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## ECONOMIC JUSTIFICATION FOR THE IMPLEMENTATION OF A CIRCULAR ECONOMY

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**Introduction.** This case study examines the economic justification for the implementation of a circular economy. The case study is structured in 2 parts. The first part describes the principles of circular economy and business models, covering the theoretical basis of this study. The theoretical basis includes a description of the principles of circular economy and the possible implementation of these principles in business operations. The second part evaluates the impact of the introduction of circular economy principles and business model on the company's financial performance and company value. The methods used are economic evaluation and investment decision methods and financial analysis, modeling and forecasting. The limitations are the research based on one company and the fact that the financial statement for 2019 was not submitted at the time of writing; however the results obtained are applicable to other companies and industries. The principles of circular economics and business models described in this case study can serve as an example for companies considering implementing the principles of circular economy in business operations.

**Aim and tasks.** The purpose of the study is to determine what the principles of circular economy are, how to implement them in business and how their implementation affects business results and company value. Following tasks have been defined in order to achieve the aim: describe the principles of circular economy, business and financing models; to analyze the business models of the circular economy in Latvia and in the world and to evaluate the impact of the implementation of the principles of circular economy and business model on the company's financial indicators and the company's value.

**Results.** Evaluating the investments made by the company AS "Cēsu Alus" and the planned investment projects related to the modernization of production equipment and improvement of efficiency, it can be concluded that the implementation of circular economy investment projects will be profitable. The company has opportunities to continue the investment project program; moreover, based on the experience of similar companies studied, AS "Cēsu Alus" can create additional revenue streams for the company when adopting circular economy principles.

**Conclusions.** Investing the company's funds in investment projects designed to improve the company's efficiency, ensuring resource savings and efficient use, which in turn leads to financial savings, the company's value increases significantly, thus concluding that circular economy investment projects that save resources and improve the efficiency of the company will make the greatest contribution to increasing the value of the company.

**Keywords:** circular economy, sustainability, investment projects.

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## ЕКОНОМІЧНЕ ОБГРУНТУВАННЯ РЕАЛІЗАЦІЇ ЦИРКУЛЯРНОЇ ЕКОНОМІКИ

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**Вступ.** У цьому тематичному дослідженні розглядається економічне обґрунтування впровадження циркулярної економіки, яке складається з 2 частин. У першій частині описуються принципи циркулярної економіки та бізнес-моделей, що охоплюють теоретичні основи цього дослідження. Теоретична основа включає опис принципів циркулярної економіки та можливе впровадження цих принципів у господарські операції. Друга частина оцінює вплив впровадження принципів циркулярної економіки та бізнес-моделі на фінансові результати та вартість компанії. Методи, що використовуються, - це економічна оцінка та методи прийняття інвестиційних рішень, фінансовий аналіз, моделювання та прогнозування. Обмеженнями є дослідження, засноване на одній компанії, і той факт, що фінансова звітність за 2019 рік не була подана на момент написання статті, однак отримані результати застосовні до інших компаній та галузей. Принципи циркулярної економіки та бізнес-моделей, описані в цьому прикладі, можуть слугувати прикладом для компаній, які розглядають можливість впровадження принципів циркулярної економіки в ділові операції.

**Мета і завдання.** Мета дослідження - визначити, які принципи циркулярної економіки, як їх впровадити в бізнес та як їх реалізація впливає на результати бізнесу та вартість компанії. Для досягнення мети було визначено наступні завдання: описати принципи кругової економіки, бізнес та моделі фінансування; проаналізувати бізнес-моделі циркулярної економіки в Латвії і світі та оцінити вплив впровадження принципів циркулярної економіки та бізнес-моделі на фінансові показники та вартість компанії.

**Результати.** Оцінюючи інвестиції, здійснені компанією AS "Cēsu Alus", та заплановані інвестиційні проекти, пов'язані з модернізацією виробничого обладнання та підвищенням ефективності, можна зробити висновок, що реалізація інвестиційних проектів циркулярної економіки буде вигідною. Компанія має можливості продовжити програму інвестиційного проекту; крім того, на основі досвіду аналогічних компаній, що вивчаються, AS "Cēsu Alus" може створювати додаткові потоки доходу для компанії при прийнятті принципів циркулярної економіки.

