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## PROFITABILITY, FINANCIAL LIQUIDITY AND THE SUSTAINABLE DEVELOPMENT OF MANUFACTURING ENTERPRISES IN POLAND

### Abstract

**Background:** The sustainable development of enterprises means undertaking economic, social, and environmental actions. This development demands certain financial outlays for investments. In this context, maintaining financial liquidity and a high level of profitability is especially significant. These are the two key pillars of assessing the financial condition of enterprises, which stimulate their current process and stable development in the future.

**Research purpose:** This paper aims to assess the impact of selected financial liquidity and profitability ratios on the sustainable development of the manufacturing enterprises sector in Poland between 2009 and 2019.

**Methods:** I create models using the OLS estimation methods, vector autoregression (VAR), and seemingly unrelated regression (SUR) to verify the research hypotheses.

**Conclusions:** The estimation results indicate a statistically significant impact of financial liquidity and profitability on the sustainable development of industrial enterprises. Moreover, the results of the SUR estimation show that both analysed areas have a different impact on all three pillars of the sustainable development of enterprises. Therefore, it must be concluded that maintaining a good financial condition, including liquidity and profitability, is essential for enterprises' social and environmental investments.

**Keywords:** sustainable development, profitability, financial liquidity.

**JEL Classification:** D22, Q01, Q56

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## 1. Introduction

Sustainable enterprise development includes activities that lead to a property base's growth, increase value, eliminate social inequality, support employees, protect the natural environment, and counteract climate change.<sup>1</sup> The necessity to engage enterprises in social and environmental responsibility actions results from the fact that economic activity often leads to the collapse of the natural environment.<sup>2</sup> Sustainable development of enterprises requires implementing sustainable business models, strategies, investments, and eco-innovation.<sup>3</sup> It depends on several factors related to the enterprise and its interaction with its environment.<sup>4</sup>

One determinant of sustainable development is the company's liquidity and profitability. The relationships between these economic categories are the subject of many analyses, mainly in corporations and listed companies that prepare integrated corporate social responsibility reports<sup>5</sup>. Researchers emphasise the positive relationship between liquidity and sustainable development, and profitability and the sustainable development of capital companies. However, no sectoral analysis would allow conclusions from a wider research group.

A novelty of the article is the attempt to assess the impact of liquidity and profitability on manufacturing enterprises' sustainable development using integrated indicators and estimation, OLS, VAR, and SUR. The analysis is important both from the point of view of theoretical considerations and practical implications.

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<sup>1</sup> **A. Pieloch-Babiarz, A. Misztal, M. Kowalska**, *An impact of macroeconomic stabilization on the sustainable development of manufacturing enterprises: The case of Central and Eastern European Countries*, *Environ Dev Sustain* 2021/23, p. 8669; <https://doi.org/10.1007/s10668-020-00988-4>

<sup>2</sup> **C. Searcy**, *Measuring Enterprise Sustainability*, *Business Strategy and the Environment* 2016/24/2, pp. 120–133; <https://doi.org/10.1002/bse.1861>

<sup>3</sup> **B.S. Silvestre, D.M. Tirca**, *Innovations for sustainable development: Moving toward a sustainable future*, *Journal of Cleaner Production* 2019/208, pp. 325–333; <https://doi.org/10.1016/j.jclepro.2018.09.244>

<sup>4</sup> **C. Isensee et al.**, *The relationship between organizational culture, sustainability, and digitalization in SMEs: A systematic review*, *Journal of Cleaner Production* 2020/275; <https://doi.org/10.1016/j.jclepro.2020.122944>

<sup>5</sup> **Chia-Ying Chan, De-Wai Chou, Huai-Chun Lo**, *Do financial constraints matter when firms engage in CSR?*, *The North American Journal of Economics and Finance* 2017/39, pp. 241–259; <https://doi.org/10.1016/j.najef.2016.10.009>

The main hypothesis of the paper is as follows: “Profitability and financial liquidity have different strengths and direction of the impact on the sustainable development of manufacturing enterprises in Poland from 2009 to 2019”. I use Pearson’s  $r$ , Spearman’s  $Rho$ , Gamma, and Kendall rank correlation coefficients, Ordinary Least Square (OLS), Vector Autoregression Analysis (VAR) and the Seemingly Unrelated Regression (SUR). I use tests to assess linearity, normality of distribution, homoscedasticity, and autocorrelation ( $p < 0.05$ ). I create four types of indicators: sustainable development (SUSD), economic (E), social (S), and environmental development (Env). The presented model can support economic decisions that respect the climate aspect, and it will also help identify which financial indicators are essential for the sustainability business.

The paper consists of the following parts: the introduction, theoretical background, research methodology, research results, discussions, and conclusions. The literature review selected publications for their citation and availability in the Web of Science databases. The discussion refers to current research results and the polemics with them, and verifies the research hypotheses. The conclusion presents findings and directions for future research.

