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Exploring the Dynamic Fusion of Cutting-Edge Technologies Associated with Industry 4.0 and Social Entrepreneurship in Emerging Europe

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Abstract: This article addresses a gap in the literature regarding corporate management in Eastern Europe during over three decades of reforms. This research reveals the influence of corporate management in Industry 4.0 on economic growth and social entrepreneurship in Eastern European countries. A combination of the regression analysis method and the least squares method is used to determine the influence of microeconomic factors connected with corporate management on economic growth in Industry 4.0 and to perform Pareto optimization of these microeconomic factors for the simultaneous achievement of economic growth and development of social entrepreneurship in these countries. The paper includes indicators of corporate management practices and identifies governance factors that influence economic growth in Eastern Europe while also contributing to social entrepreneurship. It explores the unique aspects of Industry 4.0 corporate management and emphasizes that optimizing corporate governance is a crucial response to managing regional economic crises. The article demonstrates that more than thirty years of economic transformation in Eastern Europe have produced positive results, challenging current scholarly perspectives that downplay the role of corporate governance. Improving corporate management by increasing the business disclosure index and reducing the number of companies facing losses due to theft and vandalism can enhance the effectiveness of Industry 4.0 technologies in social entrepreneurship. This approach can also provide a significant anti-crisis impact on the economies of Eastern European countries.

Keywords: social entrepreneurship; Industry 4.0; digital technologies; Eastern Europe; COVID-19 pandemic; sustainable development

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1. Introduction

Rapid technological advancements and various crises have significantly impacted economies, particularly in developing countries and Eastern Europe. State regulators' efforts to stabilize these circumstances through the management of Industry 4.0 have yielded limited success. Nevertheless, these initiatives have encouraged economic growth and fostered social entrepreneurship activities vital to sustainable development. Establishing a new management approach for Industry 4.0 is essential to create a comprehensive impact, including mitigating economic crises and promoting sustainable development

through social entrepreneurship [1–3]. This necessity has sparked a fascinating quest to identify innovative management strategies suitable for the Industry 4.0 era. This new approach should shift the focus from macroeconomic to microeconomic factors related to corporate management.

The third decade of the 21st century represents a data-driven era focused on sustainability. The current context in the new history of the economy and business is illuminated by the potential of technological progress [4–6]. Therefore, it is essential to evaluate the promising applications of emerging technologies of Industry 4.0 in social entrepreneurship, which not only contributes to implementing the sustainable development goals but also holds the potential to revolutionize the field [7–10].

Industry 4.0 and high-tech innovations opened new opportunities for the SDGs to be integrated into the economy of last-mile operations. Industry 4.0 enables revolutionary changes, ensuring an unprecedented connection between brands and consumers via voice assistants, smart assistants, and geolocational tracking of the delivery process, including unmanned transport. The combination of high technologies as the embodiment of the dominance of market relations and commercial interests with the SDGs is unique in each type of economic system [11–14].

Sustainable development requires thorough investigation, as Eastern European countries share a common culture yet are paradoxically affected by the pace of economic progress and the shift to new technologies. After 30 years of economic transformation in Eastern Europe, corporate management needs even more microeconomic changes to compete regionally and internationally. Countries must focus on competitiveness, whereas microeconomic factors must remain wide-ranging. Corporate restructuring involves firms selling parts of their operations and divisions; some profound reforms have been withdrawn because of the pandemic, and significant investment decisions have been deferred.

There is often closer scrutiny of firms having strategic business units delivering scanty results in times of stress. Topical issues and features of corporate governance in Eastern Europe are shown in [15–20]. However, while most planned Mergers and Acquisitions (M&As) were postponed, if not canceled altogether, divestitures of poorly performing business units continued during 2020–2021. The profile is that equity/stock markets dropped dramatically, reaching a nadir in the middle of March 2020. However, in a remarkable indicator of the need for long-term investors not to panic, by September 2020, many of the broad market indices were back near their record levels of February 2020. Whether this stands for rational expectations of a rapid recovery of most economies and a V-shaped COVID-19 global recession or irrational exuberance, only time will tell.

