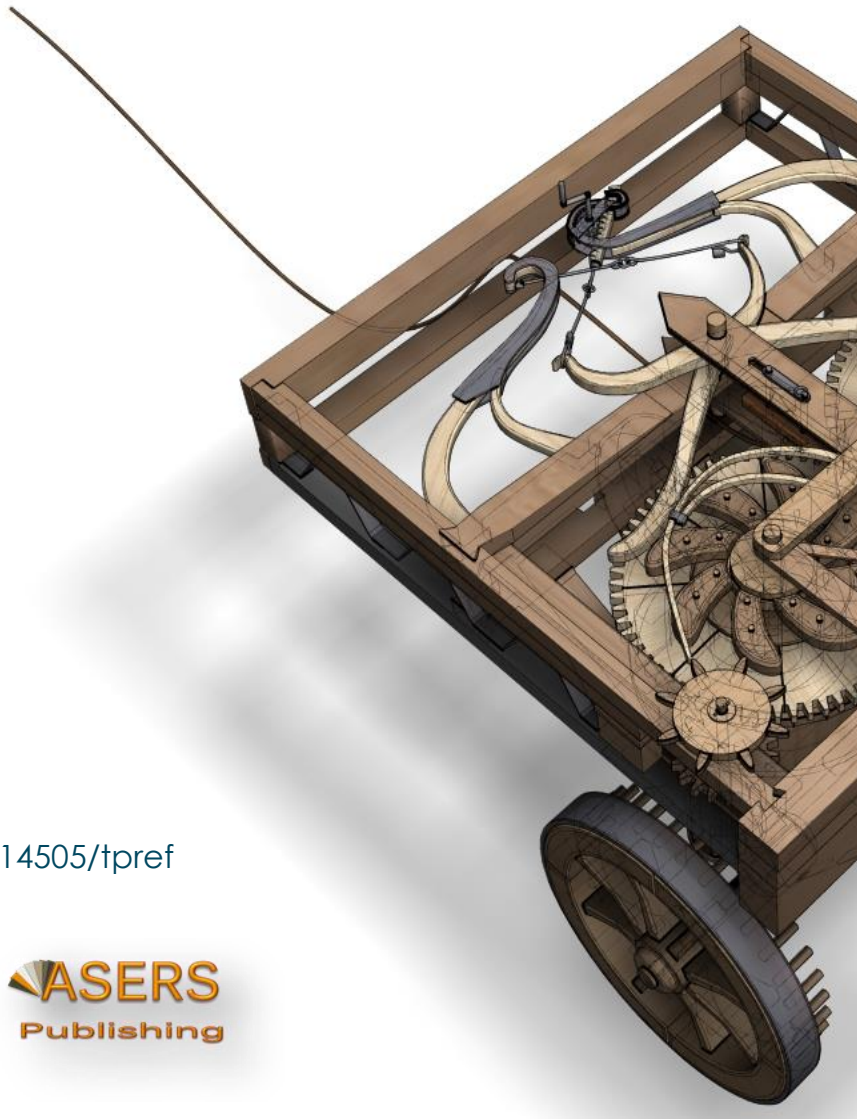
Theoretical and Practical Research in Economic Fields

Special Issue



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Theoretical and Practical Research in Economic Fields

Many economists today are concerned by the proliferation of journals and the concomitant labyrinth of research to be conquered in order to reach the specific information they require. To combat this tendency, **Theoretical and Practical Research in Economic Fields** has been conceived and designed outside the realm of the traditional economics journal. It consists of concise communications that provide a means of rapid and efficient dissemination of new results, models, and methods in all fields of economic research.

Theoretical and Practical Research in Economic Fields publishes original articles in all branches of economics – theoretical and practical, abstract, and applied, providing wide-ranging coverage across the subject area.

Journal promotes research that aim at the unification of the theoretical-quantitative and the empirical-quantitative approach to economic problems and that are penetrated by constructive and rigorous thinking. It explores a unique range of topics from the frontier of theoretical developments in many new and important areas, to research on current and applied economic problems, to methodologically innovative, theoretical, and applied studies in economics. The interaction between practical work and economic policy is an important feature of the journal.

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At the same time, the journal encourages the interdisciplinary approach within the economic sciences, this being a challenge for all researchers.

The advisory board of the journal includes distinguished scholars who have fruitfully straddled disciplinary boundaries in their academic research.

All the papers will be first considered by the Editors for general relevance, originality, and significance. If accepted for review, papers will then be subject to double blind peer review.

This Special Issue was created at the request of a group of researchers from Ukraine. It is a response to the challenging situation of Ukrainian scholars due to the Russian invasion as well as the growing demand for knowledge on Ukrainian issues.

We would like to express our endless thank to our colleagues, scholars from Ukraine who are working amid the war on topics that are important for all. Also, we thank all our international authors for their valuable contributions to this Issue.

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The Role of Investment in the Production Equipment Modernization and Its Effect on Productivity

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Abstract: Purpose: The aim of the study is to determine the role of investment in the production equipment modernization and to assess the impact of this investment on the company's productivity.

Methodology: The research employed calculation of the Weighted Average Cost of Capital (WACC), as well as the Net Present Value (NPV), Profitability Index (PI) as the methods. The final stage was the application of the correlation coefficient. For the company Builders FirstSource Inc used as an example the calculated WACC was 8.74%, for Hardie Industries plc. this figure was 9.31, for Boral — 4.3%, and for Grafton plc — 5.6%. The Profitability Index was 1.30 (Builders FirstSource Inc,), 2.34 (Hardie Industries plc), 1.51 and 1.46 for Boral and Grafton plc. The Net Present Value (NPV) amounted to $10,863 million and $128,173 million for Builders FirstSource Inc and Hardie Industries plc., respectively.