## 2. Theoretical background

Sustainable development is defined in various ways in the literature and in research (Table 1). It means the enterprise’s social and economic development, enabling the current fulfilment of aspirations, and achieving profits without compromising the possibility of pursuing aspirations and making profits in the future.<sup>6</sup> Sustainable development is an optimisation process that minimises environmental defeats and achieves specific economic and social benefits. It requires constant supervision, managerial control, and clean technologies that protect the environment.

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<sup>6</sup> S. Evans et al., *Business Model Innovation for Sustainability: Towards a Unified Perspective for Creation of Sustainable Business Models*, Business Strategy and the Environment 2017/26/5, pp. 597–608; <https://doi.org/10.1002/bse.1939>

TABLE 1: *Enterprise sustainable development – selected definitions*

Author (Year)	Definition of the sustainable development of the enterprise
1	2
J. Elkington (1997)	Business sustainability integrates three dimensions: social, environmental, and economic – and maintains a balance between them.
T. Dyllick, K. Hockerts (2002)	Meeting the needs of a company's direct and indirect stakeholders (employees, clients, pressure groups, communities, <i>etc.</i> ) without compromising its ability to meet the needs of future stakeholders as well.
J.W. Boudreau, P.M. Ramstad (2005)	Organisational sustainability is achieving business success today without compromising future needs, and it encompasses social, environmental and economic sustainability.
M.E. Porter, M.R. Kramer (2007)	A sustainable enterprise should ensure that it achieves economic targets without damaging society or the environment.
R. Lozano (2008)	The triple bottom line is a specific element of sustainable organisations and includes economic (financial factors), environmental (risk/requirement factors), and social (human factors) issues which are solved through the company's collaboration with customers, suppliers, competitors, communities and other stakeholders.
E. Giovannoni, G. Fabietti (2013)	A corporation's ability to last in time, both in terms of profitability, productivity and financial performance, as well as in terms of managing environmental and social assets that compose its capitals.
A. Pabian (2017)	A sustainable enterprise operates on the basis of sustainable resources. These resources include people, infrastructure, durable and non-durable assets, as well as any outgoing goods. Sustainable enterprises produce sustainable products. For the company to be considered sustainable, all functional areas of the strategy should be balanced, including production, finance, logistics, marketing, sales, HR and other functional areas.
S. Bansal, I. Garg, G.D. Sharma (2019)	Sustainable enterprise development is the procedure to develop shareholders' worth by economic, social, and environmental perfection.
K. Liczmańska-Kopcewicz, K. Mizera, P. Pypłacz (2019)	The concept of sustainable development is a proposal of a qualitatively new form of conscious, responsible individual and social life based on development together with the environment – social and natural – taking into account ecological restrictions and social expectations.

1	2
T. Tolstykh, L. Gamidullaeva, N. Shmeleva (2020)	Innovative sustainable development is development in which favourable conditions are created (organisational and economic mechanisms, scientific and technical base, motivational and stimulating mechanisms) to generate and implement innovative activities, introduce scientific and technological developments in production, and promote high-technology products on the market.
E. Stawicka (2021)	Sustainable development is the basis for the development of future generations and constitutes opportunities and challenges for managers in terms of building socio-economic value.

S o u r c e: own elaboration.

As explained in numerous analyses, sustainable development depends on several factors. Researchers indicate that the macroeconomic situation significantly influences its level;<sup>7</sup> the implemented economic and environmental policy,<sup>8</sup> the financial and property situation,<sup>9</sup> management style, and the approach to ecological activities<sup>10</sup> are also important.

Financial liquidity, understood as the ability to pay liabilities on an ongoing basis, seems to be important for the sustainable development of enterprises. Financial liquidity is the basis for good financial standing, which determines enterprises' creditworthiness and the size of ecological investments.<sup>11</sup>

A high level of profitability, which depends on the net profit, should strengthen its position in the market and increase its credibility and interest among customers and investors. High profitability can increase income while reducing the number of raw materials used. Here, it is necessary to implement technical progress and innovations that increase enterprises' efficiency.

<sup>7</sup> **V. Matinaro et al.**, *Extracting key factors for sustainable development of companies: Case study of SMEs in Taiwan*, *Journal of Cleaner Production* 2019/209, pp. 1152–1169; <https://doi.org/10.1016/j.jclepro.2018.10.280>

<sup>8</sup> **F. Haque, C.G. Ntim**, *Environmental Policy, Sustainable Development, Governance Mechanisms and Environmental Performance*, *Business Strategy and the Environment* 2017/27/3, pp. 415–435; <https://doi.org/10.1002/bse.2007>

<sup>9</sup> **Chia-Ying Chan, De-Wai Chou, Huai-Chun Lo**, *Do financial constraints matter when firms engage in CSR?...*, pp. 241–259.