**Висновки.** Вкладаючи кошти компанії в інвестиційні проекти, спрямовані на підвищення ефективності компанії, забезпечення економії ресурсів та ефективного використання, що, в свою чергу, призводить до економії фінансів, вартість компанії значно зростає, роблячи висновок, що інвестиційні проекти циркулярної економіки, що заощаджують ресурси та покращують ефективність компанії зробить найбільший внесок у збільшення вартості компанії.

**Ключові слова:** циркулярна економіка, стійкість, інвестиційні проекти.

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**Introduction.** The notion of a “circular economy” is modeled on self-sustaining ecosystems and grounded in their complex, self-organizing, and circular flows of energy and matter. By cascading (passing along) waste energy and processing waste nutrients for reuse in the cycle, such a closed-loop, complex system reduces new resource inputs while eliminating waste, pollution, and emission outputs. Optimized by design this way, a human-engineered system of goods and services may be considered restorative or regenerative. The circular economy stands in contrast to the extractive, once-through, or linear economy upon which our open-ended economic system — and industrialized consumption of resources — has been predicated [1].

A circular economy changes economic logic because it replaces production with sufficiency: reuse what you can, recycle what cannot be reused, repair what is broken, remanufacture what cannot be repaired [2]. Given the design of the circular economy model, the circular economy has the potential to improve the efficiency of the use of primary raw materials at both European and global levels. If raw materials are stored in high-quality products or waste is returned to the production process as high-quality secondary raw materials, the circular economy can reduce industrial demand for primary raw materials [3].

Over the last 20 years, the prices of raw materials and consumer goods in the European Union have shown an upward trend, which in turn is being felt both by producers and final consumers. In practice, supply chain constraints such as inefficient resource/process mapping and poor identification of connected input-output cycles have been observed, leading to a lack of resources [4]. Implementing the principles of the circular economy can contribute to the sustainability of the supply chain. Lower demand for primary raw materials, in turn,

will help reduce import dependence, making value chains in many industries less vulnerable to price fluctuations in international commodity markets and supply insecurity due to scarcity and/or geopolitical factors [5]. Current estimates suggest that using circular economy principles such as material recycling, waste prevention or ecodesign strategies could save 6 to 12 percent of total material consumption (including fossil fuels). In addition, the maximum savings potential, taking into account existing technologies, is estimated to be 17 percent [6]. The circular economy would create significant opportunities for industrial renewal and innovation in general, it would make it possible to gradually separate economic growth from resource consumption, foster innovation, increase growth and create more stable employment [7]. In this case study the implementation of the principles of circular economy in the company AS “Cēsu Alus”, including the investments made by the company and the planned investment projects related to the modernization of production equipment and improvement of efficiency will be evaluated in context of circular economy principles.

**Methods.** In order to find out and describe different points of view and to achieve the purpose of the research, the literature sources covering the theoretical basis of this research were reviewed. Further in the case study, methods such as economic evaluation and investment decision methods, financial analysis, modeling and forecasting were used to assess the impact of the principles of a circular economy and the implementation of the business model on the company's financial performance and company value.

The **aim** of the study is to determine what the principles of circular economy are, how to implement them in business and how their implementation affects business results and company value.