Findings: The study showed a close relationship between productivity and investment in equipment modernization, as the correlation coefficients are 0.991 (Builders FirstSource Inc,), 0.994 (Hardie Industries plc), 0.83 (Boral), and 0.97 (Grafton plc), indicating a close correlation. The obtained results can be successfully used by manufacturing companies to assess the feasibility of investment in modernization.

Originality: A possible direction of further research is the introduction of gradation of investments in modernization, with clarification of the types of modernization and the type of equipment that will be modernized.

Keywords: investment; equipment modernization; investment efficiency; weighted average cost of capital; net present value; profitability index.

JEL Classification: D24; D25.

Introduction

Relevance

The modern business world requires companies to constantly improve their competitiveness. Growing competition requires companies to be flexible, operational, and variable in their production processes. Modern technologies play a key role in this process, allowing businesses to innovate, reduce production costs, and meet diverse market needs. This is manifested through the need for constant modernization of the company's assets through the introduction of innovative production equipment, which, in turn, leads to changes in labour productivity. In this context, investments in the modernization of production equipment play a special role. Globalization of the world economy leads to increased competition, which forces companies to look for new ways to increase their production efficiency. The use of modern technologies enables companies to reduce costs, improve product quality, and the speed of innovation.

Productivity improvement is a key element of any company's business strategy. High productivity can significantly increase the company's profitability and strengthen its competitive position in the market. There are various strategies that can be used to achieve this goal, such as the introduction of the latest technologies, staff training, optimization of business processes and many others. It is important to choose the optimal approach that will consider the specifics of the company's activities and allow to achieve maximum results. Therefore, investing in modern technologies becomes a necessity for companies that strive to be leaders in the market. Only thanks to the use of advanced technologies, companies will be able to secure a stable place for themselves in the conditions of growing competition and meet the modern consumers' needs.

Unexplored Issues

In general, it should be noted that the greatest attention is paid to investment research at the level of the country, industry, and region. It is also appropriate to note that these studies are based on the attraction of investment for their implementation in the field of green energy, digitalization of business processes, implementation of effective distribution of resources and social responsibility. However, the issue of determining the role of investment in equipment modernization is almost not covered, so our research suggests shifting the focus to the methodology of studying the role investment in equipment modernization by developing a universal method for any company and any industry.

Aim

The aim of the study is to determine the role of investment in the modernization of production equipment and to assess the impact of such investment on the company's productivity.

Objectives

The aim was achieved through the fulfilment of the following research objectives:

1. Develop a universal methodology for determining the role of investment in equipment modernization and assessing the need for such investment.
2. Determine the economic effect of the implementation of the investment project for various companies producing building materials.
3. Study the relationship between investment in equipment modernization and productivity.

1. Literature Review

Growing competition in the modern world requires manufacturing companies to have greater flexibility, efficiency, and variability of production capacities. It is important to use modern technologies in order to compete as a first-class manufacturer. Globalization helps to reduce the price of technology, making it more affordable for consumers. Therefore, it is important to constantly update production processes in order to meet market requirements and ensure high product quality.

Investments are not only monetary investments, but also capital investments in any other forms of property, non-property assets, knowledge, experience, and rights. Some authors (Danylyshyn *et al.* 2023) point out that investments are important for the growth and development of regions. Involvement of local and foreign investors

contributes to the economic prosperity of the region. Investing capital in various types of assets enables creating new opportunities for business development and increase its competitiveness. So, investment can become a key factor in the successful development of the country's economy (Vranovci and Maloku 2024).

Currently, there are many studies related to determining the role of direct and foreign investment. The authors (Wuchao Liang, Ying Wang, Li Hou, 2023) determine the relationship between private investment and the innovative strategy of the enterprise. Based on their research, it appears that direct investment can play a key role in stimulating corporate innovation. They have a significant impact on significant technological and product changes in companies. This confirms the importance of investment in research and development (RandD), which can contribute to the growth of the companies' competitiveness (Prokopenko *et al.* 2023). Direct investment is a necessary tool for stimulating innovative business development.

The importance of investment is emphasized by (Lüdeke-Freund 2020), who note that it plays a vital role in facilitating the transformation of the results of innovative activities and supporting the development of innovative projects. They are an important element of economic growth and stimulate the company's innovative activity. On the other hand, studies have focused on determining the role of investment specifically in the development of high-tech companies (Dmitry Livdan, Alexander Nezlobin 2021; Shuangshuang Liu 2024). In these studies, the researchers indicate that the distribution and redistribution of financial assets leads to an increase in investment in innovation of high-tech companies. The distribution of different types of financial assets is important for the development of investment in innovations. Short-term assets can limit the ability of high-tech companies to innovate, while long-term assets promote their development. This conclusion is confirmed by the results of tests in the study of (Shuangshuang Liu 2024) for endogeneity and stability. Therefore, it is important to take this aspect into account when making decisions about the distribution of financial resources. In this context, studies (Foglia *et al.* 2024) are of interest, which consider investments in digital assets to improve company performance.

On the other hand, there is a problem of the growing number of zombie companies in the world, which is becoming the matter of discussion in society (Meixu Ren, Jinxuan Zhao, Jingmei Zhao 2023). These companies, which operate thanks to loans or government subsidies, cause serious public outrage. Their low profits and inability to compete in the market create a negative impact on the economy. And more recently, some papers have documented that it also hindered Europe's economic recovery from the 2008-2009 financial crisis (Banerjee and Hofmann 2022), worsened the global debt problem, exacerbated China's overcapacity problem, and caused a global economic slowdown.