<sup>10</sup> **E. Bombiak, A. Marciniuk-Kluska**, *Green Human Resource Management as a Tool for the Sustainable Development of Enterprises: Polish Young Company Experience*, *Sustainability* 2018/10 (6)/1739, pp. 1–22; <https://doi.org/10.3390/su10061739>

<sup>11</sup> **J.F. Egginton, G.A. McBrayer**, *Does it pay to be forthcoming? Evidence from CSR disclosure and equity market liquidity*, *Corporate Social Responsibility and Environmental Management* 2019/26/2, pp. 396–407; <https://doi.org/10.1002/csr.1691>

The research results on the relationship between sustainable development and enterprises' financial and property situation do not provide unequivocal results. Some authors indicate that, in the long run, sustainable development ensures survival and enables competitive advantage; hence the relationship between sustainable development is positive.<sup>12</sup> An indication of the simultaneous improvement of sustainable development and profitability indicators is the increase in the number of employees in the enterprise and an increase in total income.<sup>13</sup> Other researchers indicate that companies engaged in activities for sustainable development improve ROA and ROE,<sup>14</sup> while others have analysed sustainable development and financial indicators in the context of increasing the company's value.<sup>15</sup>

Interestingly, some authors emphasise that the direction of the impact of liquidity or profitability on sustainable development may differ in different industries and sectors of the economy.<sup>16</sup> Social and environmental responsibility costs will neutrally impact profitability as they will be covered by the efficiency gains generated by these expenses. Thus, profitability will increase when the profit opportunity for companies is not lost.<sup>17</sup>

There is a positive relationship between sustainable development and financial liquidity (high liquidity is a sign of a good financial condition, allows a good image to be created, and is the basis for enterprises' creditworthiness).<sup>18</sup>

<sup>12</sup> **M.E. Porter, M.R. Kramer**, *Strategy and Society: The link between Competitive Advantage and Corporate Social Responsibility*, Harvard Business Review 2007/89 (1/2)/15; **T. Laudal**, *Drivers and barriers of CSR and the size and internationalization of firms*, Social Responsibility Journal 2011/7 (2), pp. 234–256; **A. Aspelund, K.B. Fredriksen**, *Green Planet Strategy – The Managerial Role for Creating Shared Value in Manufacturing Companies*, Paper presented at the 23rd EurOMA Conference, Trondheim, Norway 2016.

<sup>13</sup> **P. Goyal, Z. Rahman, A.A. Kazmi**, *Corporate sustainability performance and firm performance research: Literature review and future research agenda*, Management Decision 2013/51 (2), pp. 361–379.

<sup>14</sup> **R.G. Eccles, G. Serafeim**, *The Performance Frontier: Innovating for a Sustainable Strategy*, Harvard Business Review 2013; **H. Fauzi, K.M. Idris**, *The relationship of CSR and financial performance: New evidence from Indonesian companies*, Issues in Social and Environmental Accounting 2009/3 (1), pp. 66–87; <https://doi.org/10.22164/isea.v3i1.38>

<sup>15</sup> **E.C. Kurucz, B.A. Colbert, D. Wheeler**, *The business case for corporate social responsibility*, in: **A. Crane et al.** (eds.), *The Oxford Handbook on Corporate Social Responsibility*, Oxford University Press, Oxford 2008.

<sup>16</sup> **K. Bangstad Fredriksen**, *Sustainable Paths to Growth and Profitability an Empirical Study of Norwegian Manufacturing SMEs*, Norwegian University of Science and Technology, 2016.

<sup>17</sup> **A. Mochammad Fauzan**, *Pengaruh Pengungkapan Sustainability Report Terhadap Profitabilitas Perusahaan*, Jurnal Akuntansi dan Keuangan, Semarang 2012.

<sup>18</sup> **A. L. Spica dan Vieka Devi**, *Faktor-Faktor yang Mempengaruhi Prediksi Peringkat Obligasi pada Perusahaan Manufaktur yang Terdaftar di Bursa Efek Jakarta*, Proceeding Seminar Nasional manajemen SMART, Universitas Kristen Maranatha Bandung, 3 November 2007.

The second view on the relationship between sustainable development and financial health shows that the relationship is negative.<sup>19</sup> Some researchers indicate that sustainable development often comes at the expense of the financial condition, as social and environmental activities require the involvement of a portion of the profits. Research shows that CSR leads to reduced profitability and financial liquidity.<sup>20</sup>

### 3. Research methodology

This research aims to assess the impact of selected financial liquidity and profitability ratios on the sustainable development of manufacturing enterprises in Poland between 2009 and 2019. The main research hypothesis is as follows: “Profitability and financial liquidity have different strengths and direction of the impact on the sustainable development of manufacturing enterprises in Poland from 2009 to 2019”.