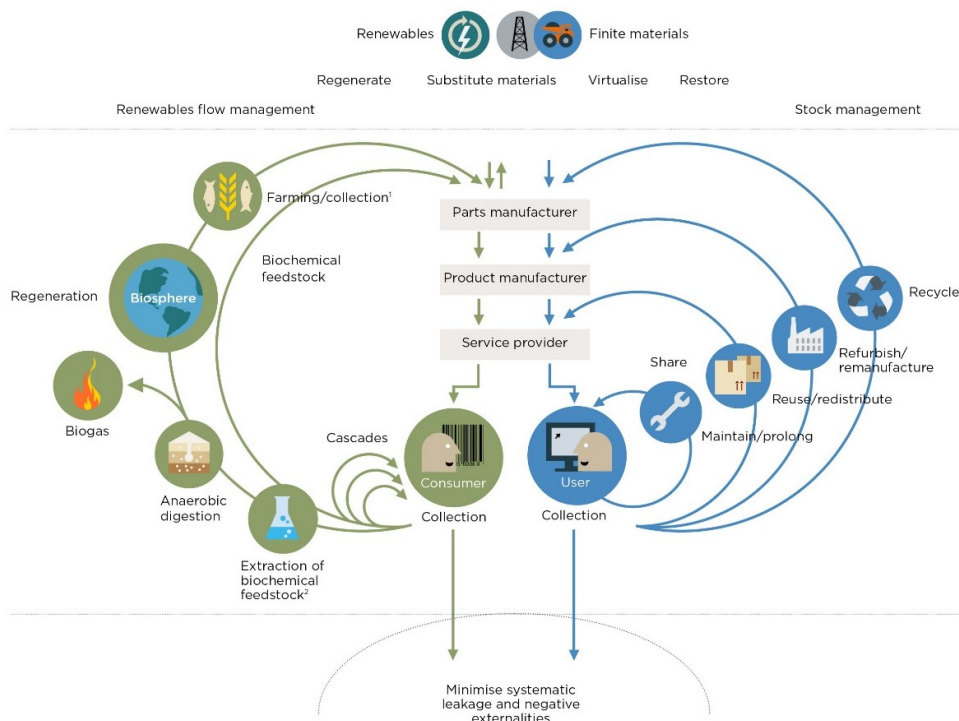


Fig. 1. Circular economy system diagram

Source:[8]

**Research results.** Figure 1 shows a schematic representation of the circular economy, which reflects the “cradle to cradle” concept developed by the German chemist Michael Braungart and the American architect Bill McDonough. This design philosophy divides all materials into two cycles - biological and technical, moreover, all materials involved in industrial and commercial processes are considered as resources [9].

The circular economy is based on three principles:

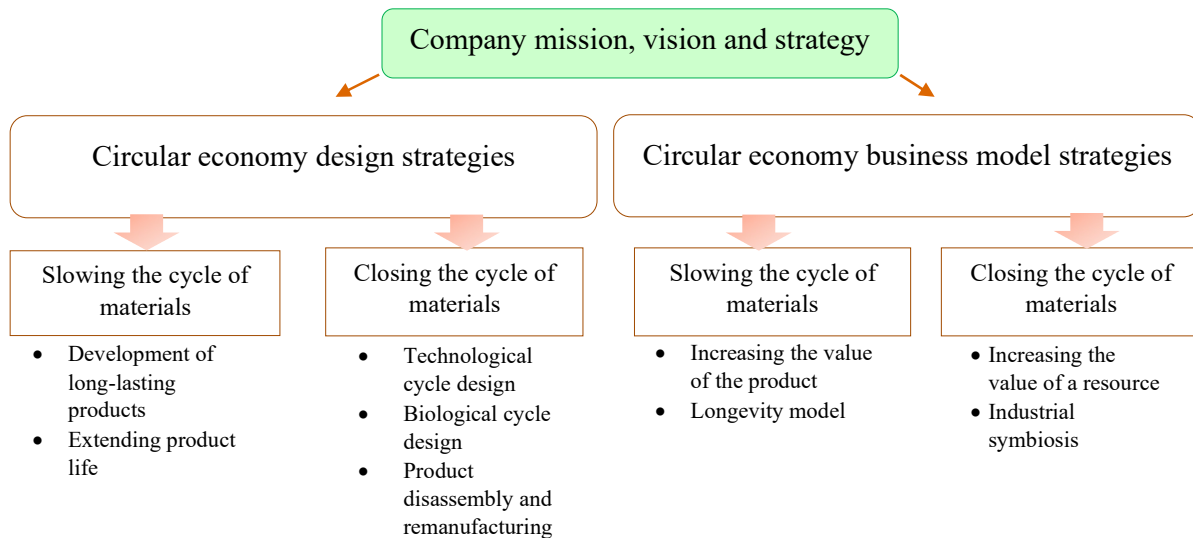
1. Minimization of waste and pollution throughout the product life cycle;
2. Reuse and application of products and materials;
3. Ecosystem restoration [8]

