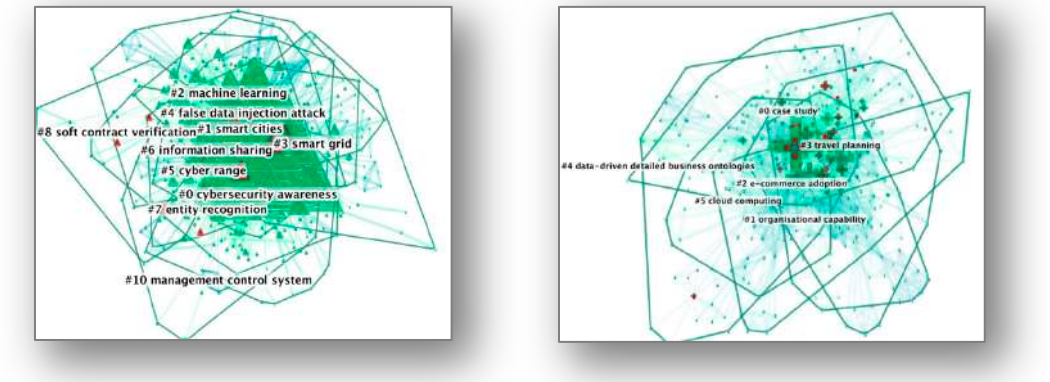
To enable a comparison between electronic commerce and cybersecurity fields of research by keyword node, a new analysis for 10,242 qualified records was run. The major themes for cybersecurity are divided into sixty-nine clusters with the three preeminent presented in Table 7.

Table 7. Labels and clusters for cybersecurity by keyword node.

Cluster ID	Size	Silhouette	Mean (Year)	Label (LLR)
0	142	0.698	2017	cybersecurity awareness (4192.79, 1.0×10^{-4})
1	132	0.628	2017	smart cities (5279.12, 1.0×10^{-4})
2	105	0.725	2016	machine learning (6747.1, 1.0×10^{-4})

The Silhouette means shows a relatively high homogeneity which is associated with the large sizes of the clusters. Therefore, the keyword nodes associated with the most relevant citers for each cluster highlight the impact of their work on the related topic of research. By comparing cybersecurity with electronic commerce (Figure 7), the authors aimed to find a possible nexus path between them. Analysing the models, cluster #0, cybersecurity awareness in cybersecurity, and cluster #2, electronic commerce adoption emerged.

Both seem to represent major areas in each network; therefore, a detailed analysis by keyword nodes was performed for further analysis of cybersecurity knowledge. The top keywords are shown in Table 8.



(**a**) (**b**)

Figure 7. Comparative analysis by cluster mapping (keyword node): (**a**) clusters for cybersecurity; (**b**) clusters for electronic commerce.

Table 8. Top keywords for cybersecurity research line.

Keywords	Strengths	Begin	End	2000–2022
cyber security	19.22	2012	2017	
smart grid	12.36	2010	2017	
cybersecurity education	7.76	2014	2018	
vulnerability assessment	6.28	2005	2018	
information security	6.21	2008	2014	
moving target defence	5.88	2016	2018	
cloud computing	5.82	2011	2017	
cyber defence	5.42	2014	2018	
information sharing	5.42	2015	2017	
static analysis	5.17	2018	2019	
computer security	5.09	2009	2015	
critical infrastructure	5	2015	2017	
security	4.99	2013	2015	
crime	4.94	2017	2018	
attack graph	4.93	2012	2018	
data protection	4.89	2017	2018	
social network	4.87	2016	2018	
big data	4.83	2012	2018	
software security	4.81	2016	2018	
game theory	4.63	2014	2018	
situation awareness	4.46	2016	2019	
smart home	4.42	2019	2020	
critical infrastructure protection	4.4	2015	2016	
malware	4.16	2019	2020	
cybersecurity training	4.13	2017	2018	

4. Discussion

The paper enriches the literature by bringing together three major themes that are strongly inter-connected. Remembering Figure 1 presented in the introduction (where the existing scientific contribution related to electronic commerce, cybersecurity, and digital resilience were illustrated), the authors exhibit a single big picture of the findings, connecting the current state of knowledge. Thus, to illustrate the important outcomes of the study, a conceptual model of Resilience Right Decisions for Electronic Commerce and Cybersecurity was created (Figure 8).



Figure 8. The Resilience Right Decisions for Electronic Commerce and Cybersecurity Model.

Electronic commerce, as a vital element in worldwide economic resilience, gains a lot of attention currently from the point of view of implementing the necessary technology to use it. Electronic commerce adoption and mobile commerce adoption are two important challenging research lines for this field in the global economic resilience [27]; the largest group of references by the keywords criteria validated it. Electronic commerce, customer experience, social media, search engine marketing, and big data perspective represent the guideline topics for digital business owners. This fact highlights the global impact.

The study revealed that cybersecurity with specific threats, the quality of information security, and the security of personal data were found as the main challenges for the resilience and the right decisions for stakeholders [26].

The analysis performed centred on the human factor in the middle of the pursuit of the risk faced when cybersecurity is referred to. The fear of cyber-attacks, such as ransomware or other types of cyber threats, is no longer a novel issue. What is now a real concern refers to facing the perception of online shopping as being risky, especially from the point of view of personal data security. Consumers who perceive online shopping as risky and who are concerned about the resilience of the retailer's infrastructure and the security of the personal data [31,32] draw a connection with cybersecurity awareness, which requires the need for fraud mitigation in the online environment. The connection between cybersecurity and electronic commerce adoption asks for cybersecurity education, cyber awareness, data protection with lasting attention to purchasing behaviour, e-WOM, social commerce, and fast shipping to increase the resilience of digital businesses. A relevant outcome of this study revealed that aiding better development requires the use of data, even in the face of challenges related to global cybersecurity. Adding blockchain and machine learning alongside Artificial Intelligence [14] as technologies in use for strengthening resilience can represent the right decision for traders to accelerate the recovery to pre-COVID-19 levels. Additionally, the results of the study can complement other knowledge research fields, such as digital transformation (addressed with bibliometric analysis) [48], cyber threat and cyber-attack literature for higher education [49], but also, a global perspective on cybersecurity trends [50].

5. Conclusions

The authors bring to light a summary of the electronic commerce research and cybersecurity knowledge field, strongly connected with global digital resilience, by presenting to the academic world: the big picture, which is easy to understand. The Resilience Right Decisions for Electronic Commerce and Cybersecurity Model promotes the top priorities

and useful information, increasing the awareness of the global impact of cybersecurity on commerce performed in the digital environment.

The managerial implications point to the priority of deploying cybersecurity optimisation actions to shape marketing strategies for purchase, re-purchase behaviour, and technology adoption. The most important detail business owners should understand is related to the nature of the human factor, which influences the competitiveness of organisations and their resilience, especially during hard times. Knowing about factors such as purchase behaviour, customer experience, blockchain technology, big data, and data protection, organisations can develop a strong resilience. Additionally, business owners have the opportunity to deploy solutions regarding the quality and security of the infrastructure and know-how for the safe use of resources: both for customers and employees.

The theoretical implications consist of collaborating with organisations, researchers, and publishers to develop and promote new theoretical frameworks to implement cybersecurity solutions for electronic commerce. Among the types of study they could create in the research field are: sentiment analysis, latent transition analysis, literature reviews, and empirical investigations.

The first limit comes from studying the research papers by only using the Web of Science Core Collection database. The second limit is represented by the probability of including several articles that are less relevant for the analysis because of the selection made automatically by the software. Additionally, the authors decided to choose only two research knowledge fields—the possibilities being endless.

These facts can turn into research directions by extending the number of both research knowledge fields. Additionally, an extension from the Web of Science Core Collection to the SCOPUS database may enlarge the analysis opportunities. It is also possible to conduct direct research on the perception of electronic commerce site owners, regarding the impact of cybersecurity, to develop their businesses.

Author Contributions: Conceptualization, D.R.V., E.N., O.M.Ț., A.Z., I.B.C., T.F. and G.B.; methodology, E.N., G.B.; literature review, I.B.C., D.R.V., A.Z.; analysis and writing the results, E.N. and O.M.Ț.; discussion and conclusions, E.N., I.B.C., O.M.Ț., D.R.V., A.Z., T.F. and G.B.; writing—original draft preparation, E.N., I.B.C., A.Z.; writing—review and editing, I.B.C., O.M.Ț., D.R.V., A.Z., T.F. and G.B.; supervision, G.B.; project administration, G.B.; funding acquisition, G.B. All authors have read and agreed to the published version of the manuscript.

Funding: This APC was funded by Transilvania University of Brașov.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available online at shorturl.at/dfiEP (last accessed on 23 June 2022).

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

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Sustainability of Supply Chains Through Digitalization: A Study on the Romanian Restaurant Industry

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Abstract

The paper investigates the role of digitalization in strengthening the sustainability of supply chains in the Romanian restaurant sector. The starting point is the intersection between the pressures for digital transformation and the integration of sustainability principles. Digitalization, through advanced digital solutions, can strengthen traceability, reduce waste, and optimize resources, strengthening responsibility for economic efficiency and the environment. However, the implementation of these solutions in HoReCa remains disproportionate and faces barriers such as lack of digital skills, high costs, and resistance to change. The authors conducted a quantitative research study among restaurant managers in Romania. The research was complemented with two Principal Component Analyses (PCA) and a TwoStep Cluster Analysis. The role of the TwoStep Cluster Analysis was to identify a typology of restaurants according to managerial behaviors related to digitalization from a sustainable perspective. The results showed that digitalization is applied predominantly in inventory management, but less in the relationship with consumers and supply chain, where it would bring considerable benefits for sustainability. The study provides theoretical and practical contributions, highlighting the role digitalization has as a facilitator of sustainability and indicating recommendations for managers and decision-makers regarding professional training and financial support policies dedicated to sustainable digitalization.