The survey covers the manufacturing sector. The data for the analysis come from the GUS and Eurostat databases. The study consists of the following steps:

- creating the indicators of sustainable development and its components: economic, social, and environmental development;
- analysing correlation coefficients (Pearson’s  $r$ , Spearman’s Rho, Gamma, and Kendall rank correlation coefficients). I adopt the ranges of correlation strength that were suggested by Evans:<sup>21</sup>  $|r_{xy}| = 0$  – no correlation;  $0 < |r_{xy}| \leq 0.19$  – very weak;  $0.20 \leq |r_{xy}| \leq 0.39$  – weak;  $0.40 \leq |r_{xy}| \leq 0.59$  – moderate;  $0.60 \leq |r_{xy}| \leq 0.79$  – strong;  $0.80 \leq |r_{xy}| \leq 1.00$  – very strong;
- creating the econometric models: the OLS estimation methods, vector autoregression (VAR), and seemingly unrelated regression (SUR).

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<sup>19</sup> **M. Friedman**, *The social responsibility of business is to increase its profits*, The New York Times Magazine 1970; <http://umich.edu/~thecore/doc/Friedman.pdf>; accessed 1.07.2022; **L.E. Preston, D.P. O’Bannon**, *The corporate social-financial performance relationship: A typology and analysis*, Business and Society 1997/36 (4), pp. 419–429; <https://doi.org/10.1177/000765039703600406>

<sup>20</sup> **M.C. Jensen**, *Value maximization, stakeholder theory, and the corporate objective function*, Business Ethics Quarterly 2002/12 (2), pp. 235–256; <https://doi.org/10.2307/3857812>; **L.J. Ho, M.E. Taylor**, *An empirical analysis of triple bottom-line reporting and its determinants: Evidence from the United States and Japan*, Journal of International Financial Management & Accounting 2007/18 (2), pp. 123–150; <https://doi.org/10.1111/j.1467-646X.2007.01010.x>

<sup>21</sup> **S. Evans at al.**, *Business Model Innovation for...* .

To create integrated indicators of economic, social and environmental development, I use the analytical variables (stimulants and destimulants) and standardise their measurement scales using the following formula:

– for stimulants:

$$Z_{ij} = \frac{x_{ij}}{\max x_{ij}}$$

– for destimulants:

$$Z_{ij} = \frac{\min x_{ij}}{x_{ij}}$$

where:  $x_{ij}$  – is the value of the  $j$ -th variable in the  $i$ -th year;  $\min x_{ij}$  is the lowest value of the  $j$ -th variable in the  $i$ -th year;  $\max x_{ij}$  is the highest value of the  $j$ -th variable in the  $i$ -th year.

The indicators of sustainable development and its key pillars were created based on the following formula:

$$\text{Sus}_{(di)} = E_i + S_i + \text{Env}_i = \frac{1}{n} \sum_{i=1}^n Z_{ij}$$

where:  $\text{Sus}_{di}$  – sustainable development index in the  $i$ -th year,  $E$  – economic development index in the  $i$ -th year,  $S_i$  – social development index in the  $i$ -th year,  $\text{Env}_i$  – environmental development index in the  $i$ -th year,  $n$  – number of indicators in the model,  $Z_{ij}$  – denotes the normalised value of the  $j$ -th variable in the  $i$ -th year.

The indicator of sustainable development is based on the following diagnostic variables:

– economic component (E):

- stimulants: turnover or gross premiums written ( $x_1$ ), production value ( $x_2$ ), gross operating surplus ( $x_3$ ), total purchases of goods and services ( $x_4$ ), financial results ( $x_5$ ), current assets ( $x_6$ ), short-term investment ( $x_7$ ),



- social component (S):
  - stimulants: wages and salaries ( $x_8$ ), number of employees ( $x_9$ ), apparent labour productivity ( $x_{10}$ ), growth rate of employment – percentage ( $x_{11}$ ),
  - destimulants: personnel costs ( $x_{12}$ ), social security costs ( $x_{13}$ ), accidents at work ( $x_{14}$ ),
- environmental component (Env):
  - destimulants: emissions of carbon dioxide ( $x_{15}$ ), nitrous oxide ( $x_{16}$ ), methane ( $x_{17}$ ), hydrofluorocarbons ( $x_{18}$ ), sulphur dioxides ( $x_{19}$ ), nitrogen oxides ( $x_{20}$ ), ammonia ( $x_{21}$ ), PM10, ( $x_{22}$ ), PM2.5 ( $x_{23}$ ).

To assess the models, I apply the OLS method. I checked the assumption of the method, including unit root tests (KPSS test), homoscedasticity (White test), autocorrelation (Durbin-Watson and Breusch-Godfrey tests), normality (Doornik-Hansen test), and collinearity (Variance inflation factor).