One of the basic features of the circular economy is the careful consumption of materials and resources and the pursuit of a general reduction in consumption, so the concepts and possible strategies for slowing down, closing and narrowing the range of resources are discussed below. To separate the circular economy model from the linear model, product design strategies are classified according to the mechanisms by which resources flow through the system, based on

parameters defined by different authors [10]. Regarding the resource and material cycle, two basic strategies are described:

- 1) Slowing the cycle of materials and resources;
- 2) Closing the cycle of materials and resources. Figure 2 summarizes and illustrates a simplified framework for the implementation strategy of the circular economy, which looks at the main aspects of the transition of business to the circular economy model and illustrates the main directions in the implementation of the principles of a circular economy in the company.

The choice of business model determines the structure of the business and the ways and strategy of expansion. Companies that have been established and operating for some time often face great difficulties in changing business models. Companies commercialize and market product and technology innovations through their business models, but existing firms often have limited opportunities to change the business models through which these innovations are implemented [12]. In this case, companies plan and implement various investment projects, making gradual changes in the company's operations.



**Fig. 2. Strategies for implementing the principles of circular economy in the company**  
*Source:[11]*

The transition to a circular economy model is a widely studied topic. In 2015, McKinsey & Company, a business management consulting firm, conducted an extensive study with the Ellen McArthur Foundation to examine the feasibility of implementing circular economy principles and the impact of improvements in 28 business sectors. This study indicated that most of the industries studied could implement at least three to four of the six potential actions to implement the principles of the circular economy, improving the company's performance and reducing costs. These actions are as follows:

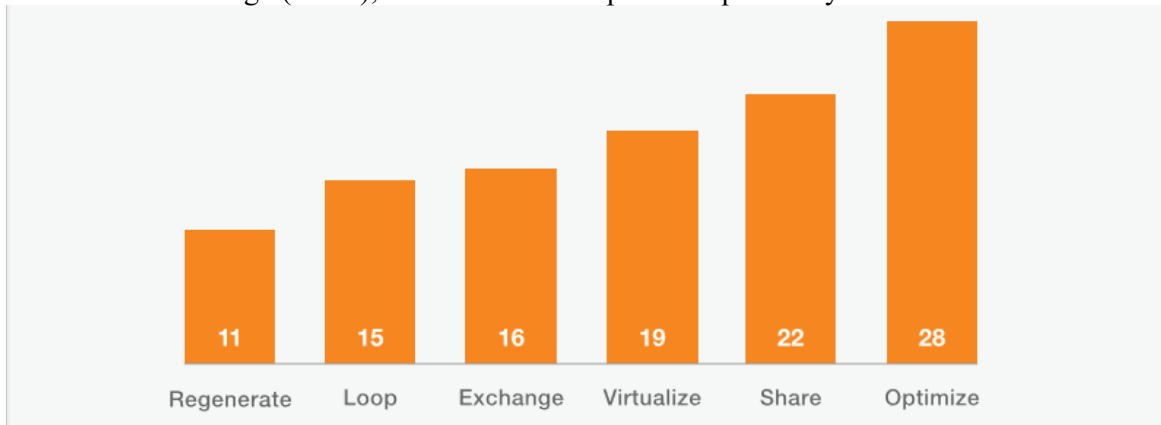
1. Shifting to renewable energy and materials (Regenerate)
2. Promoting the sharing of products or otherwise prolonging product life spans through maintenance and design (Share);

3. Improving product efficiency and removing waste from supply chains (Optimize);
4. keeping components and materials in “closed loops” through remanufacturing and recycling (Loop),

5. Delivering goods and services virtually (Virtualize)

6. Replacing old materials with advanced renewable ones or applying new technologies such as 3-D printing (Exchange) [13].