The researchers (Freiberg and Scholz 2015) point to such conclusions that when determining the feasibility of investments in modern production technologies, it is necessary to use the most effective evaluation procedures, as simplified calculations can lead to distortion of results. This can negatively affect the competitiveness and existence of the company. Discrete event modelling is a useful tool in making decisions about investment in advanced technologies, as it allows for accurate analysis and quantification of the impact of different options. In addition to economic calculations, it is important to consider other benefits such as productivity, quality, flexibility, and product delivery speed. The final decision must be well-founded and comprehensive to ensure the success of investment in production technologies.

The study by (Zhihao Shi, Libang Ma, Xiang Wang, Shanshan Wu, Jing Bai, Ziyan Li, Yuqing Zhang, 2023) is based on a systematic review of agricultural security issues and modern agricultural systems. So, there is no either a universal methodology or the use of existing models for assessing the role of investment in equipment modernization for companies producing building materials as an example. This is quite different from the approach that we proposed.

As for productivity in general, (Chen *et al.* 2021) well pointed out that improving productivity is a key element of any company's business strategy. High productivity can positively affect the company's profitability and strengthen its competitive position in the market compared to other participants. At the same time, they conclude that there are a variety of strategies that a company can use to improve productivity, and the choice of the most successful and viable strategy depends in part on market conditions and the industry in which the company operates.

2. Methods

2.1. Research Design

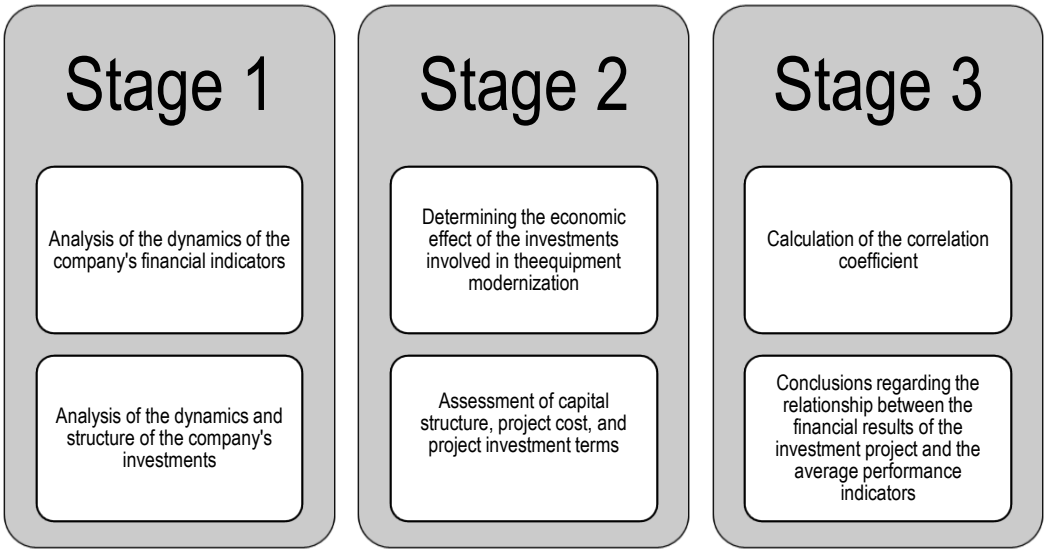
The research design involves three stages and consists in a detailed analysis of the company's investment activities (in the context of the production equipment modernization) and an assessment of the impact of investments on the company's productivity. This calculation is based on three stages (Figure 1):

1. Analysis of the company's investment opportunities;

2. Assessment of the investment project;

3. Regression and correlation analysis of the relationship between the financial results of the investment project implementation and averaged productivity indicators.

Figure 1. Research Design



2.2. Sampling

Builders FirstSource Inc. (https://www.bldr.com/), James Hardie Industries plc (https://www.jameshardie.com/), Boral (https://www.boral.com. au/about), Grafton plc. (https://www.graftonplc.com/) are selected as the basis for the research. These companies have significant amounts of production equipment and plan to modernize production equipment. Builders FirstSource Inc. (2022) is a manufacturer of windows, doors, mouldings and other carpentry, facade elements, stairs, panels, roofing, plasterboard, etc. The company is in Dallas, Texas, United States. Boral (Australia) is Australia's largest vertically integrated building materials company with a significant impact on the country's construction industry. The company has an impressive network that includes quarries, cement plants, processing plants, asphalt plants, and concrete plants. The Grafton plc Group is one of the leading companies in the field of production of all types of construction mortars in the markets of Great Britain, Ireland, and Belgium. Its main segment of activity is the supply of building and sanitary materials for the repair, maintenance and improvement of housing, as well as in the construction of new facilities. James Hardie Industries plc manufactures and markets fibre cement products and systems for interior and exterior construction, primarily in the United States, Canada, Australia, New Zealand, the Philippines, and Europe. James Hardie Industries plc is in Chicago, USA. The 2020-2022 period was chosen for the analysis, as these data are publicly disclosed by the company on the Builders FirstSource Inc (https://www.annualreports.com/).

2.3. Methods

The feasibility of investment in equipment modernization was assessed by calculating the capital structure based on the Weighted Average Cost of Capital WACC (Balážová and Luptáková 2016). WACC calculation formula:

$$WACC = (1 - T) \times r_d \times D/C + r_e \times E/C, \quad (1)$$

where T - income tax rate,
r_d - cost of loan capital (rate),
D - interest loan capital,
C - total costs,
r_e - cost of equity (rate),
E - equity.