Keywords: digital innovation; sustainable supply chain; restaurant market; managerial innovation

check for updates

Academic Editors: José Magano and Mário Coutinho dos Santos

Received: 30 September 2025
Revised: 16 November 2025
Accepted: 20 November 2025
Published: 26 November 2025

Citation: Grancea, A.; Neacșu, N.A.; Bălășescu, S.; Zamfirache, A. Sustainability of Supply Chains Through Digitalization: A Study on the Romanian Restaurant Industry. *Sustainability* **2025**, *17*, 10595. https://doi.org/10.3390/su172310595

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1. Introduction

Amid increasing global concern for digital transformation and sustainability, the supply chain has become a main object of multilateral processes of continuous modernization [1]. By digitalizing the supply chain, there is allowed an integration of digital solutions such as blockchain, ERP systems, Internet of Things (IoT), and last but not least, viable real-time data analysis solutions, which can offer significant benefits on traceability, efficiency, and environmental responsibility [2,3]. However, from the point of view of implementing digitalization in the HoReCa industry, the specialized literature highlights divergent perspectives [4]. Some studies highlight important aspects such as the obvious benefits of adopting digital solutions for sustainability and efficiency, while other studies draw attention to challenges such as resistance to change among employees, high costs, and the lack of an appropriate technological infrastructure, especially in emerging markets such as Romania [5–7].

Furthermore, numerous studies have highlighted the fact that digital transformation can contribute to operational or logistical sustainability objectives, in particular by minimizing waste, strengthening existing relationships between the social actors involved, and, at the same time, by optimizing processes [8,9].

The restaurant market has begun to play a dynamic role in the agri-food supply chain [10,11]. This dynamic role does not only refer to the final point of delivery, but in principle, it refers to the strategic actor that can influence the process by which suppliers are selected, the adoption of digital solutions and the promotion of responsibility [12]. Consumer pressures related to transparency, the increased pace of adaptation to digital technologies, and the requirements of compliance with legal environmental protection standards have increasingly begun to transform restaurants in the market toward critical points of operational sustainability [13–15]. As a result, the HoReCa industry has become an industry more vulnerable to supply disruption risks, sensitive to unpredictable variations in demand and to logistical efficiency challenges [16]. Hence, this can make digitalization an important tool for restaurant performance [17].

In Romania, the level of supply chain digitalization associated with the HoReCa industry varies considerably, and the empirical research already existing on this topic is quite limited [18]. Therefore, the main objective of this study is to investigate how digitalization could contribute to the sustainability of the supply chain in Romanian restaurants, with a certain emphasis on the realities of local markets.

In order to achieve the purpose of the study, a quantitative research study was conducted on a sample of 280 restaurant managers from Romania. In addition to this research, two Principal Component Analyses (PCA) and a TwoStep Cluster Analysis were conducted. The role of the TwoStep Cluster Analysis was to identify a typology of restaurants according to managerial behaviors related to digitalization. Moreover, complementary statistical methods were applied in the research, such as descriptive analysis, contingency tables (crosstab) with the Chi-Square test, and the KMO and Bartlett's test.

The results of this research highlight the fact that the level of digitalization related to the supply chain in the analyzed restaurants in Romania is at an intermediate point, and in this sense it is stated that digitalization is adopted in operational areas but quite limited in the direct relationship with the customer or in the specific stage of supply. At the same time, it is specified that no statistically significant link was identified between digitalization and sustainability, but the managerial perception tends to recognize the positive potential that technology has in promoting sustainable practices.

Through the results, the study makes a practical contribution to managers in the HoReCa industry, supporting them in making strategic decisions regarding the integration of digital technologies within the restaurant and in the supply chain. Simultaneously, this study provides important information to public authorities interested in promoting sustainable measures in the HoReCa industry, as well as to suppliers or developers of digital technologies. Further, this analysis certainly contributes to a consolidation of the scientific literature regarding the role of digitalization in the restaurant market and its importance for sustainable development.

Based on the results, the authors developed a conceptual model that can classify restaurants according to their level of digitalization. This level of digitalization is also correlated with the sustainability measures adopted.

The authors organized the paper in the following sections: Section 2. Literature Review; Section 3. Research Method; Section 4. Results and Discussion; and the final Section 5. Conclusions, where the limitations of the study are also presented.

2. Literature Review

Sustainable supply chain management is defined as "the management of material, information, and capital flows, as well as cooperation between companies along the chain, considering the objectives of the three dimensions of sustainable development—economic, environmental, and social—that derive from the requirements of customers and stakeholders." According to Kumar et al. [19], sustainable supply chain management will guide future research, given that more and more chains aim for sustainable development and the implementation of the UN sustainability goals.

To ensure a sustainable supply chain, the literature emphasizes the need to balance the three dimensions of sustainability by introducing practices oriented towards the sustainability of production systems [20–22].

In the restaurant industry, sustainability directly depends on how supplier relationships and supply chain flows are managed, and is not limited to the responsible use of resources. Sourcing decisions influence operational costs, product quality, and environmental impact, which positions the supply chain in ensuring the sustainable performance of restaurants [23].

In the context of the evolution towards a sustainable and digitalized economy, the HoReCa industry faces multiple pressures to adopt modern technologies that ensure both operational efficiency and alignment with the objectives of social responsibility and environmental protection [24].

In Romania, where the HoReCa sector has experienced rapid development after 2020, digitalization is no longer merely just a trend, but a necessity for meeting European sustainability requirements and responding to consumers who are increasingly attentive to social and environmental impacts [25]. According to the DESI indicator [26], Romania ranks among the last member states of the European Union in terms of digitalization of companies, including in HoReCa [27].

The supply chain is a system made up of organizations, people, activities, information, and resources involved in the delivery of a product or service from the supplier to the final customer [28]. Supply chain management aims to meet customer needs and achieve high performance within the organization, with the objectives of reducing costs, reducing waste, compressing delivery times, increasing operational flexibility, and avoiding stockouts [29–31].

The way the supply chain is organized can have direct consequences on the economic performance and sustainability of restaurants. In this context, digitalization becomes an important and strategic tool for increasing efficiency and traceability [32].

Baltescu et al. [33] highlighted, in a study conducted on 56 restaurants in Romania, that the majority pursue ingredient traceability and prefer local suppliers, not only for quality, but also for sustainability reasons. The use of digital order planning and management systems allows for more accurate demand estimation and, implicitly, the reduction in food waste [17,34].

Digitalization contributes to the sustainability of supply chains through four main mechanisms: increasing transparency and traceability, optimizing resources, reducing waste, and strengthening supplier relationships [35,36]. Technologies such as the Internet of Things (IoT), RFID, blockchain, and cloud solutions allow real-time monitoring of product flows, facilitating rapid interventions to avoid losses and minimize environmental impact [37].

Digital collaboration platforms between producers, distributors, and restaurants provide access to real-time data, facilitating rapid decision-making in situations of chain disruption [38]. This practice is becoming increasingly common in large cities in Romania.

At the same time, the process of digital transformation highlights the difference between restaurants with strong financial and managerial resources and small ones with reduced innovation capacity [39–42]. These discrepancies can influence both the level of operational efficiency and the ability of restaurants to implement sustainable strategies [43]. The specialized literature highlights that digitalization and sustainability are interdependent processes, but not inherently convergent [44]. Digitalization provides the technological infrastructure necessary for optimizing and efficiently monitoring supply chain flows, while sustainability represents the strategic framework aimed at reducing environmental impact and creating value for all parties involved in the process [45]. In other words, digitalization can support sustainability, but its effects depend on the sub-set through which technologies are integrated and used in practice [46].

Digitalization contributes to sustainability in the restaurant supply chain through several mechanisms [47]. First, digital traceability systems allow for real-time quality control of ingredients and significantly reduces the risk of losses in the supply chain. This is particularly relevant in the food industry, where transparency and food safety are essential aspects [48]. Second, digital solutions for demand forecasting and inventory management support the reduction in food waste, which represents one of the main sustainability challenges for restaurants [49].

At the same time, digital technologies can facilitate strategic collaboration between suppliers and restaurants, working together to strengthen short supply chains and use local ingredients, which reduces the carbon footprint associated with transportation. Therefore, it is clear that digitalization not only optimizes internal processes, but can also maintain more socially and environmentally responsible supply models [50].

However, the literature highlights that digitalization does not automatically guarantee improved sustainability performance. The contribution to sustainability that digital technologies can make depends on factors such as the availability of financial resources, organizational culture, the level of digital competence of staff, and the degree of openness to change [51]. In particular, small and medium-sized restaurants, face considerable difficulties in integrating advanced technologies, either due to cost constraints or limited operational capacity for adaptation [52].

Therefore, the relationship between the two interconnected components, digitalization and sustainability, can be understood as a hypothetical relationship: digitalization provides the necessary tools, and sustainability provides the direction [53]. When there is a well-defined management strategy aimed at using technology to optimize resources, reduce waste, and strengthen responsible partnerships, digitalization produces significant sustainable effects in the restaurant supply chain [54].

Considering this interdependent relationship, the literature highlights the effects that digitalization has on sustainability, through the way technology is integrated into supply chain management and operational processes [55]. Digital technologies that are integrated into the supply chain contribute to improving sustainable performance by streamlining traceability, increasing operational efficiency, and, last but not least, by reducing waste [56]. The use of predictive analytics and real-time monitoring systems allows for better management of inventories based on demand, reducing logistics costs and food losses [57]. Moreover, digital platforms that facilitate ingredient quality control and the identification of problems along the supply chain also contribute greatly to food safety and transparency [58]. Additionally, using digital solutions for effective collaboration with suppliers can support the development of responsible resource consumption and short supply chains, which strengthens the social and ecological dimensions of sustainability [59,60]. However, the impact of digitalization on sustainability depends on the level of integration and the extent to which these solutions are internalized within the operational and decision-making pro-

cesses of restaurants. This point is also emphasized in recent research, which shows that digital integration produces positive effects only when it is aligned with organizational objectives and adopted strategically [61]. There is also a need for investment readiness, specific skills, and an organizational framework oriented towards continuous improvement to implement digital technologies [62]. If these conditions are not in place, digitalization remains at an early and superficial stage, and this does not generate sustainable transformations that can be measured [63]. Therefore, the link between digitalization and sustainability essentially depends on the ability of organizations to leverage technology strategically, aimed at strengthening supply chain efficiency and reducing environmental impact [64].