Most industries already have profitable opportunities in each area, and of the 28 sectors surveyed, companies in all sectors could implement 2-3 of these circular economy elements in their business, but only 10 sectors could cost-effectively implement all of these elements [14]. Figure 3 shows the number of industries with the potential to adopt specific practices profitably.



**Fig. 3. The number of industries with the potential to adopt specific practices profitably**  
*Source:[13]*

In order to characterize possible circular economy projects, a study of similar companies and implemented circular economy principles was performed. Later, the possibilities of implementing the principles of circular economy in two similar companies operating in the sector and whose main activity is beer production, will be considered.

One of the companies studied, Pivovarna Laško, the largest brewery in Slovenia, started implementing the principles of circular economy in the company, developing a research project and studying how brewer's spent grain could be used in biogas production and anaerobic fermentation [15]. The second company studied, Mahou San Miguel, is the leading and most international brewer in Spain. Mahou excels in waste management in accordance with the principles of the circular economy, as well as in its commitment to ensure 100% energy consumption from renewable sources. One of the most notable projects is Mahou San Miguel and L. Pernía, a joint project that promotes sustainability through an innovative solar-powered brewer's spent grain drying process [16]. To summarize briefly, it can be concluded that both companies have successfully implemented 3 of the 5 previously described circular economy activities:

1. Process optimization
2. Closing resource circles
3. Use of renewable energy

This case study examines the largest beer and beverage producer in Latvia - AS "Cēsu Alus".

In order to ensure a more sustainable business, the company has also set certain environmental goals. In 2019, 3 main goals were set for improving environmental performance:

- 1) To reduce all recyclable waste by 10% per 1 litre of production by 2027.
- 2) Reduce the use of office paper by 20% by 2025.
- 3) Increase the use of self-produced biogas by 20% by 2025.

Based on the information provided in the annual report of AS "Cēsu Alus" for 2018, it is known that in 2018 the company continued to implement a long-term investment program, investing EUR 2.21m. In addition, in 2019 it was planned to invest another 2m EUR. These investments are related to the modernization of production equipment and improvement of efficiency, as well as to increase the energy efficiency of the production plant [17]. The company is showing good results of economic activity, closing 2018 with a profit of EUR 4.2m. In order to assess the company's overall financial situation, the company's main indicators in 3 aspects are summarized below - working capital, return on assets and capital structure.

Working capital reflects the difference between a company's current assets and current liabilities and is an indicator of the company's liquidity, operational efficiency and its short-term financial position. Table 1 reflects the working capital of AS "Cēsu Alus" in 2018.

**Table 1. Working capital of AS "Cēsu Alus" in 2018, in EUR**

Current assets	12,452,168
Current liabilities	6,464,024
Working capital	5,988,144
Working capital ratio	1.93

Source:[17]

The working capital ratio above 1 is to be assessed positively and indicates that the company's working capital is sufficient to cover short-term liabilities and the company can easily finance day-to-day operations.

Next, the return on assets of AS "Cēsu Alus" will be considered, providing an idea of how effectively the company's management uses the company's assets to generate income. It

is in the interest of any company to become as productive as possible - to use limited resources to achieve maximum results. The structure of the company's assets is appropriate for a manufacturing company - in 2018, 61% of assets were long-term investments, while current assets accounted for 39% of total assets.

Company makes significant investments each year by implementing a long-term

investment program. These investments are related to the modernization of production equipment and improvement of efficiency, as well as to the increase of energy efficiency of the plant, therefore the structure of assets and, accordingly, the return on assets is an important indicator for the Company.

Table 2 below shows the main capital structure indicators of AS “Cēsu Alus”. The table shows

that the company's assets are mostly financed from equity, which is indicated by the equity ratio. This ratio in three of the four periods considered is higher than 0.5 or 50%, which indicates that the company's financial position overall is stable. The Company's borrowed capital consists mainly of a long-term loan from the parent company Olvi Oy.