The Weighted Average Cost of Capital (WACC) is an important metric for businesses because it determines how much a company should pay for its capital. This indicator takes into account both the cost of equity capital and the cost of debt capital, allowing for their relative weight in the company's capital structure. It helps to assess the company's total cost of capital and make decisions about investments and project financing.

The next step was the assessment of the Net Present Value (NPV), Profitability Index (PI). NPV, as defined by Arshad (2012), is a key indicator for evaluating the performance of an investment project. This indicator reflects

the net present value, which is the result of adding up all future cash flows and discounting them at a specified rate. When calculating NPV, it is important to consider both inflows and outflows of funds, which enables getting the exact present value of the project, formula (2):

$$NPV = -CF_0 + \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \ldots + \frac{CF_n}{(1+i)^n}, \quad (2)$$

where $CF_{(t)}$ – cash flow in period t, $ thousand;
i – discount rate.

This approach gives grounds for making informed decisions about investing and determining its profitability. The formula for calculating the Profitability Index (Carlo Alberto Magni, 2015):

PI = Present Value of Future Cash Flows / Initial Value (3)

The last stage of the study involved an assessment of the presence and type of correlation between investment in equipment modernization and the sales volume carried out as a productivity increase determinant. The research uses the pair correlation method (4) (Li *et al.* 2022):

$$r = \frac{\overline{xy} - \bar{x} \times \bar{y}}{\sigma_x \times \sigma_y}, \quad (4)$$

where r – is the pairwise correlation coefficient;
σ_x — the mean square deviation of the factor feature;
σ_y — the mean square deviation of the resulting feature.

The interpretation of the equation consists in revealing the closeness of the connection between the quantities. The correlation coefficient can take values from [-1 to 1], where negative values indicate an inverse correlation, positive values — a direct correlation. If the values of the coefficient are less than ±0.3, it can be stated that there is no correlation. In case when the correlation coefficient is in the range [±0.3; ±0.5], the correlation is considered weak; the of range [±0.5; ±0.7] indicates a moderate correlation. If the coefficient falls into the range [±0.7; ±1], the correlation is considered close. The study of these correlations helps to better understand the behaviour of the studied values.

3. Results

The first stage of the calculation is the analysis of the dynamics of financial indicators of Builders FirstSource Inc. Table 1 shows the growth and dynamics of the sales volume.

Table 1. Growth in the Volume and Dynamics of the Sales Volume

Indicator	2020	2021	2022	Absolute change, $ thousand		Relative change, %	
				2021/2020	2022/ 2021	2021/2020	2022/ 2021
Builders FirstSource Inc							
Sales volume, $ thousand	17,484.2	19,531.2	21,578.2	2047	2047	112%	110%
Hardie Industries plc							
Sales volume, $ thousand	757,200	786,900	849,900	29,700	63,000	104%	108%
Boral							
Sales volume, $ thousand	2,792,300	2,924,100	2,955,900	131,800	31,800	105%	101%
Grafton plc							
Sales volume, $ million	453.3	544.3	618.3	91	74	120%	114%

The results of the assessment revealed and demonstrated a steady trend of growth in the sales volume in 2022 compared to 2021, which led to the need to modernize the equipment for further growth in the number of manufactured products. Such trends persist for all the studied companies. Special attention should be paid to the fact that according to the annual reports of Builders FirstSource Inc. (2022), Hardie Industries plc (2022), Boral, Grafton plc, the companies were seeking to attract investment to modernize equipment.

Table 2 shows a comparison of the total amount of financial resources, the total amount of investment resources and equity.

Table 2. Dynamics of the Total Amount of Financial Resources, the Total Amount of Investment Resources and Equity

Indicator	2020	2021	2022	Relative deviation, % 2021/ 2020	Relative deviation, % 2022/ 2021	Absolute deviation, $ thousand 2021/ 2020	Absolute deviation, $ thousand 2022/ 2021
Builders FirstSource Inc							
The total amount of financial resources, $ million	104.1	107.5	117.1	103%	109%	3.4	9.6
Equity, $ million	19.8	22.6	24.7	114%	109%	2.8	2.1
The total amount of investment resources, $ thousand	24.8	5.2	5.0	21%	96%	-19.6	-0.2
Hardie Industries plc							
The total amount of financial resources, $ million	4,144.5	4,407.3	4,686.9	106.3%	105.9%	262.8	279.6
Equity, $ million	1,032	1,060.8	1,332.9	102.8%	125.7%	28.8	272.1
The total amount of investment resources, $ thousand	39.3	58.2	65	148.1%	111.7%	18.9	6.8
Boral							
The total amount of financial resources, $ million	2,104	5,346	3,908	254.1%	105.9%	3242.0	-1438.0
Equity, $ million	4,772.1	4,334.8	1,897.5	90.8%	43.8%	-437.3	-2437.3
The total amount of investment resources, $ thousand	38.5	15.0	32.5	39.0%	216.7%	-23.5	17.5
Grafton plc							
The total amount of financial resources, $ million	257.6	303.2	278.8	117.7%	105.9%	45.6	-24.4
Equity, $ million	1,393.7	1,291.1	1,086.6	92.6%	84.2%	-102.6	-204.5
The total amount of investment resources, $ thousand	45.0	54.9	71.3	122.0%	129.9%	9.9	16.4

Indicators in Table 2 show that the total amount of investment resources of Builders FirstSource Inc in 2022 fell by 4% (-$211 thousand) compared to 2021. At the same time, the total amount of financial resources increased by 9,605 thousand hryvnias (9%) in 2022 compared to 2021. These data indicate changes in the distribution of resources and possible trends in the financial sphere. For Hardie Industries plc, the analysis results indicate a rapid investment growth in 2021 compared to 2020, and a significant change in equity in 2022 compared to 2021 (125.7%). There are also significant changes in the financing structure in Boral and Grafton plc, as there is a trend towards a significant reduction in equity capital.