I adopt the following ranges of the coefficient of determination ( $R^2$ ): 0.0–0.5 – unsatisfactory fit, 0.5–0.6 – weak fit, 0.6–0.8 – satisfactory fit, 0.8–0.9 – good fit, and 0.9–1.0 – perfect fit.

The estimated model 1 is given by the equation:

$$\begin{aligned} \text{Sus}_{di} &= \hat{\beta}_0 + \hat{\beta}_1 \text{ROA}_i + \hat{\beta}_2 \text{ROE}_i + \hat{\beta}_3 \text{ROS}_i + e_i = \\ &= \hat{\beta}_0 + \hat{\beta}_1 \left( \frac{\text{net profits}}{\text{total assets}} \right) + \hat{\beta}_2 \left( \frac{\text{net profits}}{\text{equity}} \right) + \hat{\beta}_3 \left( \frac{\text{net profits}}{\text{revenues from sales}} \right)_i + e_i \end{aligned}$$

Model 2:

$$\begin{aligned} \text{Sus}_{di} &= \hat{\beta}_0 + \hat{\beta}_1 C_{ri} + \hat{\beta}_2 Q_{ri} + \hat{\beta}_3 \text{Net}_{\frac{wc}{ca}i} + e_i = \\ &= \hat{\beta}_0 + \hat{\beta}_1 \left( \frac{\text{current assets}}{\text{short-term liabilities}} \right)_i + \\ &+ \hat{\beta}_2 \left( \frac{\text{current assets} - \text{inventory} - \text{short-term prepayments}}{\text{hort-term liabilities}} \right)_i + \\ &+ \hat{\beta}_3 \left( \frac{\text{net working capital}}{\text{inventory} + \text{hort-term receivables}} \right)_i + e_i \end{aligned}$$

where: ROA – return on assets, ROS – return on sales, ROE – return on equity,  $C_r$  – current ratio,  $Q_r$  – quick ratio,  $\text{Net}_{\frac{wc}{ca}}$  – net working capital to current assets.

Model 3:

$$\text{Sus}_{di} = \hat{\beta}_0 + \hat{\beta}_1 \text{ROA}_i + \hat{\beta}_2 \text{ROE}_i + \hat{\beta}_3 \text{ROS}_i + \hat{\beta}_4 C_{ri} + \hat{\beta}_5 Q_{ri} + \hat{\beta}_6 \text{Net}_{\frac{wc}{ca}} + e_i$$

I use the structural equation model to assess the impact of ROA, ROE, ROS,  $C_r$ ,  $Q_r$ , and  $\text{Net}_{\frac{wc}{ca}}$  on E, S, and Env. The model is based on the following formula:

$$\left\{ \begin{array}{l} E = \hat{\beta}_0 + \hat{\beta}_1 \text{ROA}_i + \hat{\beta}_2 \text{ROE}_i + \hat{\beta}_3 \text{ROS}_i + \hat{\beta}_4 C_{ri} + \hat{\beta}_5 Q_{ri} + \hat{\beta}_6 \text{Net}_{\frac{wc}{ca}} + \hat{\beta}_7 S_i + \hat{\beta}_8 \text{Env}_i + e_i \\ S = \hat{\beta}_0 + \hat{\beta}_1 \text{ROA}_i + \hat{\beta}_2 \text{ROE}_i + \hat{\beta}_3 \text{ROS}_i + \hat{\beta}_4 C_{ri} + \hat{\beta}_5 Q_{ri} + \hat{\beta}_6 \text{Net}_{\frac{wc}{ca}} + \hat{\beta}_7 E_i + \hat{\beta}_8 \text{Env}_i + e_i \\ \text{ENV} = \hat{\beta}_0 + \hat{\beta}_1 \text{ROA}_i + \hat{\beta}_2 \text{ROE}_i + \hat{\beta}_3 \text{ROS}_i + \hat{\beta}_4 C_{ri} + \hat{\beta}_5 Q_{ri} + \hat{\beta}_6 \text{Net}_{\frac{wc}{ca}} + \hat{\beta}_7 S_i + \hat{\beta}_8 E_i + e_i \end{array} \right.$$

The formula for the SUR estimator is as follows:

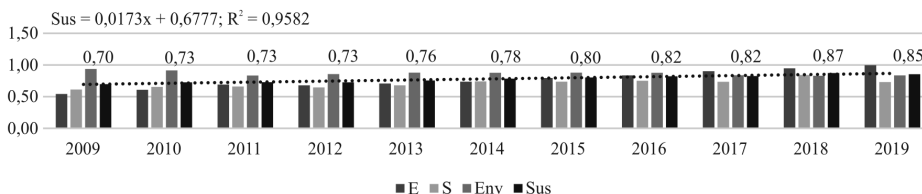
$$\sqrt{R}(\hat{\beta} - \beta) \xrightarrow{d} \text{N}\left(0, \left(\frac{1}{R} \cdot X^T \cdot \left(\sum -1 \otimes I_R\right) \cdot X\right)\right)^{-1}$$

where:  $R$  – the number of observations,  $\Omega$ – covariance matrix,  $X$  – equations,  $I_R$  – the  $R$ -dimensional identity matrix;  $\otimes$  denotes the matrix Kronecker product;  $\Sigma$  – the matrix,  $y$  – vector.