**Table 2. AS “Cēsu Alus” capital structure indicators between 2015-2018**

	2015	2016	2017	2018
Total assets	30,745,814	30,557,183	31,439,039	32,283,520
Equity (E)	15,046,971	17,424,615	22,940,199	17,638,868
Borrowed capital (D)	15,698,843	13,132,568	8,498,840	14,644,652
Equity ratio	0.49	0.57	0.73	0.55
Borrowed capital ratio	0.51	0.43	0.27	0.45
Debt-to-equity ratio	1.04	0.75	0.37	0.83

Source:[17]

In the context of capital structure, an important indicator of a company is the weighted average cost of capital. The weighted average cost of capital is the price a company pays for capital raised and it consists of the price of equity and the price of debt. Weighted average cost of capital is expressed as an interest rate and it is applied as a discount rate for the evaluation of investment projects [19].

The components used in the calculation of the weighted average capital price of AS “Cēsu Alus” are indicated in Table 3. The calculation uses the company's actual capital structure and available industry data from a database of companies and industries created by professor Aswath Damodaran at New York University's Stern School of Business.

**Table 3. AS “Cēsu Alus” weighted average cost of capital (WACC)**

Cost of equity	7.61%
Equity ratio	54.64%
Cost of debt	1.91%
Debt ratio	45.36%
Weighted average cost of capital	<b>5.02%</b>

Source:[17], [18]

When analyzing projects, the weighted average cost of capital is used as the minimum rate as it is the basic return required by the company. The weighted average cost of capital of the company A/S „Cēsu Alus” is relatively low, which can be explained by the low price of borrowed capital. It should be noted that for large companies the weighted average cost of capital can be lower than for small companies, which is associated with the added risk premium.

When implementing the principles of circular economy in the production process, which is reflected in the investments made, it is first necessary to evaluate the profitability of projects and assess the expected return. In practice, five methods are most often used in the evaluation of investment projects:

1. Payback period.
2. Net Present Value.
3. Profitability index.
4. Internal rate of return.
5. Modified internal rate of return.

Using these methods, the planned investments of AS “Cēsu Alus” will be evaluated.

1. Project payback period.

The payback period of the project is determined as the expected number of years required for full compensation of investment costs. This is the time in years until the cost of the capital investment is fully covered by the cash inflows generated by this investment [19]. Assuming that the investments made by AS

“Cēsu Alus” in 2018 were EUR 2.21m and the planned investments in 2019 were EUR 2m, within the framework of this work, it is assumed that the mentioned investments, which are related to the modernization of production equipment and improvement of efficiency, will ensure savings by reducing production costs by 2%. Table 4 reflects the main parameters of the payback period of these investment projects.

**Table 4. Main parameters of AS “Cēsu Alus” investment projects in FY 2018-2019, in thousands of EUR**

Period	1	2	3	4	5
Cash inflow (2% savings)	951	1,046	1,098	1,153	1,188
Investments	(2,210)	(2,000)	-	-	-
Projected cash flow	(1,259)	(954)	1,098	1,153	1,188
Accumulated cash flow	(1,259)	(2,213)	(1,114)	39	1,227

Source:[17]

The estimated payback period is **3.96** years. This period is considered acceptable for the investment project. This method would be useful if the company were planning to implement several investment projects; it would then be possible to compare the calculated payback period. It should be noted that the payback period is an incomplete indicator for the evaluation of the project as it does not

account for the cash inflows after the payback period.

2. Net present value method (NPV).

Table 5 below reflects the net present value of investment projects. The discount rate applied is the company's weighted average cost of capital, which was determined to be 5.02%. Net present value is positive indicating that the project will be profitable.

