The Financial Efficiency of Biogas Stations in Poland

Serhiy Zabolotnyy and Mariia Melnyk

Abstract The aim of the paper is to give an overview of financial efficiency of biogas plants in Poland. The research presents the analysis of selected biogas stations in Poland such as Biogazownia Drozdowo Sp. z o.o., Biogazownia Ostrzeszów Sp. z o.o., Biogazownia Prusinowice Sp. z o.o., Spółka Rolna Dretyń Biogazownia Sp. z o.o. The hypotheses of the research states that the biogas stations with higher profitability ratios are characterized by higher level of liquidity. In Poland the most popular is the usage of biomass among renewable energy sources. Biomass is used to produce biogas in large and small agricultural biogas stations. The production of biogas takes place under anaerobic conditions involving the usage of a number of microorganisms.

Keywords Financial efficiency · Biogas stations · Biogas production
Agro-industrial complexes · Renewable energy sources · Profitability

1 Introduction

The modern world faces a huge energy crisis, which associates with exhaustion of conventional energy resources. Therefore, power generation getting from alternative sources increasingly attracts both scientists and businessmen. Biogas is one of such type of source, which in the nearest future—together with wind and solar energy—will be an important source of renewable energy. Biogas power stations

The original version of this chapter was revised: Incorrect author name has been corrected. The erratum to this chapter is available at https://doi.org/10.1007/978-3-319-72371-6_81

S. Zabolotnyy (✉)
Warsaw University of Life Sciences (SGGW), Warsaw, Poland
e-mail: serhiy_zabolotnyy@sggw.pl

M. Melnyk (✉)
Sumy National Agrarian University, Sumy, Ukraine
e-mail: lypcheu@ukr.net

K. Mudryk and S. Werle (eds.), *Renewable Energy Sources: Engineering, Technology, Innovation*, Springer Proceedings in Energy,
https://doi.org/10.1007/978-3-319-72371-6_9

have enormous potential, which can positively influence social and economic development and improvement of the environment [1].

To ensure a prominent level of financial efficiency of biogas stations, managerial staff must assess the financial condition of both enterprise and existing potential competitors. As a rule, the desire of managerial staff of a company to maximize profits entails a risk of liquidity loss.

An analysis of solvency and profitability of biogas stations will make it possible to identify errors in its activities, reserves of its growth and help more successfully carry out their activities. The purpose of the research is to determine priorities in management of liquidity and profitability of biogas stations in Poland. To achieve this goal, it is necessary to solve the following tasks: to consider theoretical aspects of profitability and liquidity; to conduct the analysis of liquidity and profitability of specific biogas stations. Different views on the content of the concept "financial efficiency" are generalized.

The conducted analysis of liquidity and profitability of biogas stations allows us to determine priority areas of financial management during this time of period.

The value of liquidity indicators of some biogas stations exceeds the normative value, which indicates inefficient usage of funds, which could be involved in the development of Polish biogas stations. It also means the presence of unclaimed cash in accounts—it causes the need to take decisions, which should balance these indicators.

In modern terms, to provide economic sustainability, companies have to improve their own economic activities according to the concept of management, which will help fundamentally change the economic environment for their operation and enable further development [2].

2 Methodology and Aim of the Study

The goal of the research is to study financial condition and efficiency of biogas plants in Poland. The focus of the research is made on profitability and liquidity relations of research objects.

The study was based on the generally accepted methods for data quantification, processing, presentation, statistical observation, summary and grouping of observation materials, correlation and regression analysis. Liquidity and profitability ratios were used [3].

Assessing the financial efficiency of biogas stations, we used the following methods which relate to quantitative methods of economic analysis:

(1) statistical observation—recording information on certain principles and for certain purposes;
(2) calculations of average values (average arithmetic simple);

(3) series of dynamics: absolute growth, growth rates;
(4) summary and grouping of economic indicators according to certain characteristics;
(5) comparison of indicators: with competitors, standards, dynamics;
(6) graphical methods [4].

The analysis of indicators began with consideration of absolute values. These indicators are the main ones in financial accounting. In the analysis they are used to calculate average and relative values.

Typical features of the method of the analysis are:

(1) Usage of the system of analytical indicators which comprehensively characterize financial and economic activity of an organization;
(2) Research of reasons for the change in these indicators;
(3) Identification and measurement of cause-effect relationships between them [5].

Relative values are indispensable in the analysis of dynamics of phenomena. With their help time series of financial indicators were built. They include coefficients of return on assets, equity, absolute and instantaneous liquidity coefficients which characterize the change in the given indicator over time (in relation to the basic indicator taken as 100%).

The method of comparison with the previous period was also used. It is the comparison of economic indicators of the current period with those of the previous period.

Also, the comparison with the best indicators was made—the best practice gives an effect when the comparison is conducted with indicators of similar enterprises.