In the period from 2020 to 2022, companies use an aggressive financing model, which has its advantages and disadvantages. Such a model enables reducing the need for own capital in the implementation of operational activities, which helps to increase the company profitability. However, it can create problems with the current solvency and financial stability of the company.

The analysis shows that all periods are characterized by the predominance of current assets over non-current ones. This can be a positive signal, as it indicates that the company is investing in objects of labour rather than labour costs in its asset mix.

It is important to balance the use of an aggressive financing model with consideration of the current solvency and financial stability of the company. It is worth carefully studying all aspects of this strategy to ensure the company's successful operation in the future.

Before making a decision to invest in equipment modernization, the company should conduct a detailed analysis of its needs and capabilities. It is important to take into account not only the current state of the equipment, but also the prospects for business development to ensure maximum investment efficiency. As a result, investment in equipment modernization can become a key factor in the company success in the modern market environment. It is important to choose optimal investment strategies that will help the company to achieve its goals and ensure stable development.

The dynamics of investment activity is analysed for a detailed analysis of real investments (Table 3).

Table 3. Dynamics of Investment Activity in 2020-2022

Investment type	2020			2021			2022		
	$ million	Growth rate		$ million	Growth rate		$ million	Growth rate	
		$ million	%		$ million	%		$ million	%
Investment in equipment modernization (Builders FirstSource Inc)	2.534	-	-	4.15	1.616	164%	12.614	8.464	204%
Investment in equipment modernization (Hardie Industries plc)	6.2	-	-	14.1	7.9	227%	25.2	17.3	179%
Investment in equipment modernization (Boral)	5.2	-	-	3.9	-1.3	75%	4.4	0.5	113%
Investment in equipment modernization (Grafton plc)	5.0	-	-	6.0	1.1	122%	7.8	1.8	130%

The analysis of the data in Table 3 gives grounds to conclude that the amount of investment in both companies will increase in 2022, unlike 2021 (the data are calculated in Table 3). On the other hand, the company's investment in equipment modernization in 2020 amounted to $2,534,000, which is 66% less than in 2021 ($4,200,000). It should be noted that Boral increased investment in equipment modernization in 2022 compared to 2021. As for Grafton plc, in 2022 investment in modernization increased by 1.8 $million compared to 2021. Figure 2 illustrates the dynamics of investment for 2020-2022.

Figure 2. Dynamics of Investment Activity in 2020-2022

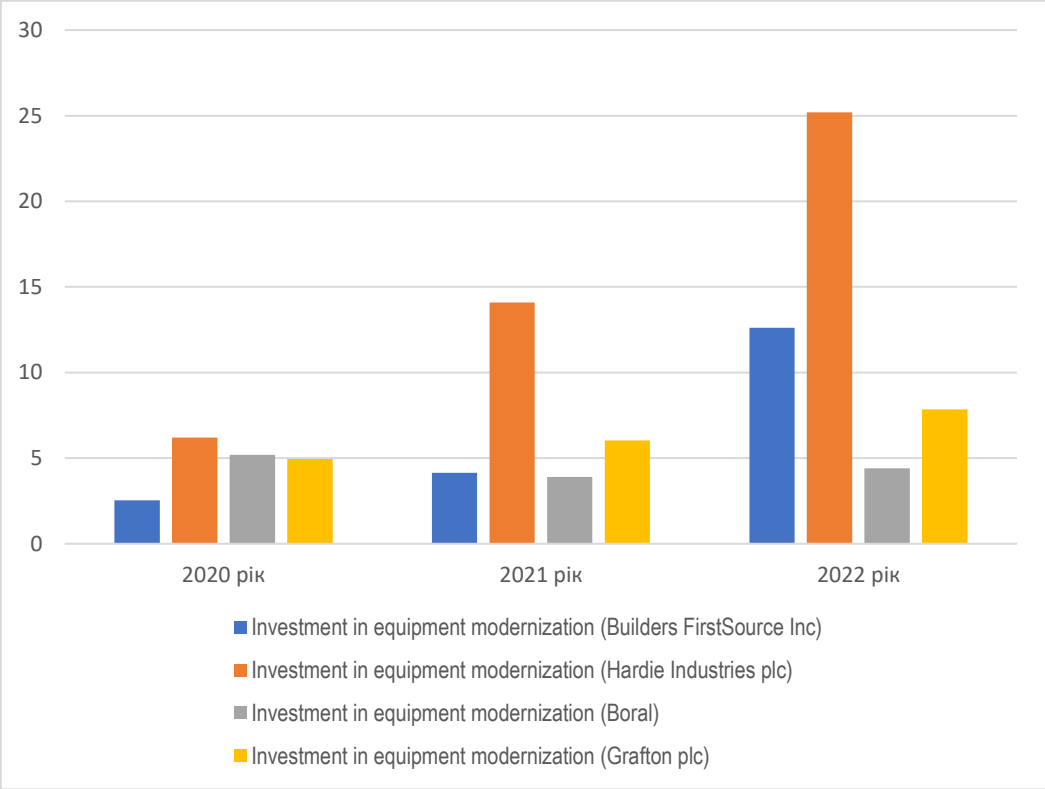


Table 4 shows a comparison of indicators of sold products and the volume of real investment.