**Table 5. Calculation of the net present value of AS “Cēsu Alus” investment projects in FY 2018-2019 in thousands of EUR**

Period	1	2	3	4	5
Cash inflows (2% savings)	951	1,046	1,098	1,153	1,188
Investments	(2,210)	(2,000)	-	-	-
Projected cash flow	(1,259)	(954)	1,098	1,153	1,188
Discount rate	5.02%				
Net present value	<b>762</b>				

Source:[17]

3. Profitability index.

This method is similar to the discounted present value method - this method is expressed as the ratio of the net present value of income to the amount of investments made A profitability index of 1.0 is the lowest allowable indicator, as

any value below this figure indicates that the present value of the project is less than the initial investment [19]. In general, the higher the profitability index, the more attractive project. Table 6 reflects the profit margin of AS “Cēsu Alus” investment projects.



**Table 6. Profitability index of AS “Cēsu Alus” investment projects in FY 2018-2019 in thousands of EUR**

Period	1	2	3	4	5
Cash inflows (2% savings)	951	1,046	1,098	1,153	1,188
Investments	(2,210)	(2,000)	-	-	-
Projected cash flow	(1,259)	(954)	1,098	1,153	1,188
Discount rate	5.02%				
Discount factor	0.976	0.929	0.885	0.842	0.802
Net present value of cash flows	928	972	972	971	953
Total cash flows	4,796				
Profitability index	<b>1.14</b>				

Source:[17]

The calculated project profit margin is 1.14, which indicates that the investment project will be profitable. The ratio is higher than 1, which indicates that the discounted cash flow of the project in the future is higher than the initial investment, so it is beneficial to implement the project.

4. Internal rate of return (IRR).

Internal rate of return method presents the discount rate at which the net present value of a project is equal to 0, indicating that if the project discount rate is above IRR, the project is deemed to be profitable [19]. Using the projections for calculation of net present value it is also possible to calculate the project's internal rate of return.

**Table 7. Internal rate of return on AS “Cēsu Alus” investment projects in 2018-2019 in thousands of EUR**

Period	1	2	3	4	5
Cash inflows (2% savings)	951	1,046	1,098	1,153	1,188
Investments	(2,210)	(2,000)	-	-	-
Projected net cash flow	(1,259)	(954)	1,098	1,153	1,188
Discount factor	0.98	0.93	0.88	0.84	0.80
Discounted cash flow	(1,228)	(886)	972	971	953
Discount rate (WACC)	5.02%				
Net present value	762				
IRR	<b>18.82%</b>				

Source:[17]

The indicator of the internal rate of return of AS “Cēsu Alus” investment projects is 18.82%, which is significantly higher than the set discount rate. As already determined above, the investment project will be profitable and the implementation of the project will be profitable; moreover, the established internal profitability norm indicates that deviations from the project results are possible, but the implementation of this project will still be beneficial for the

company.

5. Modified internal rate of return (MIRR).

Using the previously prepared projections for the calculation of the net present value of the expected cash flow, the modified internal rate of return of AS “Cēsu Alus” investment projects has been calculated, and is reflected in Table 8.

**Table 8. Modified internal rate of return on AS “Cēsu Alus” investment projects in 2018-2019 in thousands of EUR.**

Period	1	2	3	4	5
Revenue (2% savings)	951	1,046	1,098	1,153	1,188
Investments	(2,210)	(2,000)	-	-	-
Projected net cash flow	(1,259)	(954)	1,098	1,153	1,188
Discount factor	0.98	0.93	0.88	0.84	0.80
Discounted net cash flow	(1,228)	(886)	972	971	953
Discount rate (WACC)	5.02%				
Net present value	762				
MIRR	<b>10.10%</b>				

Source:[17]