Based on the theoretical framework that was presented, the first research hypothesis is formulated:

Hypothesis 1 (H1). *There is an association between the use of digital technologies within the supply chain and the implementation of sustainable measures in restaurants.*

Existing literature has highlighted that the adoption of digital technologies in restaurants is essentially influenced by organizational characteristics [65]. These characteristics are the size of the organization, the management structure, the chain membership, and the available resources. Moreover, restaurants that are part of large networks, such as fast-food chains or international franchises, have more developed technological infrastructure, investment capital, and managerial skills that usually allow for the integration of digital solutions into the supply chain [66]. On the other hand, independent, casual, or small restaurants tend to adopt technology to a lesser extent, due to the lack of technological knowledge and investment capital [67]. Therefore, these differences related to the structure are directly reflected in the level of integration of digital technologies [68].

Following the above, the second research hypothesis is reformulated, which concerns the relationship between the level of adoption of digital technologies and the type of restaurant:

Hypothesis 2 (H2). *The type of restaurant influences the adoption of digital technologies in the supply chain.*

3. Research Method

In this study, quantitative research, which has an exploratory nature, was conducted. Figure 1 illustrates the research design. The research method adopted in this study is similar to that used by Türkeș, Bănacu, and Stoenică [69], who used a questionnaire and quantitative analysis to demonstrate the impact of supply chain sustainability and the performance of Romanian companies.

The aim of the present research is to identify various aspects regarding the digitalization of the Romanian restaurant supply chain, with a focus on the sustainability component.

In order to achieve the purpose of the study, the following objectives were established:

O1—Identifying the level of digitalization in the supply chain of restaurants in Romania;
O2—Determining the relationship between the level of digitalization and the concern for sustainability;
O3—Identifying the main barriers that prevent digitalization in the supply chain of restaurants in Romania;
O4—Identifying the main factors that influence the adoption of digitalization in the supply chain.

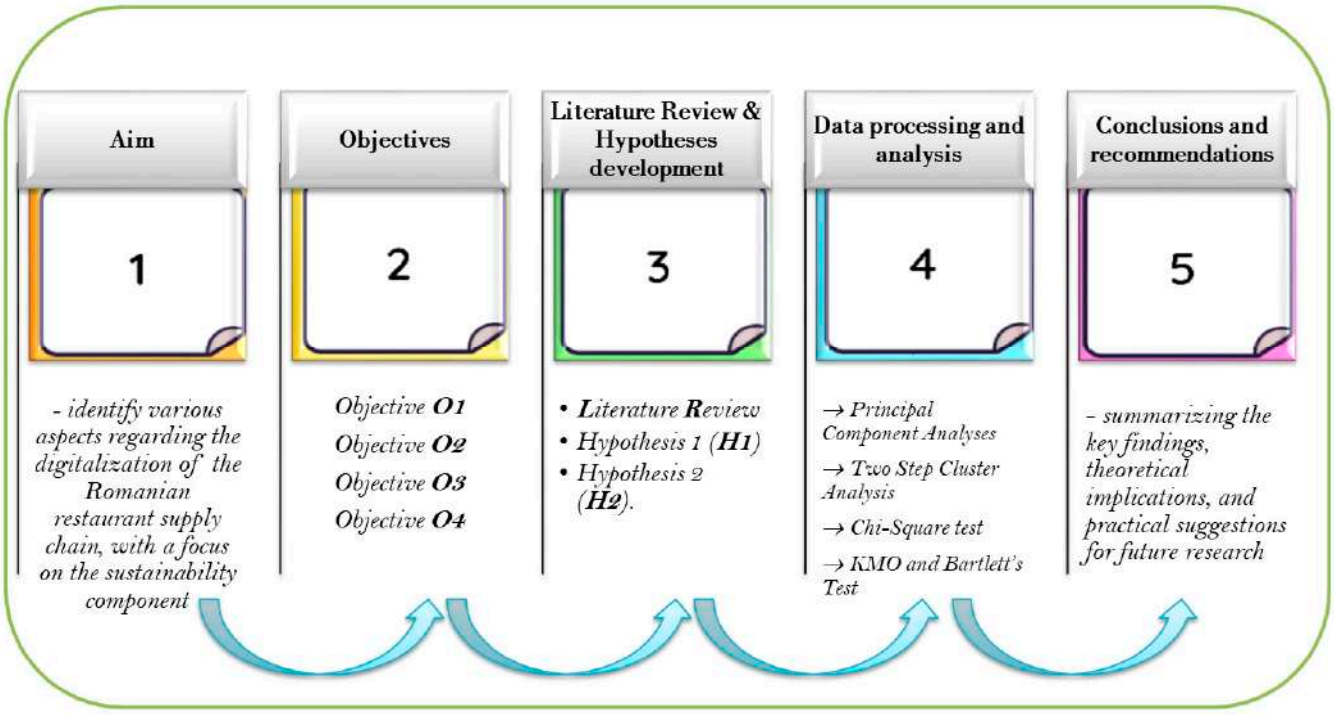


Figure 1. The research design. Source: Model proposed by authors.

3.1. Data Collection and Study Sample

The research instrument that formed the basis of the quantitative marketing research was the questionnaire. The questionnaire was first tested on 10 respondents to avoid possible ambiguities. After the pre-testing stage, the questionnaire in its final form was distributed to the final respondents.

Data collection was carried out using the Computer Assisted Web Interviewing (CAWI) method. This technique is widely used and allows for the administration of questionnaires in an electronic format, where respondents can complete the information directly on the web page [70]. This approach reflected a more diverse sample and presented a certain flexibility in the answers provided [71].

Data were collected from respondents during the period of March—April 2025, and within this interval, they were invited to complete the questionnaire. The sampling method that was chosen by the authors was the non-probabilistic one, being considered the most appropriate for this study. The questionnaire was sent by e-mail to 530 restaurant managers, inviting them to complete it through accessing a link. Finally, after eliminating missing cases, a sample of 280 restaurant managers from Romania was obtained. The sample structure showing the type of restaurant, size, and duration of activity in the industry is available in Table 1.

Table 1. Sample structure.

Type of Restaurant	Frequency	Percent	Valid Percent	Cumulative Percent
Fast-Food Restaurant	112	39.9	40.0	40.0
Casual Restaurant	56	19.9	20.0	60.0
Premium Restaurant	56	19.9	20.0	80.0
Cafe	56	19.9	20.0	100.0
Total	280	99.6	100.0	

Table 1. *Cont.*

Restaurant Size	Frequency	Percent	Valid Percent	Cumulative Percent
1–5 employees	56	19.9	20.0	20.0
6–15 employees	168	59.8	60.0	80.0
Over 15 employees	56	19.9	20.0	100.0
Total	280	99.6	100.0	
Activity Duration in The Restaurant Industry	Frequency	Percent	Valid Percent	Cumulative Percent
1–5 years	56	19.9	20.0	20.0
6–10 years	168	59.8	60.0	80.0
Over 10 years	56	19.9	20.0	100.0
Total	280	99.6	100.0	

Source: Data from own research.

The sample consisted of 280 respondents, but in the case of certain filter questions applied in the questionnaire, the number of cases analyzed varied. Therefore, it is specified that in some analyses the number of respondents is smaller than the initial sample.

3.2. Data Analysis Techniques

For a deeper analysis, the quantitative research was completed by two Principal Component Analyses (PCA) and a TwoStep Cluster Analysis. The Principal Component Analysis allows a reduction in the number of variables through the identification of factors that group the variables initially analyzed according to the correlations between them [72]. This statistical method is often used to highlight certain structures that are usually hidden in a larger data set and this greatly simplifies their interpretation, without dilating on important information [73].

In the context of this research, through the first Principal Component Analysis (PCA), the dimensions that influence the adoption of digital solutions within the supply chain were identified. Therefore, in this case, managers' perceptions of the associated benefits and decision-making factors were analyzed. The purpose of this approach was to understand how these factors group and how they can contribute to the decision-making process regarding restaurant digitalization.

The second Principal Component Analysis (PCA) was used to highlight fundamental dimensions of the barriers perceived by the study respondents in the restaurant digitalization process. In this regard, a new set of information was analyzed. Therefore, the purpose of this approach was to pursue a better understanding of how the responding managers group and perceive certain obstacles they encountered.

The research also applied complementary statistical methods, such as descriptive analysis, contingency tables (crosstab) with the Chi-Square test, and the KMO and Bartlett's test to verify the validity of the PCA.

Simultaneously, a cluster analysis (TwoStep Cluster Analysis) was used. This method aimed to identify restaurant typologies based on the level of digitalization. This analysis was evaluated using the Silhouette measure. Last but not least, two synthetic indicators of the level of digitalization were constructed: the first synthetic indicator was based on the areas of application of digital solutions and the second was based on the number of digital solutions used within the supply chain.

To test Hypothesis 1 (H1) and Hypothesis 2 (H2), the Chi-Square test is used. The results show that both hypotheses were rejected (H1: $\chi^2_{calculated} = 0.083 < \chi^2_{0.05;1} = 3.841$; H2: $\chi^2_{calculated} = 0.085 < \chi^2_{0.05;3} = 7.815$).