In the financial statements, the real investment shown consist of the following elements: capital construction; acquisition (production) of fixed assets; acquisition (production) of other non-current material assets; acquisition (creation) of intangible assets; acquisition (cultivation) of long-term biological assets; others. According to companies' reports, there are only two components in the structure of real investments — acquisition of intangible assets and acquisition (production) of fixed assets.

Table 4. Dynamics of the Volume of Sold Products and Investment in Equipment Modernization in 2020-2022

Indicator	2020	2021	2022	Absolute change, $ thousand		Growth rates, %	
				2021/ 2020	2022/ 2021	2021/ 2020	2022/ 2021
Builders FirstSource Inc							
Sales volume, $ million	285.786	338.508	466.461	52.722	127.953	118%	138%
The volume of investments in equipment modernization, $ million	2.534	4.2	12.734	1.666	8.534	166%	303%
Hardie Industries plc							
Sales volume, $ million	757.2	786.9	849.9	29.7	63	104%	108%
The volume of investments in equipment modernization, $ million	6.2	14.1	25.2	7.9	11.1	227%	179%
Boral							
Sales volume, $ million	2792.3	2924.1	2955.9	131.80	31.80	105%	101%
The volume of investments in equipment modernization, $ million	5.2	3.9	4.4	-1.30	0.50	75%	113%
Grafton plc							
Sales volume, $ million	453.3	544.3	618.3	91.00	74.00	120%	114%
The volume of investments in equipment modernization, $ million	4.95	6.04	7.84	1.09	1.80	122%	130%

The features of companies that specialize in the production of building materials are characterized by the need for significant investment, and the management is tasked to develop effective mechanisms for interaction with various types of investors. Shareholders may be attracted as such investors, or investments may be realized at the expense of own funds or long-term liabilities.

Under the condition of reducing short-term liabilities, including at the expense of attracting investments by at least 12.92%, this will lead to an increase in the value of both companies, which is illustrated in Table 5. The reference year is 2020, because the debt-to-equity ratio is within the normative value and is 0.68 and 0.71 for Builders FirstSource Inc. and Hardie Industries plc, respectively.

Table 5. Economic Effect of Investment Attraction

Indicator	2020	2022		Economic effect
		Before implementing the recommendations	After implementing the recommendations	
Builders FirstSource Inc				
Company liabilities, $ million	76.9	550.7	632.4	-81.7
Company assets, $ million	278.5	1,009.3	893.8	115.5
Market value, $ million	201.6	458.6	261.4	197.2
Hardie Industries plc				
Company liabilities, $ million	32.7	234.27	269.03	-34.8
Company assets, $ million	2,089.6	7,573.19	6,706.69	866.5
Market value, $ million	1,555.2	3,537.48	2,016.49	1,521.0
Boral				
Company liabilities, $ million	3,274.5	2,3459.7	2,6940.4	-3,480.7
Company assets, $ million	7,609.3	27,577.9	24,422.5	3,155.4
Market value, $ million	197	448.1	255.4	192.7
Grafton plc				
Company liabilities, $ million	1,233.7	8,838.7	10,150.1	-1,311.4
Company assets, $ million	2,953.2	10,703.1	9,478.5	1,224.6
Market value, $ million	307.8	700.1	399.1	301.0

Analysing the data obtained in Table 5, we see that Builders FirstSource Inc has the potential to grow in value by $197.1 million if it receives investment. At the same time, Hardie Industries plc is even more favourable, as its market value could increase by $1,521.0 million after the investment. As for Boral, the market value of the company could increase by $192.7 million, and the market value of Grafton plc could increase by $301 million.

Table 6. List of Investment Costs at the Stage of Development and Construction, $ million

Types of costs	The amount of expenses by years of project implementation					Total
	0	1	2	3	4	
Design and construction works	6.7	7.9	217.1			231.7
Construction and installation work	-	-	1,056.7	1,408.9	1,056.7	3,522.4
Equipment			6,208.2	8,277.6	6,208.2	20,693.9
Project launch			264.2	352.2	264.2	880.6
Other			10,207.3	1,609.8	1,207.3	424.5
Total costs	6.7	7.9	8,953.5	11,648.5	8,736.4	29,353.1

Considering the companies' plans to modernize equipment and expand the production line, including the construction of a concrete production shop, the investment project looks like a justified step. We propose to calculate the effectiveness of the implementation of the same investment project in two different companies, as both companies are representatives of the same industry. The list of investment costs for this project is shown in Table 6.

According to preliminary calculations, the investor should allocate 85% of the total value of the investment proposal in the case of the investment for Builders FirstSource Inc and 72% of the total value of the investment proposal in the case of the investment for Hardie Industries plc. The rest of the project costs can be covered by the companies' own funds. Table 7 presents the capital structure, project cost and investment conditions.

When considering investment proposals for Builders FirstSource Inc and Hardie Industries plc, it is important to consider the capital structure and investment terms. The investor must have a clear idea of the cost of the project and the allocation of investment for each company to ensure the successful implementation of the project.