Industry 4.0, as discussed by [21–23], highlights the importance of aligning business interests and economic growth objectives with non-profit initiatives and sustainable development goals. This paper explores corporate management's impact in Industry 4.0 on economic growth and social entrepreneurship in Eastern Europe. Corporate management has undergone significant changes over the past 30 years of transformation. However, key microeconomic factors crucial to understanding economic growth and social entrepreneurship have not been thoroughly studied. This research examines the role of corporate management in fostering sustainable economic development in these markets.

This paper develops a theoretical methodology. It explores the potential of social entrepreneurship business models in the new data-driven era brought about by the emerging technologies of Industry 4.0. The research identifies a promising Pareto optimal solution specifically for the Emerging Europe region, aimed at maximizing economic growth and fostering the development of social entrepreneurship in the area. An algorithm and practical recommendations help achieve this Pareto optimum in Emerging Europe. The core idea is to shift the responsibility for economic growth and the advancement of social en-

trepreneurship from government to the business sector. This transition would alleviate the financial burden on national budgets and enhance the flexibility of Industry 4.0 initiatives. The paper concludes with final remarks summarizing the findings.

2. Theoretical Background

This paper builds on corporate entrepreneurship theory in Industry 4.0 [24–31]. The current literature reflects the essence and methodological evolution of corporate management and capabilities [32,33] when applied to the 30-year experience of corporate management reforms in Eastern Europe.

Many scholars [34–36] note that adopting Industry 4.0 drives companies' global strategies and increases the value of their products and services. Modern companies actively implement new technologies to improve their business models, and advantages for sustainability are a top priority [37,38].

Operations management theory and practice were studied by [39–52].

Likewise, Eastern Europe's corporate management approaches are poorly studied. Specifics of economic growth in Eastern Europe are in [53–62]. These works illustrate the differences in economic growth and vectors while also revealing current management practices in Industry 4.0 across Eastern Europe:

- Implementation of national projects to modernize production complexes by subsidizing their transition to Industry 4.0 from the national budget, specifically for the mining industry and energy sectors;
- Stimulation of the innovative activity in processing industries for import substitution and strengthening of their global digital competitiveness, which is peculiar to the high-tech industry;
- Improvement of accessibility of state services through the development of the e-government system;
- Institutional support for developing social entrepreneurship in online commerce can enhance the accessibility of goods for low-income populations. This support expands opportunities for the growth of a sharing economy based on electronic marketplaces;
- Creation of national digital platforms to promote social entrepreneurship services with the help of electronic non-commercial marketing.

The issues of corporate management and its microeconomic approaches have been studied widely, e.g., [63–74].

Specific issues of corporate management in Eastern Europe are found in [75–88].

Still, the literature has not figured out the extent of corporate management's contribution to the economic growth of new market economies in Industry 4.0. It also has only superficially examined the cause-and-effect relationships of corporate governance, economic development, and competitiveness. Another drawback in the economic literature relates to the experience of emerging market economies, in particular in Eastern Europe [89–91].

In Industry 4.0, non-human actors actively influence firms' activities and decentralized decision-making processes [92]. Corporate entrepreneurship functions and develops in the new context of Industry 4.0. The market pressure on social entrepreneurship, which faces a difficult choice, is exceptionally high. First, social entrepreneurship must choose between financial stability and competitiveness during the transition to Industry 4.0 [93,94]. However, social entrepreneurship's activities are particularly acute due to limited financial sources and increased expenditures due to socially significant, non-commercial projects.

In general practice, corporate entrepreneurship's financial resources can be either preserved to support financial leverage or spent to implement the digital technologies

of Industry 4.0 [95]. Social entrepreneurship has an even more difficult choice between implementing socially essential projects and promoting digital competitiveness [96].

Second, the usage of artificial intelligence should rationalize decision-making. Social entrepreneurship activities are knowingly irrational [97,98]. Social entrepreneurship voluntarily refuses a part of received or foregone earnings in favor of society [99,100]. Due to this, [101–105] state that economic growth and social entrepreneurship development in Industry 4.0 are achieved thanks to state regulation.