4. Results and Discussion

The obtained results were grouped according to the objectives established within the research. It is mentioned that this approach allowed for a clearer and more coherent analysis of the data, in relation to the research directions pursued by the authors.

O1. *Identifying the level of digitalization in the supply chain of restaurants in Romania.*

The results indicate a predominant application of digital solutions in essential operational processes (80%). Therefore, it is found that inventory management is most frequently digitalized (71%), immediately followed by electronic payments and invoicing, with a percentage of 67.9%, and the relationship with suppliers, with a percentage of 47.3%. Paradoxically, from the point of view of the application of digital solutions, areas such as online deliveries through platforms (21.4%) and marketing and customer loyalty (15.2%), were less addressed by the responding managers.

The distribution of answers shows that 75% of respondents do not use digital technologies in supply management.

The results show that half of the respondents mentioned that they use artificial intelligence to optimize orders within the restaurant. This suggests an increased interest in anticipatory process efficiency and the use of new technologies that have appeared on the market. Also mentioned by the responding managers were inventory management (30.4%) and traceability systems (26.8%), reflecting a concern for the control and transparency of the supply chain. These results also confirm the observations of Alt [66], which highlights the fact that digitalization in restaurants mainly varies in increasing operational transparency and optimizing internal processes.

Naturally, the duration (age) of using digital technologies in procurement was identified, and the results show that most of the responding managers stated that they have been using them for over 3 years (78.6%). At the same time, only 21.4% of the responding managers indicated a duration under 3 years old. Last but not least, it is found that all the responding managers who use digital solutions in the restaurant supply state that they use them daily. This obtained result indicates an advanced integration of digital solutions in the operational processes of the analyzed restaurants. In this sense, it can be confirmed that digitalization is essentially a permanent and essential tool in daily activity.

The benefits of digitalization in supply mentioned by the responding managers within the restaurant supply process are improved traceability and food safety (26.5%) stock optimization and waste reduction (23.1%). This highlights that the digitalization process is associated with much better control over product quality and safety, not just operational efficiency. Other benefits specified by the responding managers are the following: reduction in the time required to place orders and better collaboration with suppliers, in proportions of 10.3%. The results obtained align with the conclusions of An and Galera-Zarco [74], who specify that digitalization aims to increase transparency in the supply chain and improve operational efficiency by optimizing logistical processes and reducing waste.

Based on the results obtained in the analyses carried out for the study, the level of digitalization of the restaurants included in the research was highlighted depending on the type of restaurant. To make this possible, the answers regarding the areas of application of digital solutions within the analyzed restaurants were processed. Therefore, following the process, a synthetic indicator of the level of digitalization was defined, which was then used in a comparative analysis of the restaurants. The main purpose of this approach was to evaluate the degree of digitalization of the restaurant from a technological perspective in the different operational processes. In other words, the more a restaurant among those analyzed uses digital solutions in more areas of activity, the more strongly digitalized it is.

Furthermore, the new variable entitled "level of digitalization based on areas of application" was analyzed in direct relation to the type of restaurant managed (Table 2).

Table 2. The relation between the level of digitalization based on areas of application and the type of restaurant managed.

The Restaurants' Level of Digitalization Based on Application Areas	Type of Restaurant				
	Fast-Food	Casual Restaurant	Premium Restaurant	Cafe	Total
1—Very low level	47.7%	15.9%	18.2%	18.2%	100.0%
2—Low level	39.6%	20.9%	19.8%	19.8%	100.0%
3—Moderate level	32.4%	23.5%	26.5%	17.6%	100.0%
4—High level	28.6%	14.3%	14.3%	42.9%	100.0%
5—Very high level	39.6%	20.8%	18.8%	20.8%	100.0%
Total	39.7%	20.1%	20.1%	20.1%	100.0%

Source: Data from own research.

It is found that, in the categories with very low and low digitalization, fast-food restaurants predominate, where they represent 47.7% of the total establishments with very low digitalization, and 39.6% of those with low digitalization. The distribution at each level of the other types of restaurants is quite balanced in these two categories, which may result in a general trend towards reduced digitalization, regardless of the type of establishment. At the same time, it is observed that as the level of digitalization increases, the proportions begin to become much more dispersed between the types of restaurants analyzed, but the percentage values become lower in general. This suggests a much more limited presence of restaurants in the categories with high or very high digitalization. Moreover, it is highlighted that certain types of restaurants, such as cafes (42.9% at high level) and fast-food restaurants (39.6% at very high level), are also represented in the categories with a high level of digitalization.

Following the outlined results, the analysis was deepened and aimed at the existence of a possible association between the use of digital technologies for supply management and the type of restaurant managed (Table 3).

Table 3. The relation between restaurant type and the use of digital technologies for supply management.

Does Your Restaurant Use Digital Technologies for Supply Management?	Type of Restaurant				
	Fast-Food	Casual Restaurant	Premium Restaurant	Cafe	Total
Yes	39.3%	19.6%	19.6%	21.4%	100.0%
No	39.9%	20.2%	20.2%	19.6%	100.0%
Total	39.7%	20.1%	20.1%	20.1%	100.0%

Source: Data from own research.

From the data obtained, it is evident that the use of digital technologies for supply management is quite balanced among the types of restaurants managed in the sample. Therefore, 39.7% of fast-food restaurants use such digital technologies, with a similar percentage among premium, casual, and cafe restaurants. Furthermore, to verify Hypothesis 2 (restaurant type influences the adoption of digital technologies in the supply chain) the Chi-Square test was applied (Table 4).

According to the data obtained, it is found that the value of $\chi^2_{calculated} = 0.085$ is lower than the critical value $\chi^2_{0.05;3} = 7.815$, and the significance level p-value = 0.994 > 0.05. Therefore, it is found that there is no statistically significant association between the use of digital technologies in the supply process and the type of restaurant managed, so H2

is rejected. Finally, the type of restaurant (fast-food, premium, casual, and cafe) does not influence the probability of using digital solutions in supply management, at the level of the sample that was analyzed.

Table 4. The Chi-Square test on the relation between the restaurant type and the use of digital technologies for supply chain.

	Chi-Square Tests		
	Value	**df**	**Asymptotic Significance (2-Sided)**
Pearson Chi-Square	0.085 [a]	3	0.994
Likelihood Ratio	0.084	3	0.994
Linear-by-Linear Association	0.054	1	0.817
N of Valid Cases	224		

[a] Zero cells (0.0%) have expected count less than 5. The minimum expected count is 11.25.

Continuing the analysis, the level of digitalization of the restaurants included in the sample was assessed, this time, depending on the digital solutions that are used in the supply chain, but in direct relation to the type of restaurant managed. It is mentioned that the question included a list of multiple options. Therefore, each option corresponded to a specific technology (inventory management platforms, product traceability systems, ERP, mobile applications for procurement, and artificial intelligence for order optimization). As a result, a synthetic indicator of the level of digitalization was built according to the digital solutions used in the supply. The indicator directly highlighted the number of digital solutions used in the supply chain by each type of restaurant that was analyzed. Then, this synthetic indicator was transformed into an ordinal variable organized into five levels of digitalization, where 1 signifies a very low level of digitalization and 5 signifies a very high level of digitalization. Thus, if the restaurant uses fewer digital solutions in the supply chain, it is less digitalized, and if it uses more digital solutions in the supply chain, it is more digitalized. In order to complete the analysis, the distribution of the level of digitalization according to the type of restaurant managed was evaluated (Table 5). The purpose of this approach was to identify a possible association between the level of restaurant digitalization depending on the number of digital solutions used in the supply chain and the type of restaurant managed.

Table 5. The level of digitalization of restaurants depending on the technologies used in supply and the type of restaurant managed.

The Level of Digitalization of Restaurants According to the Technologies Used in Supply	**Type of Restaurant**				
	Fast-Food	**Casual Restaurant**	**Premium Restaurant**	**Cafe**	**Total**
2—Low Level	42.5%	17.5%	22.5%	17.5%	100.0%
3—Moderate Level	42.9%	28.6%	14.3%	14.3%	100.0%
4—High Level	22.2%	22.2%	22.2%	33.3%	100.0%
Total	39.3%	19.6%	21.4%	19.6%	100.0%

Source: Data from own research.

In Table 5 it is observed that restaurants with a low level of digitalization are the best represented, being usually associated with fast-food establishments (42.5%). The following types of restaurants have a lower level of digitalization as well: premium (22.5%) and cafe (17.5%). The moderate level of digitalization is found in a higher proportion in casual restaurants (28.6%). It is also noted that the high level of digitalization is mostly found in cafes (33.3%). A complete absence of the analyzed restaurants can be noted in the extreme

categories (level 1 and level 5). This distribution (Table 5) may suggest that the analyzed restaurants are still in the early stages of digitalization of supply processes.

O2. *Determining the relationship between the level of digitalization and concern for sustainability.*

Managers from 224 analyzed units (80%) declared that they implement sustainable measures in the supply chain and only managers from 56 restaurants (20%) out of the total of 280 declared that they do not implement such measures in the supply chain.

Next, the responding managers had the possibility to select multiple options regarding the sustainable strategies they apply in the supply process. The strategy entitled collaboration with suppliers that use biodegradable packaging was the most mentioned by the responding managers (70.5%). This was immediately followed by the purchase of certified organic/bio products (54.9%). It is noteworthy that the responding managers mentioned that they source from local suppliers to reduce their carbon footprint (33.9%), and 29.9% stated that they use digital technologies to optimize orders and reduce waste. These results may indicate an openness to concrete and visible digital solutions from a sustainable point of view (organic products, eco-friendly packaging).

Managers consider the supply chain (and its digitalization) to play an important role in ensuring the long-term sustainability of a restaurant, 75% of them indicated that a sustainable supply chain is very important, while 25% mentioned that it is important.

Furthermore, to investigate whether there is a certain relationship between the level of digitalization and the concern for sustainable aspects within the supply chain, a bivariate analysis was performed to identify the extent to which digitalization is associated with the environmentally responsible approach in the activity of the analyzed restaurants.