#### 4. Research results

Figure 1 presents sustainable development indicators (Sus) and pillars (E, S, Env). Sus increased from 0.7 in 2009 to 0.85 in 2019. The Sus trendline was positive (0.0173). The results show a positive phenomenon, which is the result of many factors, including macroeconomic conditions and the internal situation of enterprises. E and S increased, while Env decreased. It is due to the increased emissions of harmful substances into the environment. The decline in environmental development indicates that it is necessary to implement ecological investments and eco-innovations.

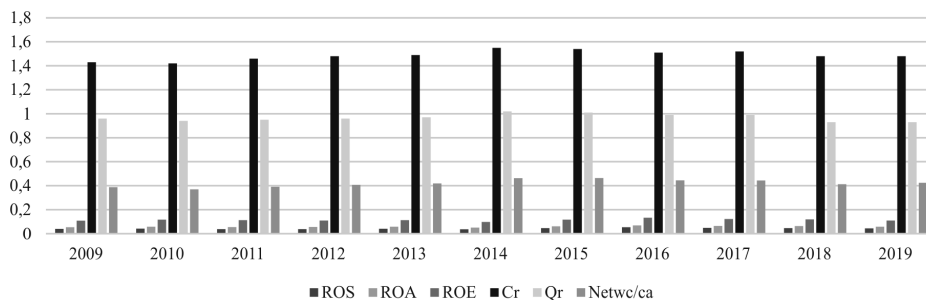
FIGURE 1: Indicators of sustainable development, economic, social, and environmental development in manufacturing enterprises in Poland from 2009 to 2019



Source: own calculations based on <https://bdl.stat.gov.pl/bdl/dane/podgrup/tem>; accessed 9.02.2022.

Figure 2 shows the profitability and financial liquidity ratios. The return on assets, equity, and sales are similar throughout the analysed period, not exceeding 6.5%. The current ratio is at a satisfactory level.

FIGURE 2: ROA, ROE, ROS, Cr, Qr, and Net<sub>w/c/a</sub> in manufacturing enterprises in Poland from 2009 to 2019



Source: own calculations based on <https://bdl.stat.gov.pl/bdl/dane/podgrup/tem>; accessed 9.02.2022.

The results of the linear correlation at the level of  $p < 0.05$  indicate a weak statistical significance of the correlation between the variables (Table 2). Only Spearman’s Rho shows the relationship between the return on sales and sustainable development (0.65) and the networking capital (0.62). The results demonstrate that sustainable development depends on several factors and that decisions made by entrepreneurs are based on a comprehensive financial situation, and that the level of possible social and environmental investments depends on it.

TABLE 2: *Correlation coefficients between Sus (sustainable development) and ROA – return on assets, ROS – return on sales, ROE – return on equity,  $C_r$  – current ratio,  $Q_r$  – quick ratio,  $Net_{we/ca}$  – net working capital to current assets in manufacturing enterprises in Poland from 2009 to 2019 (bold items are statistically significant at  $p < 0.05$ )*

Correlation with Sus	Pearson's r	Spearman-s Rho	Gamma	Kendall rank
ROS	0.66	<b>0.65</b>	0.42	0.42
ROA	0.60	0.60	0.42	0.42
ROE	0.37	0.47	0.31	0.31
$C_r$	0.53	0.51	0.35	0.34
$Q_r$	0.11	-0.05	0.00	0.00
$Net_{we/ca}$	0.37	<b>0.62</b>	0.38	0.38

Source: own calculations based on <https://bdl.stat.gov.pl/bdl/dane/podgrup/tem>; accessed 9.02.2022.

The correlogram and VAR results are presented in Table 3. The sustainable development and the economic indicator from the current period depend on the previous period. It shows a continuity of decisions, and it is a positive phenomenon considering the positive trend line in both indicators. Previous periods are not affected by the current one for social and environmental development. In the case of Env, this is a positive phenomenon due to the negative trend of the indicator between 2009 and 2019. Therefore, it is necessary to support environmentally friendly activities in the EU and national programs.