Overcoming such an inconsistency regarding Eastern Europe has not been elaborated on sufficiently, and this article is meant to fill this gap. The revealed literature gap accounts for our research questions:

1. What microeconomic factors (related to corporate governance) determine economic growth in Eastern Europe in Industry 4.0?
2. How can Industry 4.0 foster economic growth and promote social entrepreneurship in Eastern European countries by effectively managing these factors?

Based on the works by [106–112] and on the international experience of various countries participating in the Fourth Industrial Revolution, this paper offers the following response: a hypothesis that microeconomic factors connected with corporate management—shadowization of business, rationality of personnel selection, legal protection of business, accessibility of state services, reliability of infrastructural support, and complexity of implementation of foreign economic activities—regulate the economic growth, and that optimization of microeconomic factors allows for the simultaneous achievement of economic growth and development of social entrepreneurship.

H1. *Microeconomic factors connected with corporate management regulate economic growth, and optimization of microeconomic factors allows for the simultaneous achievement of economic growth and development of social entrepreneurship.*

The paper suggests that corporate management's microeconomic practices significantly influence Eastern Europe's economic competitiveness. It supports this assertion through the theory of corporate management optimization, underscoring the importance of implementing emerging data-driven technologies in social entrepreneurship within the new digital landscape of Industry 4.0.

3. Methodology

The research is developed in three successive stages. First, the determinants of corporate management in Eastern Europe are compared to developed markets. Then, we figure out the influence of corporate governance on Eastern Europe's economic growth. After this, we elaborate on recommendations for Eastern Europe's growth rates by employing corporate management optimization.

The advantages of these methods were the rationale for choosing economic and mathematical modeling. This methodology helps establish the cause-and-effect relationships and changes in the studied economic processes. The advantage of the regression model is its applicability for optimization. Due to this, the combination of the regression analysis method and the least squares method reveals the interdependence of the studied indicators and their optimal combination for research purposes.

These methods are used to check the offered hypothesis by determining the influence of microeconomic factors connected with corporate management—shadowization of business, rationality of personnel selection, legal protection of business, accessibility of state services, reliability of infrastructural support, and complexity of implementation of foreign economic activities—on economic growth in Eastern European in Industry 4.0, as well as to perform

Pareto optimization of these microeconomic factors, for the simultaneous achievement of economic growth and development of social entrepreneurship in these countries.

According to this paper's regression and least squares methods, calculations are performed in the Microsoft Excel analysis package. The hypothesis is assessed using the following model:

$$\begin{cases} y_1 = a_1 + b_{11} \times x_1 + b_{12} \times x_2 + \ldots + b_{n1} \times x_n; \\ y_2 = a_2 + b_{21} \times x_1 + b_{22} \times x_2 + \ldots + b_{n2} \times x_n, \end{cases}$$

where

y_1—economic growth;
y_2—Social Entrepreneurship Index;
a—constant;
b—regression coefficient with factor variable;
x_1, x_2, … x_n—preselected corporate governance factors positively affecting economic growth.

The hypothesis is demonstrated if a combination (Pareto optimum) of factor variables x_1, x_2, … x_n is found. This will increase the rate of economic growth (y_1) and develop social entrepreneurship (y_2).

We have selected the evaluation indicators from the World Bank. Unlike the indicators used in the annual Doing Business, which the World Bank scrapped in September 2021 due to an external review of data irregularities, this paper includes indicators that characterized corporate management practices directly. The indicators for the characteristics of corporate management are as follows:

- Shadowization of business (A): the business extent of disclosure index (a_1), companies that hide revenues from taxation (a_2), aggregate tax rate (a_3);
- Rationality of personnel choice (B): companies with a top female manager (b_1);
- Legal protection of business (C): companies making unofficial payments to government workers (c_1), losses from stealing and vandalism (c_2), index of the legal protection of business (c_3);
- Accessibility of state services (D): time spent on following state regulators' requirements (d_1), the average time needed for a new business (d_2), and newly registered companies (d_3);
- Reliability of infrastructural supply (E): lost profit from electric supply failures (e_1), index of the effectiveness of logistics (e_2);
- Complexity of conducting foreign economic activities (F): average time spent on imports (f_1) and exports (f_2).