Following the results obtained, it is found that 79.9% of managers mentioned that they implement sustainable measures, and 20.1% stated that they do not. It is found that 80.4% of the restaurants analyzed do not use digital technologies in supply management, but still implement sustainable measures within the process. It is also observed that 78.6% of the managers of the responding restaurants stated that they use digital technologies for supply management and that they also implement sustainable solutions. Therefore, following the distribution of the answers, the question arises whether there is a statistically significant association between the use of digital technologies in the supply chain and the implementation of sustainable measures within this process (Table 6).

Table 6. Contingency table on the relation between digitalization and sustainability applied in the supply chain.

Does Your Restaurant Use Digital Technologies for Supply Management?	Does Your Restaurant Implement Sustainable Measures in Its Supply Chain?		
	No	**Yes**	**Total**
Yes	19.6%	80.4%	100.0%
No	21.4%	78.6%	100.0%
Total	20.1%	79.9%	100.0%

Source: Data from own research.

In order to verify Hypothesis 1 (there is a statistically significant association between the use of digital technologies and the implementation of sustainable measures in the supply chain) the Chi-Square test was applied (Table 7). The results obtained indicated an $\chi^2_{calculated}$ = 0.083 (df = 1), with a significance level of p-value = 0.773. Given that the p-value > 0.05, there is no statistically significant association between the two variables analyzed, and therefore H1 is rejected. Although these results do not indicate a significant relationship between sustainability and digitalization, Zaid et al. [75] showed that this con-

nection becomes relevant only when digitalization is accompanied by efficient information exchange and responsiveness within the supply chain.

Table 7. The Chi-Square test results for the association between the use of digital technologies and the implementation of sustainable measures in the supply chain.

	Chi-Square Tests				
	Value	**df**	**Asymptotic Significance (2-Sided)**	**Exact Sig. (2-Sided)**	**Exact Sig. (1-Sided)**
Pearson Chi-Square	0.083 [a]	1	0.773		
Continuity Correction [b]	0.009	1	0.923		
Likelihood Ratio	0.083	1	0.774		0.454
Fisher's Exact Test				0.848	
Linear-by-Linear Association	0.083	1	0.773		
N of Valid Cases	224				

[a] Zero cells (0.0%) have expected count less than 5. The minimum expected count is 11.25. [b] Computed only for a 2 × 2 table.

Managers believe that the supply chain plays an important role in ensuring the long-term sustainability of a restaurant, especially its digitalization. Thus, 75% of the managers interviewed stated that they have implemented sustainability measures in their restaurant through digital technologies.

The responding restaurant managers were asked, through a multiple-choice question, what types of sustainable measures they had implemented through the use of digital technologies. In this regard, the answers highlighted a diversity of practices. The most frequently adopted practice is the implementation of digital solutions to optimize transportation and reduce CO_2 emissions (74.4%), when it comes to sustainable measures implemented through digital technologies. The responding restaurant managers also mentioned in proportions of 63.7% the use of monitoring and analysis systems for resource consumption, and in proportions of 51.8% and 51.2%, the use of digital platforms for sourcing from local suppliers and digital inventory management to reduce food waste. To a lesser extent, digitalization of menus is implemented to reduce paper consumption (35.1%). Thus, it is mentioned that the results may indicate a trend of integrating digital technologies into the sustainable strategies of the analyzed restaurants.

It is found that the most frequently mentioned benefit in the study responses was increased energy efficiency and resource saving (61.9%). This benefit is immediately followed by optimizing supply and reducing product surplus (43.5%) and reducing operational costs (42.9%). Other benefits mentioned by respondents to the study are creating relationships with sustainable suppliers (36.9%) and reducing food waste (25.6%). It stands out that the least transparent benefit was increased transparency within the supply chain, as it was mentioned by only 13.7% of respondents. The results obtained may indicate that digital technologies are seen as a means of streamlining and reducing resources rather than a vector based on transparency or extended collaboration within the supply chain.

O3. *Identifying the main barriers that hinder digitalization in the restaurant supply chain in Romania.*

The analysis of the data allowed the classification of managers into four categories. Therefore, 35 managers fall into the *first category* of those who ***do not use digital solutions at all*** in the restaurant. Thus, the most common barrier identified was the difficulty of integration with existing systems (60%) and 40% mentioned that they do not consider digitalization necessary, and this may suggest a rather low perception of its benefits. Reasons that were mentioned by the responding managers include: high implementation

costs (20%), lack of digital skills of staff (20%), and, last but not least, resistance to change from employees.

The *second category* includes 224 managers, who ***use digital solutions in several operational processes*** of the restaurant but had different challenges in the digitalization process. Hence, the biggest challenge for the responding managers was employee resistance to change (48.7%). This challenge is immediately followed by the high costs of software (41.5%), lack of training of the employed staff (37.9%), integration with current digital systems (32.1%), and technical problems that are frequent (21%). These details are very important, because they actually reflect certain financial and educational barriers.

The *third category* includes 56 managers who ***use digital solutions only within the supply chain*** but have difficulties with implementation. Thus, 50% mentioned the lack of training of personnel to use digital systems, the lack of compatibility between systems (37.5%), and the reluctance of suppliers to adopt certain digital solutions (28.6%). Also, 25% mentioned the high cost of implementation and maintenance, and 26.1% mentioned the difficulties of integration with existing management systems (ERP, CRM).

The *fourth category* includes 168 managers who ***use digital solutions for sustainable purposes***. It is noteworthy that 34.5% of respondents assessed the process of digitization for sustainable purposes as very difficult and 32.7% stated that the process was moderately difficult.

O4. *Identifying the main factors influencing the adoption of digitalization in the supply chain.*

In order to highlight the main factors that can influence the adoption of digital solutions in the supply chain, items related to decision-makers and perceived benefits were considered. It is noted that this approach is justified, as these items are complementary. Decision-makers target important aspects such as costs, ease of use, market, or regulatory pressure, and perceived benefits include reducing food waste, improving the relationship with suppliers, and increasing product transparency and traceability. In order to better understand the main dimensions that influence the adoption of digital technologies in the supply chain, the answers provided to the two categories of items were analyzed.

Table 8 shows the descriptive statistics obtained for the items that assess the perception of the managers responding to the study regarding the importance of factors in adopting digital solutions within the supply chain. It is important to note that the level of importance of the factors was measured on a 5-point Likert scale, where 1 means not at all important and 5 means very important. Following the results obtained, it is clear that the most important factors perceived by the respondents are the following: the cost of technology (M = 4.2), ease of use (M = 4), and increased transparency and traceability of products (M = 4). Factors with a lower impact, but still perceived as important, are the following: reducing food waste (M = 3.55), pressure from the market or regulations (M = 3.47), and improving the relationship with suppliers (M = 3.08).

Furthermore, after identifying the factors that can influence the use of digital technologies within the supply chain, a Principal Component Analysis (PCA) was conducted in order to investigate the latent structure of these factors and to highlight the correlations between them.

In Table 9 it is observed that the KMO test provided a value equal to 0.541, indicating a medium level of adequacy. It is also observed that the Bartlett test indicated $\chi^2(15) = 541.693$, p-value < 0.05), so the results are statistically significant and Principal Component Analysis (PCA) can be performed.

In Table 10 it is observed that after applying the principal components analysis, two components were retained out of the ten analyzed. Therefore, the first component explains 38.94% of the total variance and the second component that was retained explains 22.25% of the total variance. It can be noted that both components explain 61.19% of the total variance.

Table 8. Descriptive statistics on factors influencing the adoption of digital technologies in the supply chain.

	Descriptive Statistics		
	Mean	**Std. Deviation**	**Analysis N**
The cost of technology	4.2000	0.74967	280
Ease of use	4.0000	0.63359	280
Market or regulatory pressure	3.4714	0.69244	280
Reducing food waste	3.5536	1.09609	280
Improving the relationship with suppliers	3.0893	1.01735	280
Increasing product transparency and traceability	4.0000	0.63359	280

Source: Data from own research.

Table 9. KMO and Bartlett's tests on factors influencing the adoption of digital technologies in the supply chain.

KMO and Bartlett's Test		
Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.541
Bartlett's Test of Sphericity	Approx. Chi-Square	541.693
	df	15
	Sig.	0.000

Source: Data from own research.

Table 10. Total variance explained for factors influencing the adoption of digital technologies in the supply chain.

Total Variance Explained									
Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	2.337	38.948	38.948	2.337	38.948	38.948	2.334	38.894	38.894
2	1.335	22.250	61.198	1.335	22.250	61.198	1.338	22.304	61.198
3	0.968	16.136	77.333						
4	0.735	12.258	89.592						
5	0.497	8.286	97.877						
6	0.127	2.123	100.000						

Extraction Method: Principal Component Analysis.

After the analysis of the principal components was carried out (Table 11), two clear directions were identified in the perception of the factors that can influence the decision of the responding managers to integrate digitalization in the restaurant supply chain. Therefore, it can be observed that the following variables contribute to the first identified component: *Technology cost* (0.886), *Ease of use* (0.722), and *Increasing product transparency and traceability* (0.911). These obtained results highlight a concern related to the accessibility, efficiency, and value of digital solutions from an economic and functional point of view. In this sense, the first identified component can be called "Internal factors of efficiency and technological transparency".

In the second identified component, the following variables predominate: *Market or regulatory pressure* (0.747) and *Improving the relationship with suppliers* (0.570). In this sense, it can be seen that these variables express external and relational influences and indicate a market evolution in accordance with the collaborations of social actors in the industry.

Finally, the second component can be called "External pressure factors and collaboration in the supply chain".

Table 11. The Rotated Component Matrix regarding the factors influencing the adoption of digital technologies in the supply chain.