TABLE 3: *The results of the correlogram and vector autoregression analysis ( $p < 0.05$ )*

Endog. variable	Correlogram				Vector autoregression analysis							
	Lag	ACF/PACF	Ljung-Box Q	p-value	AIC	BIC	HQC	Expl. Var.	Coeff.	Std. Error	p-value	R <sup>2</sup>
1	2	3	4	5	6	7	8	9	10	11	12	13
Susd	1	0.73	7.71	0.005	-4.85	-4.79	-4.92	const	0.09	0.09	0.3713	0,88
								Susd_1	0.91	0.12	< 0.0001	
E	1	0.68	6.56	0.010	-4.16	-4.10	-4.22	const	0.05	0.06	0.3495	0,96
								E_1	0.99	0.07	< 0.0001	

1	2	3	4	5	6	7	8	9	10	11	12	13
S	1	0.51	3.75	0.05	-2.95	-2.89	-3.02	const	0.35	0.18	0.08	0.36
								S_1	0.52	0.25	0.07	
Env	1	0.36	1.87	0.17	-4.4	-4.34	-4.46	const	0.49	0.21	0.04	0.29
								Env_1	0.42	0.24	0.11	

Source: own calculations based on <https://bd1.stat.gov.pl/bdl/dane/podgrup/tem>; accessed 9.02.2022.

Model 1 (Table 4) confirmed the relationship between sustainable development and the profitability of assets and the return on equity. The increase in the profitability of assets contributes to the growth of sustainable development, and the increase in the profitability of equity capital causes a decrease. Model 2 shows a negative impact of the quick ratio on sustainable development and a positive impact of net working capital. Model 3, considering the impact of liquidity and profitability on sustainable development, shows that the quick ratio harms sustainable development while networking capital increases it.

TABLE 4: The OLS estimation results ( $p < 0.05$ )

Model: Susd	Expl. Var.	Coefficient	Std. Error	t-ratio	p-value	R <sup>2</sup>
Model 1	const	0.67	0.14	4.69	0.00	0.74
	ROA	26.74	6.12	4.37	0.00	
	ROE	-12.72	3.67	-3.47	0.01	
Model 2	const	1.75	0.28	6.28	0.00	0.86
	$Q_r$	-2.26	0.41	-5.54	0.00	
	Net <sub>wc/ca</sub>	2.89	0.41	7.06	0.00	
Model 3	const	1.53	0.23	6.54	0.00	0.93
	ROS	3.31	1.31	2.54	0.04	
	$Q_r$	-1.99	0.33	-5.98	0.00	
	Net <sub>wc/ca</sub>	2.47	0.36	6.91	0.00	

Source: own calculations based on <https://bd1.stat.gov.pl/bdl/dane/podgrup/tem>; accessed 9.02.2022.

Table 5 shows the results of the seemingly unrelated regression. The results indicate that economic and social development indicators are influenced by return on sales, the current ratio, and the quick ratio.  $C_r$  and ROS have a positive effect on E and S, while an increase in  $Q_r$  causes a decrease in E and S.  $C_r$  has a negative and  $Q_r$  a positive impact on Env (the impact results are different than for the other two sustainability pillars).

TABLE 5: *The SUR estimation results*

Dependent variable		Coefficient	Std. Error	t-ratio	p-value	Mean dependent var	S.D. dependent var	R-squared
E	const	-1.23	0.36	-3.40	0.0114	0.77	0.14	0.95
	ROS	10.27	2.00	5.12	0.0014			
	$C_r$	4.53	0.41	10.93	1.19e-05			
	$Q_r$	-5.36	0.54	-9.97	2.18e-05			
S	const	-0.44	0.34	-1.29	0.2393	0.71	0.06	0.77
	ROS	4.45	1.86	2.39	0.0482			
	$C_r$	1.8	0.39	4.6	0.0025			
	$Q_r$	-1.78	0.51	-3.50	0.0100			
Env	const	1.21	0.19	6.32	0.0002	0.87	0.03	0.75
	$C_r$	-1.17	0.21	-5.56	0.0005			
	$Q_r$	1.45	0.28	5.15	0.0009			
Cross-equation VCV for residuals				log determinant	Breusch-Pagan test for diagonal covariance matrix: Chi-square	Sargan-Hansen over-identification test: Chi-square		
Correlations above the diagonal	0.00	(-0.05)	(-0.12)	-22.2044	0.67 [0.8800]	0.26[0.6113]		
	0.00	0.00	(0.21)					
	0.00	0.00	0.00					

Source: own calculations based on <https://bdl.stat.gov.pl/bdl/dane/podgrup/tem>; accessed 9.02.2022.

The OLS and SUR estimation results indicate the diversification of individual financial liquidity and profitability ratios on sustainable development and its pillars. The models most often show a statistically significant influence of ROS on Sus, E, and S. Moreover,  $Q_r$  and  $\text{Net}_{wc/ca}$  influence sustainable development.  $C_r$  and  $Q_r$  influence the three pillars of sustainable development.

## 5. Discussion

Sustainable development is fundamental for improving conditions and quality of life for current and future generations. One of the determinants of sustainable development is enterprises' financial and property conditions<sup>22</sup>. The paper distinguished only two key aspects that influence enterprises' sustainable development: financial liquidity and profitability.