Verifying the research hypothesis envisages a positive regression. Using data from 2020, we studied Russia, Bulgaria, Hungary, Moldova, Poland, Romania, Slovakia, and the Czech Republic. Deviations are calculated as the percentage ratio between each country's absolute value and the arithmetic mean of the sample. This method of calculating deviation offers the advantage of determining individual deviations for each country, highlighting their specific characteristics. This approach ensures that our conclusions and recommendations are practically relevant. Additionally, the calculation of deviations reveals the overall variation of values among the countries, reflecting the general deviation from the average value across the sample while still considering the unique aspects of each country (Table 1).

Revealed deviations in Eastern Europe are in Table 2.

Table 1. Indicators of economic growth and corporate management in 2020.

Indicator	Russia	Bulgaria	Hungary	Moldova	Poland	Romania	Slovakia	Czech Republic
a_1, 0–10	6.0	10.0	2.0	7.0	7.0	9.0	3.0	2.0
a_2, % of firms	40.7	16.4	40.4	41.4	44.6	26.3	20.4	54.9
a_3, % of commercial profits	7.3	4.9	9.4	8.7	14.5	15.6	9.1	5.2
b_1, % of firms	24.0	29.0	22.0	19.0	28.0	20.0	23.0	16.0
c_1, % of firms	16.6	13.4	20.2	12.5	10.4	18.7	25.3	19.9
c_2, % of firms	14.0	10.0	10.0	13.0	9.0	17.0	9.0	20.0
c_3, 0–12	9.0	8.0	9.0	8.0	7.0	9.0	7.0	7.0
d_1, % of senior management time	5.6	10.5	10.4	9.8	7.7	15.8	16.5	13.2
d_2, days	10	23	7	4	37	20	22	25
d_3, number	317.468	45.683	24.252	4.801	36.879	94.244	19.720	30.336
e_1, % of sales for affected firms	0.3	0.9	0.2	1.1	0.5	1.3	0.6	0.3
e_2, 1 = low to 5 = high	2.76	3.03	3.42	2.46	3.54	3.12	3.03	3.68
f_1, days	5.0	2.0	3.0	32.0	1.0	2.0	3.0	5.0
f_2, days	3.0	2.0	1.0	25.0	1.0	2.0	2.0	7.0
y_1, %	−2.951	−4.154	−4.957	−6.969	−2.720	−3.859	−4.754	−5.794
y_2, points 1–100	61.147	38.763	34.373	34.302	46.651	38.515	34.700	38.401

Source: Compiled by the authors based on [113–115].

Table 2. Deviations in 2020.

Sphere of Corporate Management	Indicator	Average	Deviation							
			Russia	Bulgaria	Hungary	Moldova	Poland	Romania	Slovakia	Czech Republic
Shadowization of business (A)	a_1, 0–10	5.75	1.04	1.74	0.35	1.22	1.22	1.57	0.52	0.35
	a_2, % of firms	35.64	0.88	2.17	0.88	0.86	0.80	1.36	1.75	0.65
	a_3, % of commercial profits	9.34	1.28	1.91	0.99	1.07	0.64	0.60	1.03	1.80
Rationality of personnel selection (B)	b_1, % of firms	22.63	4.17	5.00	3.83	3.30	4.87	3.48	4.00	2.78
Legal protection of business (C)	c_1, % of firms	17.13	1.03	1.28	0.85	1.37	1.65	0.92	0.68	0.86
	c_2, % of firms	12.75	0.91	1.28	1.28	0.98	1.42	0.75	1.42	0.64
	c_3, 0–12	8.00	1.57	1.39	1.57	1.39	1.22	1.57	1.22	1.22
Accessibility of state services (D)	d_1, % of senior management time	11.19	2.00	1.07	1.08	1.14	1.45	0.71	0.68	0.85
	d_2, days	18.50	1.85	0.80	2.64	4.63	0.50	0.93	0.84	0.74
	d_3, number	71.67	5.00	5.00	4.22	0.83	5.00	5.00	3.43	5.00