Rotated Component Matrix [a]		
	Component	
	1	2
The cost of technology	0.886	−0.063
Ease of use	0.722	0.343
Market or regulatory pressure	0.189	0.747
Reducing food waste	0.403	−0.553
Improving the relationship with suppliers	−0.026	0.570
Increasing product transparency and traceability	0.911	−0.167

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. [a] Rotation converged in three iterations.

Therefore, two clear directions can be discussed. First, we discuss a direction that is more directed towards technological characteristics and internal perceptions of the entire digitalization process, and secondly, we discuss a direction directed towards the restaurant's relations with the business environment.

The following data was obtained: 65.5% of the responding managers stated they are actively analyzing new solutions to expand the use of various digital solutions in the direction of restaurant sustainability. It is observed that there is a fairly high inclination of restaurant managers towards integrating digitalization for sustainable purposes.

Based on the results obtained, the authors observed that the responding managers encountered difficulties in the process of digitalizing the restaurant supply chain. To better understand the nature of the difficulties, all managers in the sample were asked to evaluate a series of statements that actually represent barriers to the implementation of digital solutions in the supply chain. Considering the need to identify common patterns and the complexity of the responses, a Principal Component Analysis (PCA) was conducted. The purpose of this analysis was to highlight fundamental dimensions of the barriers perceived by the study respondents in the restaurant digitalization process.

Following the results obtained regarding the perceived barriers to adopting digital solutions in the supply chain, it was highlighted that "Lack of customized technological solutions for the restaurant industry" was identified as an important barrier in the perception of the respondents, with an average of 4.20 points on a scale from 1 to 5 (Table 12). Other important barriers perceived by the responding managers are "Lack of digital skills of the staff" (M = 3.80), "Difficulties in integrating digital technologies with existing systems" (M = 3.60), and "High initial investments for implementation" which recorded an average of 3.50 points.

In Table 13 it can be seen that the value of KMO is 0.565. From this it can be concluded that it has moderate adequacy, but it is acceptable for factor analysis. Also, the Bartlett test was statistically significant for ($\chi^2(10) = 383.775$, p-value < 0.05), so the Principal Component Analysis (PCA) can be performed.

It is found that, following the analysis, two principal components were retained out of the five analyzed. The first component explains 44.12% of the total variance and the second component explains 21.63% of the total variance. It is noted that both components explain 65.76% of the total variance (Table 14).

Table 12. Perceived barriers to adopting digital technologies in procurement.

	Descriptive Statistics		
	Mean	**Std. Deviation**	**Analysis N**
Lack of digital skills of staff	3.8000	1.60286	280
Difficulties in integrating digital technologies with existing systems	3.6000	0.49078	280
Employee resistance to change	3.0321	1.06207	280
High initial investments for implementation	3.5036	0.99820	280
Lack of customized technological solutions for the restaurant industry	4.2000	0.74967	280

Source: Data from own research.

Table 13. KMO and Bartlett's tests for principal components analysis regarding perceived barriers to the adoption of digital technologies.

KMO and Bartlett's Test		
Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.565
Bartlett's Test of Sphericity	Approx. Chi-Square	383.775
	df	10
	Sig.	0.000

Source: Data from own research.

Table 14. Total variance explained for perceived barriers to adopting digital technologies.

Total Variance Explained									
Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	2.206	44.127	44.127	2.206	44.127	44.127	1.945	38.904	38.904
2	1.082	21.637	65.764	1.082	21.637	65.764	1.343	26.860	65.764
3	0.988	19.760	85.524						
4	0.520	10.409	95.933						
5	0.203	4.067	100.000						

Extraction Method: Principal Component Analysis.

In Table 15 it can be seen that the principal components analysis highlighted two main components in the perception of barriers to the adoption of digital technologies within the supply chain. Therefore, the first component is made up of the following variables: Difficulties in integrating digital technologies with existing systems (0.876) and Lack of customized technological solutions for the restaurant industry (0.885). This identification may suggest a structural problem regarding the compatibility of digital solutions that are newer in the industry and the first component can be called "***Lack of adapted solutions and technological limitations***".

It can also be seen that the following variables contribute to the second component: Lack of digital skills of staff (0.762), Employee resistance to change (0.558), and High initial investments for implementation (0.625). In this case, it can be said that these variables reflect more human barriers, but also internal financial barriers. They also suggest a certain resistance on the part of the organization, while also indicating a lack of training of the staff employed to adapt to new technologies. The second component can be called "***Internal reserves and organizational barriers***". It is important to state that these results indicate different directions in the perception of barriers. Meaning that, one component is closely

related to external technological adaptability, while another component is more related to the internal preparation and openness of the restaurant actors towards change.

Table 15. Rotated Component Matrix of perceived barriers to adopting digital technologies.

Rotated Component Matrix [a]		
	Component	
	1	2
Lack of digital skills of staff	0.333	0.762
Difficulties in integrating digital technologies with existing systems	0.876	0.245
Employee resistance to change	0.402	0.558
High initial investments for implementation	−0.351	0.625
Lack of customized technological solutions for the restaurant industry	0.885	0.001

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. [a] Rotation converged in three iterations.

Furthermore, in order to deepen the analysis, a typology of restaurants was identified according to the level of digitalization applied to the supply chain and organizational features. To identify the level of digitalization applied to the supply chain, a synthetic indicator was built based on the responses regarding the digital sustainable measures implemented. This indicator was based on options such as digital inventory management to reduce food waste, the use of platforms for local suppliers, solutions for optimizing transportation and reducing CO_2 emissions, resource consumption monitoring systems, as well as the digitalization of menus. Therefore, this synthetic indicator highlighted a restaurant's capacity to actively integrate digital technologies to support environmental and restaurant sustainability and ultimately operational efficiency.

Based on the synthetic indicator that was mentioned and based on three other variables (type of restaurant and its size, expressed in number of employees and length of service in the industry), the TwoStep Cluster segmentation algorithm was used. Through this approach, the study authors created a typology of restaurants and laid a foundation for the analysis of managerial behaviors related to the digitalization of restaurant supply chain processes.

In Figure 2 it is observed that the algorithm automatically identified five clusters, and the criterion for selecting the ideal number of groups was the Bayesian indicator (BIC). It is noted that this approach allowed for a relevant, and also rigorous, segmentation of restaurants. The approach also provided a certain basis for the differentiated analysis of managerial behaviors that are related to the introduction of digital solutions in the supply chain, with an emphasis on the sustainability component.

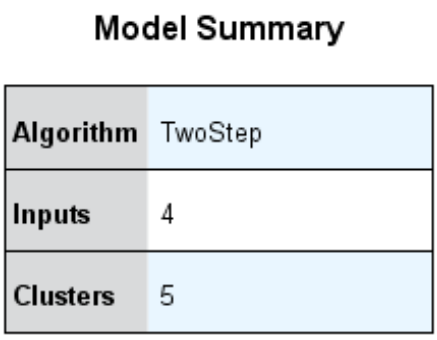


Figure 2. Summary of the TwoStep Cluster model applied to the level of digitalization and characteristics of restaurants. Source: Data from own research.

In Figure 3, a Silhouette value of over 0.5 can be observed. This indicates a satisfactory level of internal cohesion, but also of separation between the clusters created. It is important to state that in the specialized literature, if the Silhouette value is between 0.5 and 0.7, the structure is considered consistent [76], which shows that the respondents were grouped in a fairly coherent way within each determined cluster, and the differences between the groups formed are clear enough to support a different interpretation of them. Therefore, the value supports the validity of the segmentation model and suggests that the typologies determined following the analysis can be used to describe the differences between the analyzed restaurants in terms of strictly the level of digitalization they have and the organizational characteristics.

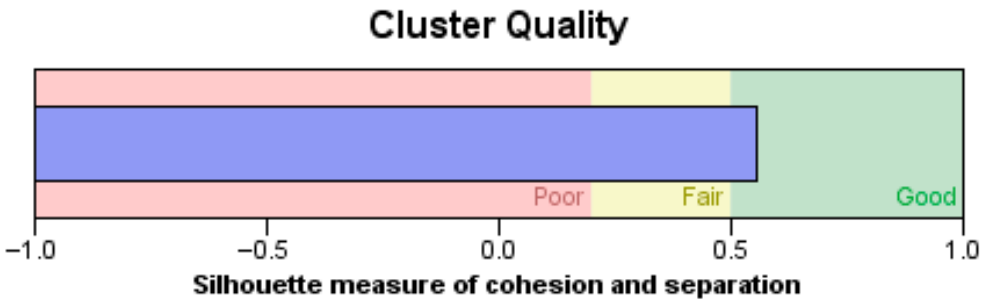


Figure 3. Silhouette measure for assessing the quality of clusters obtained by TwoStep Cluster Analysis. Source: Data from own research.

Following the TwoStep Cluster Analysis, five different clusters of restaurants were determined. It is stated that these were classified according to size, experience they have in the industry, type of restaurant, and the digital sustainable measures implemented. It was identified that all clusters have a moderate level of digitalization, as the averages obtained are between 2.97 and 3.35 points, on a scale from 1 to 5. This finding highlights quite well the need for relevant measures and policies, which would accelerate a direction from the moderate level of sustainable digitalization to the advanced level (Table 16).

Table 16. Organizational characteristics and level of digitalization of the supply chain based on sustainable measures for each identified cluster.

Cluster	Type of Restaurant	Size of Restaurant	Industry Experience	Digitalization Level (Based on Sustainable Measures)	
1	Cafe (100.0%)	1–5 employees	1–5 years (100.0%)	Mean =2.97	Moderate level of digitalization
2	Premium Restaurant (100.0%)	6–15 employees	Over 10 years	Mean =3.35	Moderate level of digitalization
3	Fast-food (100.0%)	Over 15 employees	6–10 years (100.0%)	Mean =3.26	Moderate level of digitalization
4	Fast-food (100.0%)	6–15 employees	6–10 years (100.0%)	Mean =3.24	Moderate level of digitalization
5	Casual Restaurant (100.0%)	6–15 employees	6–10 years (100.0%)	Mean = 3.12	Moderate level of digitalization

Source: Data from own research.

