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COLLABORATIVE ACTIONS TO SUPPORT SMES' SUSTAINABILITY IN TIMES OF CRISIS

Alexandra ZAMFIRACHE [1]✉, Camelia-Cristina DRAGOMIR [1,2], Ruxandra-Gabriela ALBU [1], Tiberiu FORIS [1]

[1]*Department of Management and Economic Informatics, Faculty of Economic Sciences and Business Administration, Transilvania University of Brasov, Brasov, Romania*
[2]*Academy of Romanian Scientists, Bucharest, Romania*

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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.

✉Corresponding author. E-mail: ***alexandra.zamfirache@unitbv.ro***

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

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.

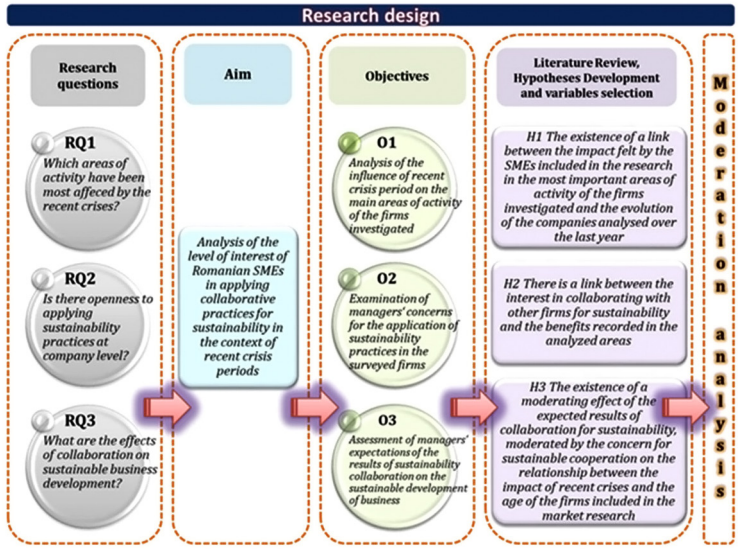


Figure 1. Research design

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 ($R^2 = 0.407$, $F(7, 664) = 65.180$, $p = 0.000$).

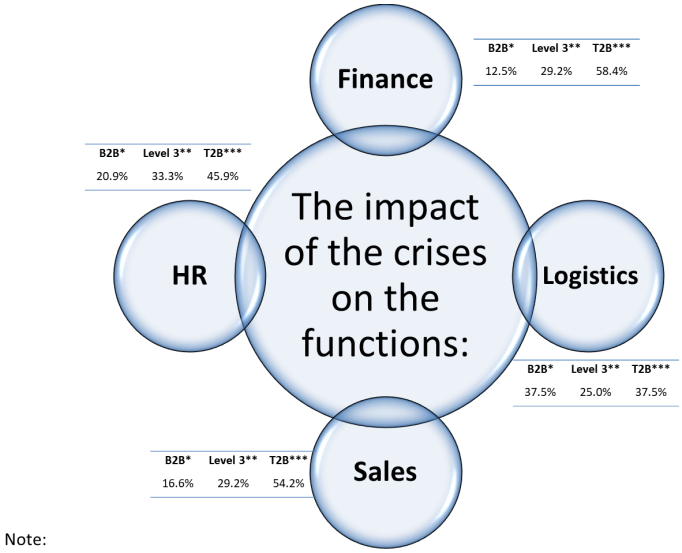
4. Results

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



Note:
* B2B = Bottom Two Box (sums the response variants of level 1 = less felt impact and level 2)
** Level 3 is the middle of the scale
*** T2B =Top Two Box (sums the reponse variants of level 4 and 5 = most frecquently felt impact)

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.