Table 2. *Cont.*

Sphere of Corporate Management	Indicator	Average	Deviation							
			Russia	Bulgaria	Hungary	Moldova	Poland	Romania	Slovakia	Czech Republic
Reliability of infrastructural supply (E)	e_1, % of sales for affected firms	0.65	2.17	0.72	3.25	0.59	1.30	0.50	1.08	2.17
	e_2, 1 = low to 5 = high	3.13	0.48	0.53	0.59	0.43	0.62	0.54	0.53	0.64
Complexity of conducting foreign economic activities (F)	f_1, days	6.63	1.33	3.32	2.21	0.21	5.00	3.32	2.21	1.33
	f_2, days	5.38	1.79	2.69	5.00	0.22	5.00	2.69	2.69	0.77

Source: Calculated by the authors.

4. Results

We apply a quantitative-qualitative approach to examine how traditional challenges in corporate entrepreneurship are reduced due to technological advances. First, comparing the average values of corporate management indicators in Eastern Europe to these indicators' average values is necessary. For these indicators (positive phenomena in the economy), higher values are better (business extent of disclosure index, firms with a top female manager, strength of legal rights index, new businesses registered, logistics performance index: overall), and the factual values/direct average values ratio is calculated for the selected countries.

For the indicators for which a lower value is better (c_1, c_2, d_1, d_2, e_1, f_1, and f_2), the direct average values/factual values ratio is calculated. All values that exceed 5 are set equal to 5 to avoid data distortion (when the values of specific indicators exceed other indicators' values and ensure all the indicators' compatibility). This allows for the accuracy of the evaluation to be increased and the model's errors to be minimized. A polygon of competitiveness of corporate management in Eastern Europe is shown in Figure 1.

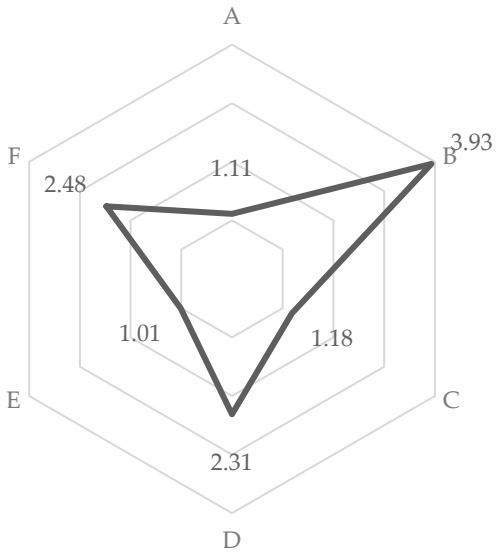

Figure 1. Polygon of competitiveness of corporate management in Eastern Europe. Source: calculated and built by the authors.

Figure 2 shows the correlation analysis of data by columns from Table 1. We use the correlation analysis from Figure 2 to select the significant corporate management factors. Only three corporate management factors positively influence economic growth (y_1):

- a_1, whose cross-correlation with the economic growth rate equals 18.55%;
- c_1, whose cross-correlation with the economic growth rate equals −31.00%;
- c_2, whose cross-correlation with the economic growth rate equals −20.29%.