Table 7. Capital Structure, Project Cost, and Project Investment Terms

Indicator	Builders FirstSource Inc.	Hardie Industries plc.	Boral	Grafton plc
Equity, $ thousand	4,402.96	8,306.92	4,696.49	3,522.37
WACC, %	8.74	9.31	4.3	5.6
Borrowed capital	24,950.12	21,046.16	24,656.59	25,830.71
Loan term, years	15			
Grace period, years	5			
Discount rate, %	10			

According to the results of the calculations, it was found that the Weighted Average Cost of Capital (WACC) is 8.74% for Builders FirstSource Inc. and 9.31% for Hardie Industries plc, 4.3% for Boral, and 5.6% for Grafton plc. Analysing Table 7, the economic efficiency of the investment project was estimated using the NVP (according to formula 3) and PI (according to formula 2) indicators. For Builders FirstSource Inc., the NPV was $10,863 million, and PI was 1.3. The results of the NVP calculation for Hardie Industries plc. amounted to $128,173 million, and PI was 2.34. NVP for Boral amounted to $126,000 million, PI = 1.51. The calculation of NPV and PI for Grafton plc: $121,655 million and 1.46. These data indicate that an increase in WACC of the company by 8.74%, 9.31%, 4.3% and 5.6%, respectively, will lead to an increase in the value of the business due to the attraction of investments in equipment modernization.

Table 8. The Results of the Calculation of the Correlation Coefficient for Builders FirstSource Inc.

Volume of sold products (X)	The volume of investment in equipment modernization (Y)	X * Y	X2	Y2
Builders FirstSource Inc. ($ thousand)				
285,786	2,534	7.24E+08	8.17E+10	6421156
338,508	4,200	1.42E+09	1.15E+11	17640000
466,461	12,734	5.94E+09	2.18E+11	1.62E+08
1,090,755	19,468	8.09E+09	4.14E+11	1.86E+08
Hardie Industries plc.. ($ million)				
757.2	6.2	4,694.64	573,351.8	38.44
786.9	14.1	,.29	619,211.6	198.81
849.9	25.2	21,417.48	722,330	635.04
2394	45.5	10,8927	5,731,236	2,070.25
Boral				
2,792.3	5.2	14519.96	7,796,939	27.04
2,924.1	3.9	11403.99	8,550,361	15.21
2,955.9	4.4	13005.96	8,737,345	19.36
8,672.3	13.5	117076.1	75,208,787	182.25
Grafton plc				
453.3	4.95	2244.773	205,,480.9	24.523
544.3	6.04	3287.088	296262.5	36.47085
618.3	7.84	4849.327	382,294.9	61.51265
1,615.9	18.83418	30,434.15	2,611,133	354.7263

The correlation coefficient was calculated to determine the impact of investments in equipment modernization on the volume of sales, which was 0.991 for Builders FirstSource Inc. and 0.994 for Hardie Industries plc.; for Boral is 0.83, and for Grafton plc – 0.97 (Table 8). These indicators show a high degree of interrelationship between investments in equipment modernization and the volume of production, which can contribute to the further development of enterprises.

This indicates a significant impact of this type of investment on the sales volume, which testifies a relationship between productivity and investment in modernization. Such results confirm the importance of investing in equipment modernization to improve company productivity.

4. Discussion

The proposed evaluation method determines the expediency of investment in equipment modernization. This approach is universal, as it calculates the feasibility of investment, using information about the costs of upgrading equipment. Taking into account this method, it is possible to make a reasoned decision about the implementation of investments in the modernization of equipment. This decision was made based on a significant number of studies that focus on a certain specific field only. Assessing the feasibility of investment in equipment modernization is an important stage for the company. It determines whether the investment in modernization will be profitable in financial terms. The proposed methodology takes into account all the necessary aspects and parameters affecting the evaluation results. For example, (Xiaoyi Mu, 2024) examines the role of internal and external investment among oil companies. The scientist comes to the conclusion that investments in foreign assets of oil companies are costlier than the same investments in assets of Chinese oil companies. Similarly, the authors (Zhihao Shi, Libang Ma, Xiang Wang, Shanshan Wu, Jing Bai, Ziyan Li, Yuqing Zhang, 2023; Y.F. Chen *et al.* 2021; B.L. Gong 2020) analyse the modernization of agricultural equipment, in contrast to our approach.

The authors (Niyozova and Azimov 2021; Mukhtorovna 2021) note that investment funds play an important role in industrial production, influencing its results. Such funds make it possible to modernize the equipment. The role of these funds depends on various factors, such as the conditions of circulation, the impact on social production and the relationship with other distributive categories. Despite the variety of results obtained from the use of investment funds, they constantly affect social production processes. In this context, this study partially correlates with our results regarding the relationship between investment in equipment modernization and productivity (Kwilinski *et al.* 2022).

The assumption that there are independent investment in immovable and movable property may or may not be appropriate (Meilin Ma 2023; X. Wang *et al.* 2020). The authors argue that the investment of large farms in infrastructure plays a key role in determining their choice of movable assets, especially when public investment in infrastructure is limited. Even without credit constraints, the conceptual model shows that large farms tend to underinvest in fixed assets and overinvest in low-performing mobile assets that face insecure land rights. And these studies are also quite different from the studies that we proposed.

However, we agree with the authors' research (Chipangamate *et al.* 2023; Blesia *et al.* 2023) regarding the need to modernize equipment to a state where equipment becomes 'smart'. The emphasis is placed on investments in digitization of equipment. In the current business environment, the competition to attract and develop exceptional talent and leadership is becoming a key success factor for any company. According to (Dodoo *et al.* 2023), an important condition for organizational prosperity is the ability to meet society's demands for environmental, social, and managerial responsibility. In this context, cooperation with various stakeholders (Blesia *et al.* 2023) and integration of their interests into the company's development strategy becomes important. Fulfilment of these tasks requires an organization not only to attract talent and develop leaders, but also to implement current approaches to management and interaction with stakeholders. The studies (Kemp *et al.* 2023; Le Roux 2021) emphasize the need to carefully develop a modernization strategy aimed at obtaining a social operation license.