Previous research focused on reporting and analysing a business's social and environmental responsibility, liquidity and profitability, and environmental protection activities<sup>23</sup>. The models depend on the selection of financial liquidity and profitability indicators. There is a difference between assessing the impact of only liquidity and profitability on sustainable development or treating them simultaneously<sup>24</sup>.

The results confirm the main research hypothesis: "Profitability and financial liquidity have different strengths and direction of the impact on the sustainable development of *manufacturing* enterprises in Poland from 2009 to 2019". Although the OLS and SUR models confirmed the statistically significant relationship, most correlation coefficients are not statistically significant.

According to the VAR results, a significant relationship at the level of  $p < 0.05$  occurred in the case of the influence of the previous period on the current one in the indicator of sustainable development and economic development. However, such a relationship does not occur in the case of the social and environmental index. Therefore, economic factors still determine sustainable development.

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<sup>22</sup> Chia-Ying Chan, De-Wai Chou, Huai-Chun Lo, *Do financial constraints matter when firms engage in CSR?... .*

<sup>23</sup> E.C. Kurucz, B.A. Colbert, D. Wheeler, *The business case for corporate social responsibility... .*

<sup>24</sup> A.L. Spica dan Vieka Devi, *Faktor-Faktor yang Mempengaruhi Prediksi Peringkat Obligasi... .*

The impact of liquidity and profitability on the pillars of sustainable development is different due to the strength and direction of the influence. It is indicated by the results of the SUR estimation method. It has been noted that the economic and social indicators are influenced by the current ratio, quick ratio, and return on sales (the strength and direction of the impact are differentiated). The current ratio and quick ratio influence the environmental indicator.

The study has significant limitations in selecting variables for the model, selected estimation methods, or the duration of the study period (due to environmental data availability). Moreover, the models do not consider several other determinants that influence the results.

Further research will be devoted to analysing the impact of endogenous and exogenous determinants on other sectors of the Polish economy. Additionally, I will try to assess the determinants in the developed and developing countries in the European Union and verify their similarities and differences.

## 6. Conclusion

Financial liquidity and profitability are two key dimensions of assessing a company's financial situation. Maintaining the appropriate level of both indicators is the basis for enterprises' free operation and development. The study results show a statistically significant relationship between financial liquidity, profitability, and sustainable development (this relation is varied). Moreover, the liquidity and profitability ratios also influence the pillars of sustainable development. The results of the SUR estimation indicate that return on sales, current ratio, and quick ratio are important for economic and social development, while only the current ratio and quick ratio are important for environmental development. The results show that the influence of the financial situation on economic and social development is similar, while the direction of the influence on environmental development is different. It may indicate that industrial enterprises are still based on economic development and undertake activities for social development while focusing on environmental development to a slightly lesser extent. Further research requires more complex financial analysis and the isolation of other economic, legal, and environmental factors.



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## RENTOWNOŚĆ, PŁYNNOŚĆ FINANSOWA I ZRÓWNOWAŻONY ROZWÓJ PRZEDSIĘBIORSTW PRZEMYSŁOWYCH

### Abstrakt

**Przedmiot badań:** Zrównoważony rozwój przedsiębiorstw to podejmowanie działań gospodarczych, społecznych i środowiskowych. Rozwój ten wymaga pewnych nakładów finansowych na inwestycje. W tym kontekście szczególnie istotne jest utrzymanie płynności finansowej i wysokiego poziomu rentowności. To dwa kluczowe filary oceny kondycji finansowej przedsiębiorstw, które stymulują ich funkcjonowanie i stabilny rozwój w przyszłości.

**Cel badawczy:** Celem artykułu jest ocena wpływu wybranych wskaźników płynności finansowej i rentowności na zrównoważony rozwój przedsiębiorstw produkcyjnych w Polsce w latach 2009–2019.

**Metoda badawcza:** Cel badawczy i weryfikację hipotez badawczych osiągnięto, wykorzystując metody korelacji liniowej, estymacji OLS, autoregresji wektorowej (VAR) i regresji pozornie niepowiązanej (SUR) w celu weryfikacji hipotez badawczych.

**Wyniki:** Wyniki estymacji podkreślają statystycznie istotny wpływ płynności finansowej i rentowności na zrównoważony rozwój przedsiębiorstw przemysłowych. Ponadto wyniki estymacji SUR pokazują, że oba analizowane obszary mają różny wpływ na wszystkie trzy filary zrównoważonego rozwoju przedsiębiorstw. Dlatego należy stwierdzić, że utrzymanie dobrej kondycji finansowej, w tym płynności i rentowności, jest niezbędne dla inwestycji społecznych i środowiskowych przedsiębiorstw.

**Słowa kluczowe:** zrównoważony rozwój, rentowność, płynność finansowa.