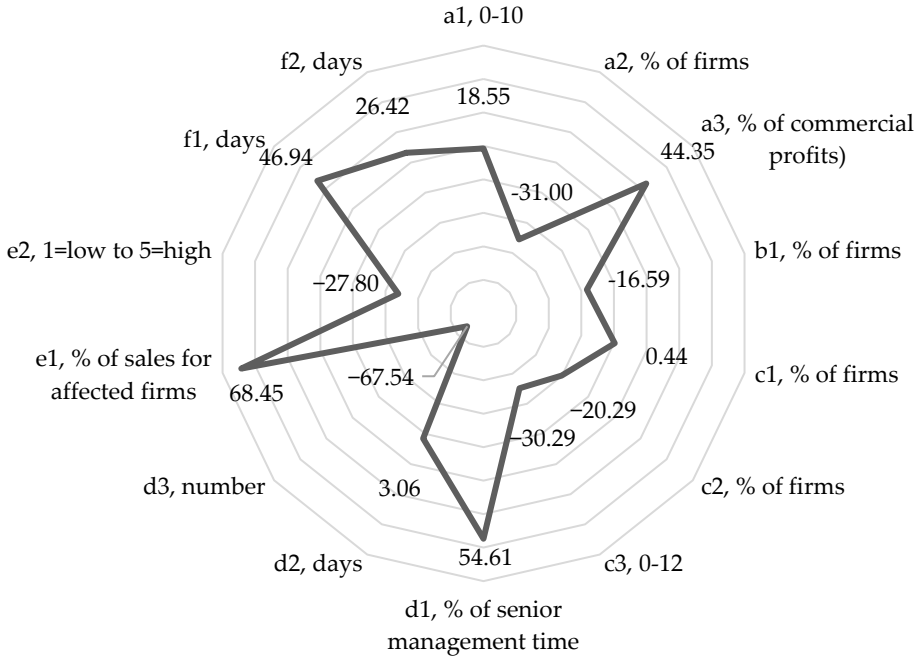

Figure 2. Correlation between the components of corporate management and economic growth in Eastern Europe in 2020, %. Source: calculated and built by the authors.

The regression dependence function:

$$\begin{cases} y_1 = -4.61 + 0.16 \times a_1 + 0.01 \times c_1 - 0.10 \times c_2; \\ y_2 = 24.81 + 1.23 \times a_1 + 0.33 \times c_1 - 0.22 \times c_2, \end{cases}$$

According to the model of multiple linear regression, we notice three econometric dependencies:

- An increase of a_1 by 1 point leads to a rise in the rate of economic growth (y_1) by 0.16% and an increase in the Social Entrepreneurship Index by 0.16 points;
- A decrease of c_1 does not have a positive impact on economic growth and the Social Entrepreneurship Index;
- Decreasing c_2 by 1 point leads to a rise in economic growth (y_1) by 0.10% and an increase in the Social Entrepreneurship Index by 0.22 points.

The values of the determination coefficient $R_1 = 0.4165$ and $R_2 = 0.4270$ show that the change in the dependent variable (y_1) is 41.65%, explained by the factor variable (x); the change in the Social Entrepreneurship Index (y_2) is 42.70%, explained by the factor variable (x)—the correlation of indicators is relatively high.

To achieve socio-economic development, the economic growth rate in our sample countries must reach at least 5.55%, as stated by [116–118]. This is necessary to converge on the global average and reduce inequality. This enables our optimization task:

- Target functions: multiple regression dependence $y_1(a_1,c_1,c_2)$ and $y_2(a_1,c_1,c_2)$, should be maximized;
- Variables: a_1,c_1,c_2;

– Limitations: values of factor variables should be improved compared to their average values in 2020 but do not exceed their maximum allowable values: $5.75 \leq x_1 \leq 10.0 \leq x_2 \leq 35.64$, $0 \leq x_3 \leq 12.75$.

If corporate management optimization had been implemented in these countries, the scale of the crisis during the pandemic would have been 42.84% less. The decline in GDP in Emerging Europe could have been less severe had efficient social entrepreneurship applications been implemented. The scenario analyses indicate that effective corporate management could have a significant anti-crisis effect, which would be advantageous in future economic downturns. The Social Entrepreneurship Index is projected to rise by 19.58%, increasing from 40.86 to 48.86 points.

The Pareto optimum is achieved in the case of an increase in the business extent of disclosure index (a_1) up to 10 (+73.91%). A decrease in c_2 moves to zero. The economic essence of the proposed measures is that the government's ensuring security through law enforcement activity (fighting theft and vandalism) will allow companies to implement more high-tech equipment without the danger of unlawful damage or theft. Reducing losses from theft and vandalism will free up companies' financial resources for the more active implementation of high-tech innovations.