Finally, based on the results obtained, the authors propose a conceptual model through which restaurants can be classified according to the level of digitalization (Figure 4). This level of digitalization is also correlated with the sustainable measures adopted. It is important to note that this approach does not only aim at a descriptive segmentation of restaurants, but essentially provides an explanatory and integrated framework, which directly correlates the level of digitalization with the perceived barriers, the benefits that

have been identified, and the sustainable practices that have been implemented through the digital solutions adopted.

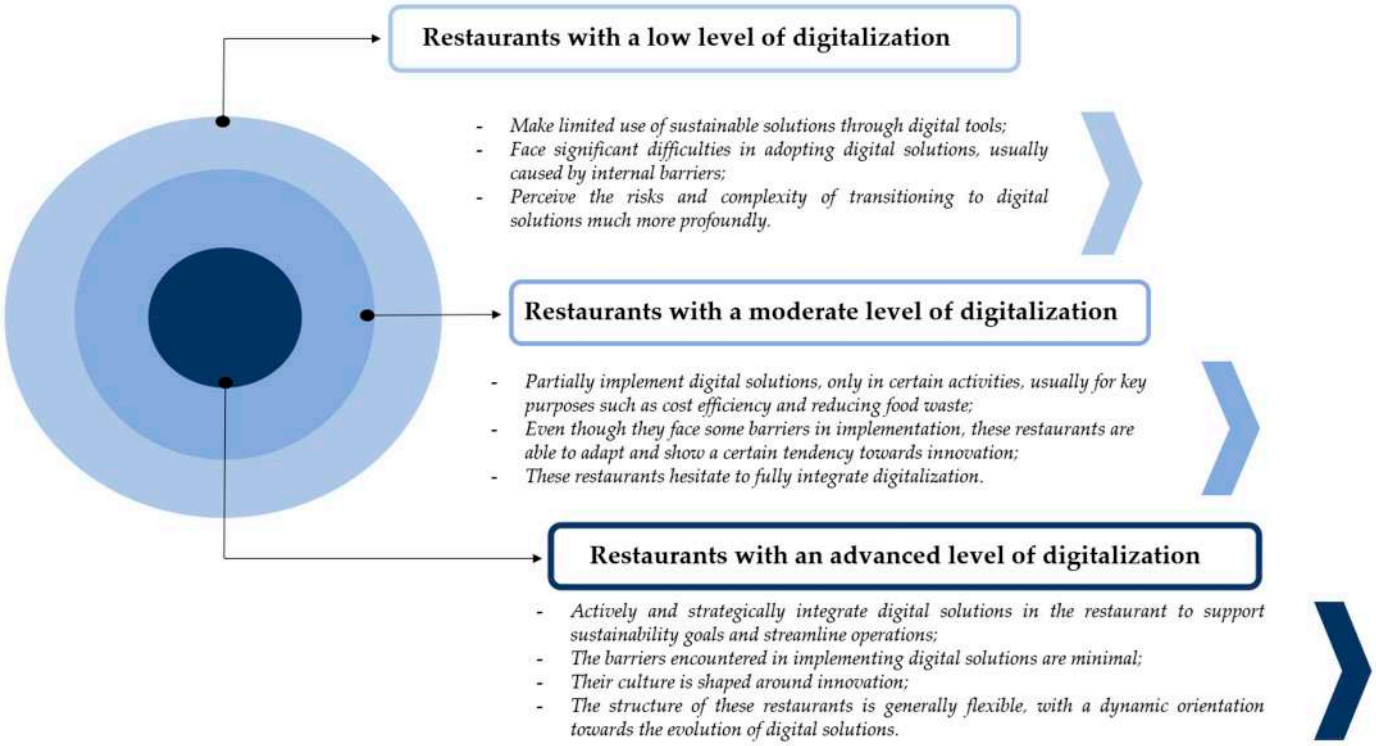


Figure 4. Classification of restaurants according to the level of digitalization. Source: Model proposed by authors.

Thus, the results obtained materialized and were highlighted in three different groups of restaurants (Figure 4).

First, we discuss restaurants that have a low level of digitalization. These restaurants have quite great difficulties in adopting digital solutions, that are usually caused by various internal barriers such as lack of digital skills, resistance to change on the part of employees, and lack of financial resources. Moreover, these restaurants perceive in a much deeper way the risks and complexity of switching to digital solutions. This can significantly limit the implementation of modern technologies in the supply chain or in other activities of the restaurant.

Secondly, we can mention restaurants that have a moderate level of digitalization. In this case, these restaurants partially implement digital solutions, but only in certain activities. They implement digital solutions for more specific purposes such as "cost efficiency" or in order "to reduce food waste". These restaurants, even if they have certain barriers in the process of implementing digital solutions, have a certain degree of adaptability and a tendency that is quite inclined towards innovation. At the same time, it is specified that these restaurants hesitate to fully integrate digitalization.

Finally, we can discuss restaurants that have an advanced level of digitalization. Restaurants that fall into this category actively and strategically integrate digital solutions, generally to support sustainable objectives and to streamline processes. The perceived barriers when implementing digital solutions are reduced by these restaurants, and their culture is deeply directed towards innovation. It is worth noting that the structure of these restaurants, which have an advanced level of digitalization, is generally flexible and has a dynamic direction towards the continuous evolution of digital solutions.

This classification made by the authors brings applicative and theoretical value. This is possible because it allows an advanced understanding of the different stages of digi-

talization in the restaurant sector. At the same time, the classification can facilitate the formulation of more specific interventions for the following different categories: public policies, professional training, and financial support. Finally, it can be said that this classification can represent a basis for continuous monitoring of digital progress over a long period of time among similar units.

5. Conclusions

Following the obtained results, it can be concluded that the digitalization process of the supply chain of the analyzed Romanian restaurants analyzed is at a relatively intermediate stage and has certain trends that lead to an evolution. Therefore, the study highlighted the fact that digitalization is used in the most essential processes of the analyzed restaurants (relations with suppliers, inventory management, payments), but is little implemented in the components that target the direct relationship with the buyer or the supply area. Even though a fairly large number of the analyzed restaurants use digital solutions, especially artificial intelligence for order optimization, the level of digitalization of the supply process still remains quite low.

These results are also supported by the study conducted by Radu Rugiubei and Florina Pînzaru [77], which showed that supply chain practices are partially digitalized and require constant development and improvement—a finding that is likewise confirmed by the research carried out for the present article.

From the point of view of sustainability, the vast majority of the responding restaurants indicated that they implement sustainable measures in this direction, but no statistically significant relationship was identified between digitalization and sustainability. In other words, it was found that managerial perception had only began to recognize a relatively positive role of technology in promoting sustainable practices. However, there are studies in the specialized literature that have managed to demonstrate this phenomenon, for example, the article *How Digitalization Drives Supply Chain Performance in the Romanian Industry: The Roles of Sustainability, Resilience, Risk Management, and Integration* [69], shows that digitalization exerts a significant positive influence on sustainability.

Simultaneously, barriers that hinder digitalization were also highlighted; these are organizational, which include low skills and resistance to change on the part of employees, and structural, which include the lack of adapted solutions and integration with existing systems. It was also observed that the main factors that can influence the adoption of digital technologies were perceived from the perspective of external pressures and from the perspective of internal efficiency.

Finally, the classification of restaurants, which was carried out according to the level of digitalization, highlighted a need for differentiated policies, adapted to the current level of digitalization of each restaurant analyzed, with a particular emphasis on financial support and continuous professional training.

These results are important and valuable for entrepreneurs and managers in the HoReCa industry, who can understand more clearly and concisely how they can integrate digital solutions into their strategies regarding sustainability. At the same time, the results are essential for consultations in digital transformation for suppliers and for those who are clearly interested in a more efficient and responsible supply chain.

This study has certain **limitations** that need to be mentioned. First, the research was conducted on a limited sample, and the sampling method was non-probabilistic, which means that the results cannot be extrapolated to the entire HoReCa industry in Romania. Nevertheless, the results remain valuable for the academic world, but also for restaurant managers, because they reveal a series of realities that the restaurant industry faces in the Romanian market. Moreover, because only one country was studied, it is only possible to

present the particularities of this market. Second, the approach was exclusively quantitative, and this did not allow for a deep understanding of the reasons and contexts behind the answers provided by the respondents. It is also noted that the opinions of suppliers were not included. Their opinions could have provided a more complete perspective on the relationships created in the supply chain. Thus, these aforementioned aspects can be taken into consideration for future research, in which a qualitative dimension or comparison data between different restaurants can be explored.

Author Contributions: Conceptualization, A.G., N.A.N., S.B. and A.Z.; methodology, A.G., N.A.N., S.B. and A.Z.; data curation, A.G.; data validation, A.G.; investigation, A.G., N.A.N., S.B. and A.Z.; resources, A.G., N.A.N., S.B. and A.Z.; writing—original draft preparation, A.G., N.A.N., S.B. and A.Z.; writing—review and editing, A.G., N.A.N., S.B. and A.Z.; visualization, A.Z.; supervision, N.A.N.; project administration, N.A.N.; funding acquisition, S.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Transilvania University of Brasov, Romania.

Institutional Review Board Statement: The study complied with the Declaration of Helsinki and all relevant academic ethics guidelines. This research does not incorporate, collect, process, or relate to sensitive personal data; therefore, there is no applicable institutional provision. However, the completion of the questionnaires was held under the condition of informed consent.