Conclusions

Modernization of the company's assets through the introduction of innovative production equipment leads to changes in labour productivity. Investment in the modernization of production equipment play an important role in this process. Modern technologies play a key role in the companies' development. Their implementation enables companies to innovate, reduces the cost of production, and meets the market needs. The conducted research demonstrates a real example of how the proposed method will allow calculating the necessity and feasibility of investment in modernization using the example of the studied companies Builders FirstSource Inc., Hardie Industries plc., Boral and Grafton plc. The feasibility of investment in equipment modernization is illustrated by the WACC indicator - 8.74; 9, 31; 5.6 (respectively) and the Profitability Index - 1.30; 2.34; 1.51; 1.46, respectively. A

close correlation between productivity (which is expressed in the dynamics of sales volume) and investment in equipment modernization is proven, because the correlation coefficients are 0.991 for Builders FirstSource Inc and 0.994 and for Hardie Industries plc., for Boral and Grafton plc - 0.83 and 0.97. They all fell into the range [±0.7; ±1]. Such results should be used in manufacturing companies to assess the feasibility of investment in modernization. Of course, the research has certain limitations related to the time of its implementation - 2020-2022, the period of the COVID-19 pandemic. The methodology was tested on the US companies, and it needs to be tested on the companies from other countries. This can be a prospect of further research. It is also appropriate to implement the gradation of investments in modernization, noting exactly the type of equipment modernization.

Credit Authorship Contribution Statement

The authors equally contributed to the present research, at all stages from the formulation of the problem to the final findings and solution.

Declaration of Competing Interest

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

Declaration of Use of Generative AI and AI-assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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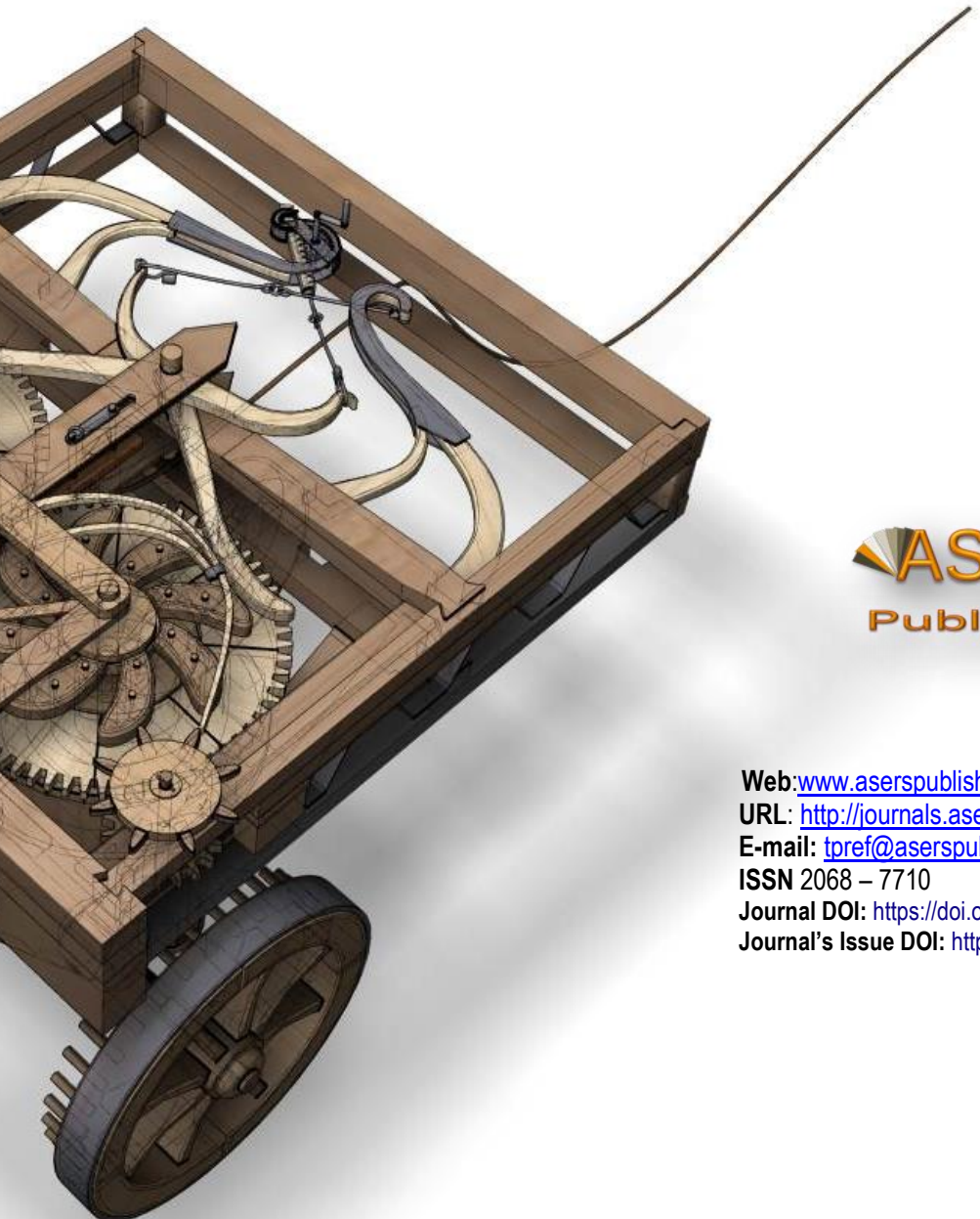

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