The measure of an increase in information disclosure level belongs to state regulation (correction of norms and standards of information disclosure) and corporate management (an increase in companies' information openness). Increasing companies' openness strengthens their connection and increases interested parties' loyalty. This reduces the pricing elasticity of products and allows for a moderate price rise during a crisis while preserving the volume of sales and market share. This is especially useful for social companies, enabling them to attract a wider circle of interested parties to their activities and raising their resilience to economic crises.

5. Discussion

This paper contributes to developing corporate entrepreneurship theory in Industry 4.0 and outlines emerging technologies' perspectives on applying social entrepreneurship in a data-driven era of sustainability. The research findings are compared to the extant literature (Table 3).

As shown in Table 3, the contradiction of social entrepreneurship in Industry 4.0 is resolved successfully in Eastern Europe. Unlike [101–105], in Eastern European countries, Industry 4.0 does not hinder but supports the development of social entrepreneurship.

Unlike [93–96], it has been proved that economic growth in Industry 4.0 is determined not only by state regulation and commercial entrepreneurship (contrary to the international practice) but also by social entrepreneurship, depending on the following microeconomic factors (related to corporate governance): (1) legal protection of business; (2) accessibility of state services; (3) reliability of infrastructures for business; and (4) speed of foreign trade operations.

This paper builds on recent studies [106–112], which yielded similar findings. It demonstrates that in Eastern European countries, certain microeconomic factors associated with corporate management—precisely, the disclosure index's business extent and the percentage of firms experiencing losses due to theft and vandalism—significantly influence economic growth in Industry 4.0. By optimizing these microeconomic factors, it is possible to achieve both economic development and the advancement of social entrepreneurship in these regions.

Table 3. Comparison of the received results and the extant literature.

Research Question	Provisions of the Literature		New Results (Answers)
	Scientific Provisions	Sources	
1. What microeconomic factors (related to corporate governance) determine economic growth in the countries of Eastern Europe in Industry 4.0?	Social entrepreneurship poorly contributes to economic growth, which is primarily determined by state regulation and commercial entrepreneurship (international practice).	[93–96]	In the countries of Eastern Europe's Industry 4.0, economic growth is primarily predetermined by social entrepreneurship and depends on such microeconomic factors (related to corporate governance) as (1) legal protection of business; (2) accessibility of state services; (3) reliability of infrastructures for business; and (4) speed of foreign trade operations.
2. How can Industry 4.0 simultaneously achieve economic growth and social entrepreneurship development in Eastern European countries by managing these factors?	Industry 4.0 creates barriers on the path of development of social entrepreneurship (in international practice).	[101–105]	In Eastern European countries, Industry 4.0 supports the development of social entrepreneurship.

Source: calculated by the authors.

This paper's theoretical contribution lies in uncovering a previously unknown significant anti-crisis effect of corporate management within Industry 4.0, along with a related impact on the development of social entrepreneurship. As a result, this paper establishes a theoretical and methodological foundation for a new management approach in Industry 4.0. This approach aims to create a comprehensive effect that includes an anti-crisis influence on the economy and sustainable development through social entrepreneurship. This new framework incorporates corporate management in Industry 4.0 as an alternative to current state management measures, fostering systemic economic growth and sustainable economic development. It is important to note that the references cited in this paper—including works from 2005, 2009, 2011, and 2017—draw on data that differ significantly from those of 2020, which the COVID-19 pandemic has dramatically impacted. This underscores the importance of new research and clarifies the distinction between its findings and the theoretical framework.

6. Policy Implication

Varying macroeconomic conditions are traits of corporate management in the region. Growth rates require complex and interconnected measures at the national and organizational levels, and corporate management optimization is implemented here through a two-stage algorithm to achieve the Pareto optimum. It is favorable to create an ideal institutional environment for business development by conducting the following measures at the state level:

- Increase of legal protection of business (development of contractual law);
- Increase of accessibility of state services (development of e-government);
- Improvement of infrastructures;
- Acceleration of foreign trade operations.