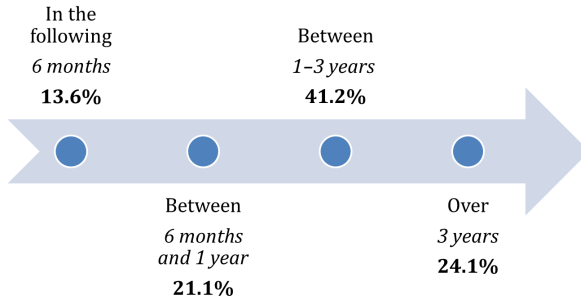
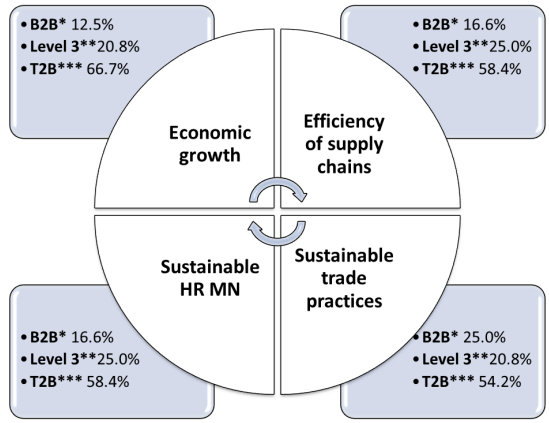


Figure 3. The time horizon in which company managers intend to initiate collaborative partnerships aimed at sustainable company development

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.

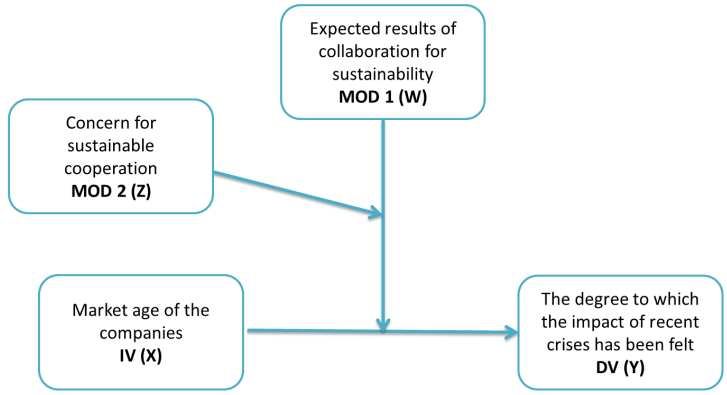


Figure 5. Regression model

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.

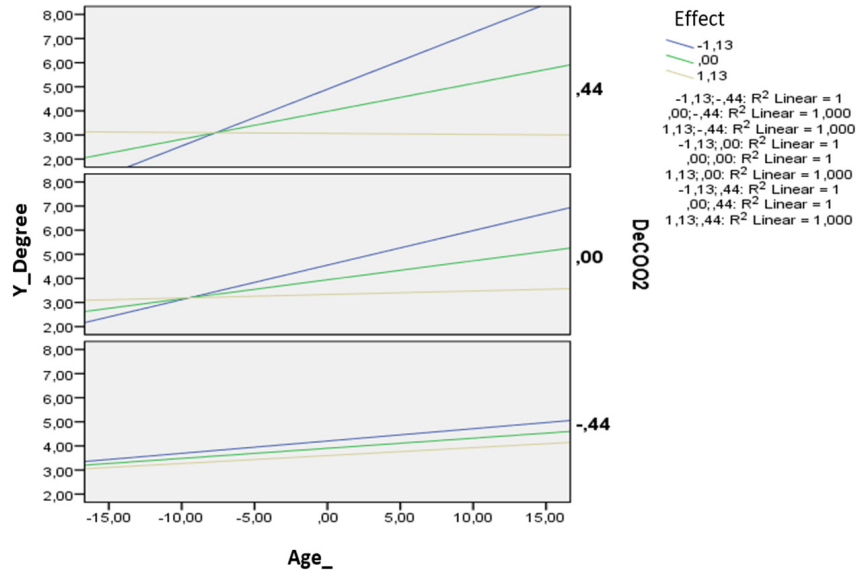


Figure 6. Graphical representation of the moderation effect

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.

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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.

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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