Informed Consent Statement: All study participants were informed and assured of anonymity. The data are used for statistical purposes only. No approval from the ethics committee was required.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: The authors express their gratitude to the anonymous reviewers for their insightful comments and helpful suggestions, which greatly enhanced the quality of this manuscript. Throughout the manuscript's preparation process, ChatGPT 5.1 (OpenAI, San Francisco, CA, USA) was used as a support tool to refine some sections of the text, without replacing the contribution of the authors. The final content was fully reviewed, verified, and validated by the authors, to ensure the scientific accuracy and academic integrity of the paper.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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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

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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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Citation: Zamfirache, A.; Suciu, T.; Anton, C.E.; Albu, R.-G.; Ivasciuc, I.-S. The Interest Shown by Potential Young Entrepreneurs in Romania Regarding Feasible Funding Sources, in the Context of a Sustainable Entrepreneurial Education. *Sustainability* **2023**, *15*, 4823. https://doi.org/10.3390/su15064823

Academic Editors: Anderson Rei Galvão, Carla Mascarenhas, Carla Susana Marques, Alexandra Braga and Vítor Braga

Received: 1 February 2023
Revised: 27 February 2023
Accepted: 6 March 2023
Published: 8 March 2023

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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.

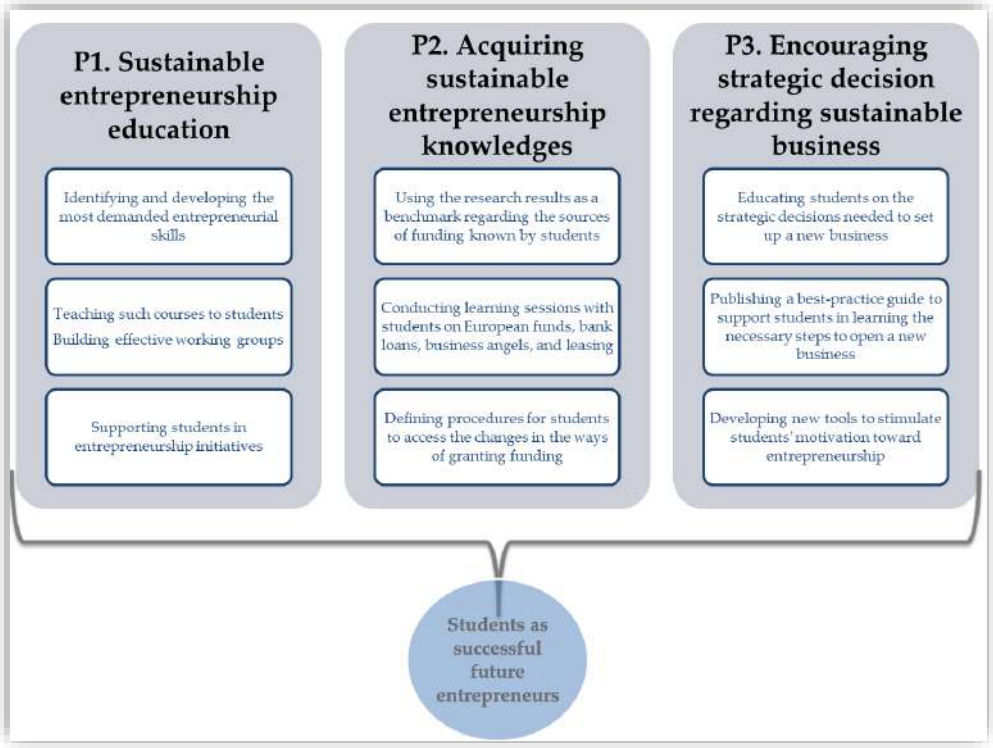


Figure 2. Program proposal to support entrepreneurship among students as seen by the authors. Source: Developed by the authors.

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.

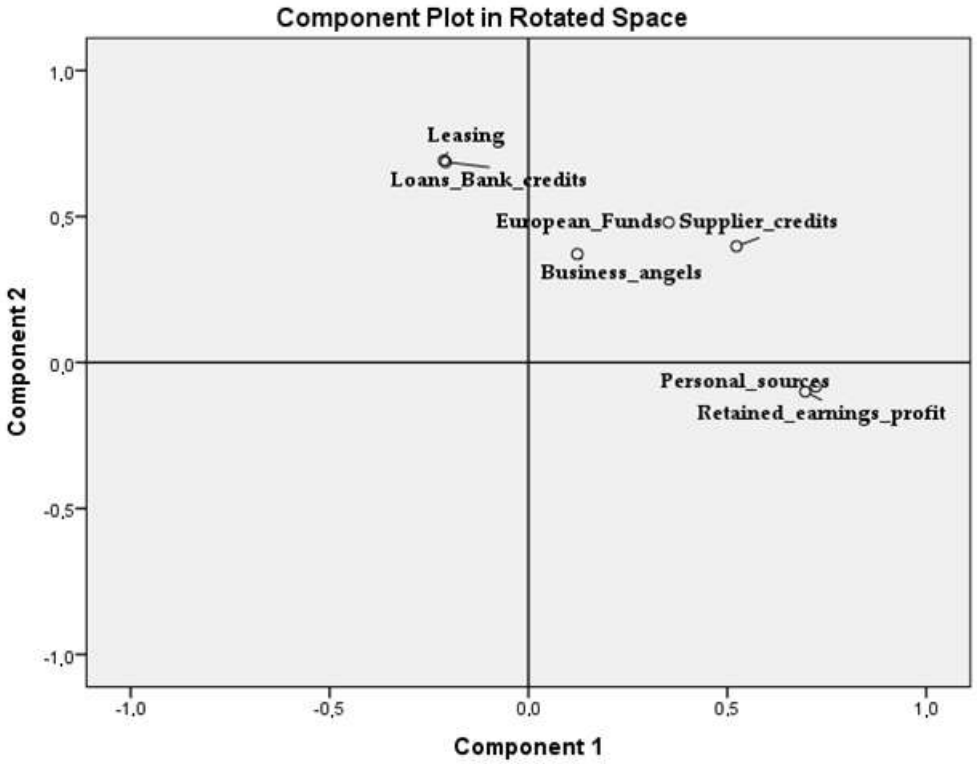


Figure 3. Graphical representation of the association between variables and factors. Source: Author's calculation based on collected data.

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.

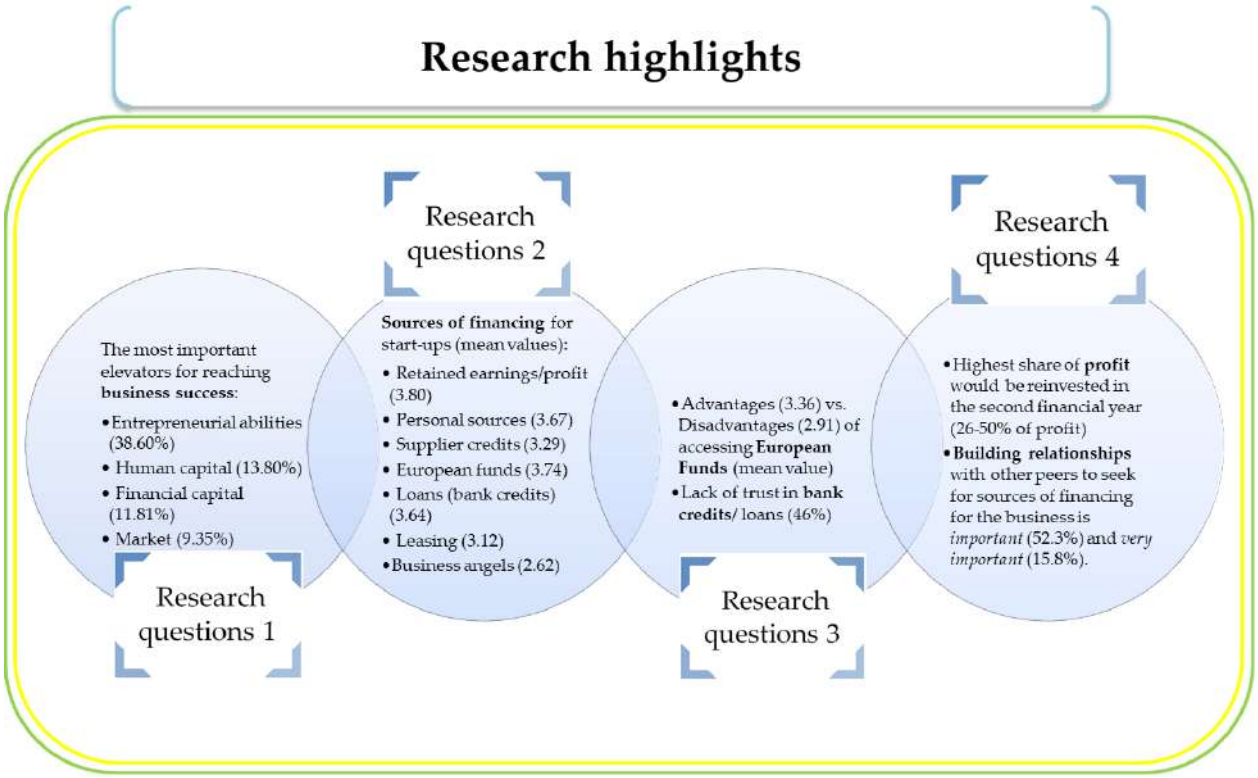


Figure 4. Overview of the main research conclusions. Source: Developed by the authors.

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).

Author Contributions: Conceptualization, C.E.A., T.S. and A.Z.; methodology, A.Z., C.E.A., T.S. and R.-G.A.; software, A.Z.; writing—original draft preparation, A.Z., T.S., C.E.A., R.-G.A. and I.-S.I.; writing—review and editing, A.Z., T.S., C.E.A., R.-G.A. and I.-S.I.; visualization, A.Z., T.S., C.E.A., R.-G.A. and I.-S.I.; supervision, C.E.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by TRANSILVANIA UNIVERSITY OF BRAȘOV.

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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