Unlike the theories of corporate governance [21–23], our results indicate that Industry 4.0 does not lead to a complete separation between commercial interests aimed at economic growth and non-commercial interests focused on sustainable development.

Optimizing corporate governance is essential for balancing and achieving various goals and interests. This article identifies two key microeconomic factors related to corpo-

rate governance that promote economic growth in Eastern Europe within the context of Industry 4.0 and support the development of social entrepreneurship. First, an increase in the extent of disclosure among businesses is beneficial, and second, a reduction in the number of firms suffering losses due to theft and vandalism is crucial. At the Pareto optimum, economic growth and advancement in social entrepreneurship accelerate. The article presents an algorithm and recommendations for effectively achieving Pareto optimality. Our findings suggest that the responsibility for promoting economic growth and supporting social enterprises should shift from the state to the business sector. To attain Pareto optimality, it is essential to implement measures that help businesses and stimulate targeted activities.

7. Conclusions

This paper explores three decades of transformation in eight Eastern European countries: Russia, Bulgaria, Hungary, Moldova, Poland, Romania, Slovakia, and the Czech Republic. It highlights how automation and process design can eliminate scalability constraints in last-mile operations. Additionally, it discusses operations management amidst corporate reforms in Emerging Europe and the enhancement of operations management for social entrepreneurship as these countries transition fully to Industry 4.0. In this context, optimizing corporate governance is crucial for achieving a balanced outcome between economic growth and the development of social entrepreneurship. The Pareto optimum illustrates that effective corporate management can pursue these two objectives simultaneously.

In response to the question, "What is the next step in fully transitioning to Industry 4.0?" we recommend corporate management reforms in Emerging Europe. Key factors include increasing the business disclosure index and reducing the number of firms experiencing losses due to theft and vandalism. Additionally, promoting social entrepreneurship is essential for effectively developing Industry 4.0. Our findings indicate that microeconomic factors related to corporate management contribute 41.65% to economic growth in Eastern European countries within the context of Industry 4.0. The primary microeconomic factors identified are the extent of business disclosure, as measured by the disclosure index, and the proportion of firms reporting losses from theft and vandalism.

Optimizing microeconomic factors fosters economic growth and social entrepreneurship development in Eastern Europe. Achieving a Pareto optimum—defined by a 73.91% increase in the business extent of the disclosure index (up to 10) and a reduction in the number of firms suffering losses from theft and vandalism—would enhance corporate management. This improvement could have made the impact of the COVID-19 crisis on GDP in Eastern European countries 42.84% less severe during the pandemic. The Social Entrepreneurship Index would have increased by 19.58% (from 40.86 to 48.86 points).

Enhancing corporate management also boosts the effectiveness of applying Industry 4.0 technologies within social entrepreneurship, leading to a significant anti-crisis effect in Eastern European countries. This identified benefit will be crucial in navigating future economic crises, promoting economic growth, and advancing social entrepreneurship in alignment with sustainable development goals during the Decade of Action.

This paper contributes to the literature by exploring how to reorganize social entrepreneurship within the context of Industry 4.0 in order to develop new strategies and business models. It refines the concept of Industry 4.0 and demonstrates that 30 years of economic transformation in Eastern Europe have produced positive outcomes. In a refreshing departure from conventional wisdom, this article reveals that significant opportunities for growth and innovation may arise from corporate governance.

Future research should focus on developing specific recommendations tailored to individual countries, considering the unique characteristics of various regions. It should

also explore new practical solutions for managing operations in social entrepreneurship, particularly in addressing scalability challenges for last-mile operations within the context of Industry 4.0. The effectiveness of corporate management in Industry 4.0, as evidenced by experiences in Emerging Europe, needs to be validated with examples from other developing nations.

A promising direction for research is creating a universal methodological approach to management in Industry 4.0 that can be applied across developing countries. This approach should emphasize corporate governance to make a significant impact, including an anti-crisis effect and support for sustainable development through social entrepreneurship. Additionally, examining the relationships between corporate management in Industry 4.0, economic growth, and social entrepreneurship on a global scale would be beneficial.

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