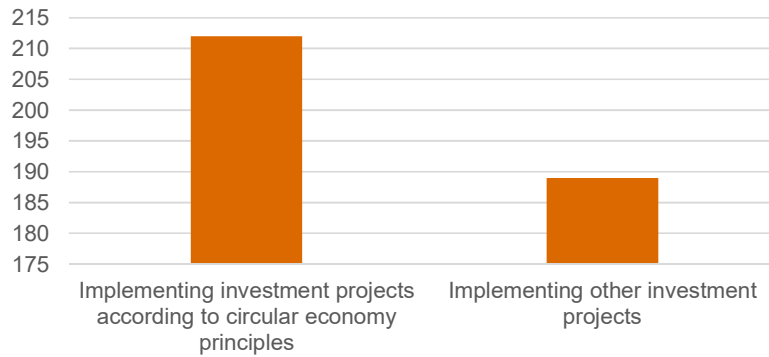
The modified internal rate of return of AS “Cēsu Alus” investment projects is 10.10%, which, similar to the internal rate of return, is significantly higher than the determined discount rate. This indicator also confirms that the investment project will be profitable and it will be beneficial to implement the project.

To finalize, the value of the company and its changes will be studied by looking at two options – investment projects will provide the desired result, improving the company's production efficiency and desired resource savings or, conversely, maintaining the company's performance at historical levels [21]. The value of the company will be calculated using the discounted cash flow method (DCF).

In determining the value of the company, a cash flow forecast for five years has been prepared, which is based on the author's assumptions. The main indicator of cash flow is revenue. Analyzing the historical development of the company, it is concluded that the average annual revenue growth in the period from 2015 to 2018 is 11% compared to the previous year. Taking into account the forecasts of the Bank of Latvia's economist Agnese Rutkovska [21], no rapid growth is forecasted in the food and beverage sector; moreover, production is declining. It was assumed that the revenue of the company would grow and increase 10% in the first and second forecast period, a 5% increase in the next two periods and a 3% increase in the fifth forecasted year. The growth rate of the terminal period is determined in accordance

with the long-term inflation forecast of the European Central Bank, which is currently 1.7% [22]. Costs are based on historical structure and ratio. The main expenditure items are production costs, selling expenses and administration costs. The model includes depreciation and amortization costs, which are forecasted on the basis of historical data, and investment project costs, which in 2018 were EUR 2.21m and EUR 2m.

The first version of the company's value calculation assumes that the investments made will provide resource savings, which are reflected in the operating profit margin. This option assumes that the operating profit margin will increase by 1 percentage point to 11%. Applying the discounted cash flow method, the value of the company is EUR 212m, which is possible on the assumption that the analyzed investment projects provide the expected return and ensure more efficient operation of the company, in accordance with the principles of circular economy. In order to compare the impact of investment projects on the company's value, another cash flow model is developed, but the company's performance indicator, on which the first option company's value calculation is based - operating profit margin – remains at the historical level and is 10%. The second version of the company's value calculation assumes that the investments made will not lead to resource savings and assumes that the operating profit margin will remain at the historical level of 10%. The value of the company calculated in this case is EUR 189m.



**Fig. 4. Impact of the circular economy projects on enterprise value.**

Source: \*created by authors.

**Conclusions.** By evaluating the investments made by the company AS “Cēsu Alus” and the planned investment projects related to the modernization of production equipment and improvement of efficiency, it can be concluded that the implementation of investment projects will be beneficial and worth investing in such projects.

The calculation of the company's value shows that by investing the company's funds in investment projects designed to improve the company's efficiency, ensuring resource savings and efficient use, which in turn leads to financial savings, the company's value increases significantly, thus concluding that circular economy investment projects that save resources and improve the efficiency of the company will make the greatest contribution to increasing the value of the company.

From a financial management perspective, when implementing the principles

of circular economy in the production process, which is reflected in the investments made, it is first necessary to evaluate the profitability of projects and assess the expected return. Evaluating the investments made by the company AS “Cēsu Alus” and the planned investment projects related to the modernization of production equipment and improvement of efficiency, it can be concluded that the implementation of investment projects will be profitable. The company has opportunities to continue the investment project program; moreover, based on the experience of similar companies studied, AS “Cēsu Alus” can develop both biogas production and the use of beer by-products in the production of other products, thus creating additional revenue streams for the company. This case study can be used by other companies enabling them to adopt good practice and implement circular economy principles in business operations.

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