The most used method was the method of horizontal analysis (temporary)—the comparison of each position of reporting with the corresponding position of the previous period, consisted in the construction of several analytical tables. During the horizontal analysis absolute and relative changes in the values of different balance accounts the reporting period were determined.

3 Renewable Energy Market in Poland

Biogas in Poland is an important source of energy that can increase the stability of gas supply. Poland possesses huge resources for production of agricultural biogas. The energy potential of biogas related to agricultural biomass is estimated to reach approximately 48.595 GWh/year [6].

In 2013, 10 new biogas plants were opened. This is a good result given that at the end of 2012 the total number of biogas plants was less than 30, and in 2012 were commissioned 12. Currently, trends in the market show an increase in the planned capacity of installed biogas plants. According to the Institute of Renewable Energy, about 212 biogas plants were designed, and in the near future 37 facilities will be built [7].

The main attention should be paid to the production of agricultural biomass in the producing of energy from renewable sources in Poland. Poland has a high level of biomass production compared with the rest of the EU member countries. This is directly related to the highly developed agro-industrial sector [8].

The stable development of the agro-industrial complex and rural areas also depends on how efficiently agricultural biogas will be used. This sustainable development is an integral part of the development of the European Union.

The development of energy in Poland is conditioned by the norms of the European Union. Poland, as a member of the European Union, is committed to diversifying energy sources. By 2020, renewable energy should account for 15% of the final energy consumption in Poland. Compared to other countries of the European Union, this should be: in Austria—34%, Germany—18% and the Czech Republic—13% [9].

From 7.2% in 2005, Poland aims to achieve a 15% target for renewable energy in 2020. Solid biomass (wood) and hydropower currently account for about 90% of electricity production based on renewable energy sources. Poland has great potential for more efficient use of solid biomass, as well as for energy generation from waste, sludge, energy crops and landfill gas. It is expected that Poland will be able to fulfill the EU goal of 5.75% of biofuel in the transport sector. Poland is the only country in the EU that had a positive GDP growth in 2009 after the economic crisis [10].

The situation in Poland in 2012/2013 in terms of the stability of legal norms for the energy sector was far from the state of stability and predictability. Negative assessment of work on the necessary amendments to the Energy Law does not apply to its objectives, since they are mainly determined by EU rules, they were also related to the need to regulate the sector. Exist three basic laws, namely the Law on Energy, the Gas Law and the Law on Renewable Energy Sources influence the regulation of this sector and its financing [11].

4 Side of Financial Efficiency of Biogas Stations in Poland

4.1 Return on Assets

Return on assets (ROA) is the financial coefficient which characterizes the return on the usage of all assets of an organization. The coefficient shows the ability of the organization to generate profit without considering a structure of its capital (financial leverage), the quality of asset management. Unlike the indicator "return on equity capital" this indicator considers all assets of the organization, and not only its own funds.

The coefficient of the return on assets is calculated using the following formula:

Return on assets = (Net profit (loss)/Assets) $\times$ 100% [12].

Table 1 The coefficients of return of assets of biogas stations in Poland for 2013–2015 (%)

Enterprises	2013	2014	2015	Deviation (±)
Biogazownia Drozdowo Sp. z o.o.	2.79	−8.02	23.8	21.01
Biogazownia Ostrzeszów Sp. z o.o.	−0.39	−0.11	2.4	2.79
Biogazownia Prusinowice Sp. z o.o.	−31.39	58.61	−16.09	15.3
Spółka Rolna Dretyń Biogazownia Sp. z o.o	−8.28	−3.06	−2.48	5.8

Source Own research

The coefficient of profitability of assets shows how much money (regardless of the source of their attraction) was required to obtain 1 zloty profit. This coefficient is an important indicator of competitiveness of the enterprise, to determine a level of which the obtained value of the return on assets should be compared with the industry average [13].

Let us examine coefficients of profitability of assets on the example of five Polish enterprises, such as Biogazownia Drozdowo Sp. z o.o., Biogazownia Jezierzyce Sp. z o.o., Biogazownia Ostrzeszów Sp. z o.o., Biogazownia Prusinowice Sp. z o. o., Spółka Rolna Dretyń Biogazownia Sp. z o.o. the main activities of which are production, transmission and distribution of electricity (Table 1).

According to this table, we can conclude that return on assets of biogas stations, which are under consideration, has increased for 2013–2015. Return on assets of Biogazownia Drozdowo Sp. z o.o. increased from 2.79% in 2013 to 23.8% in 2015. This indicates that the efficiency of the biogas station has increased. It was caused by the fact that net profit in 2015 was significantly higher than in previous years.

The norm for the coefficient of return on assets, as well as for all coefficients of profitability is C (coefficient) >0. If the value is less than zero—this is the reason to think seriously about efficiency of an enterprise. It will be caused by the fact that the enterprise works at a loss [13]. This situation can be observed in the case of Spółka Rolna Dretyń Biogazownia Sp. z o.o. As we can notice here, the coefficient of return on assets for 2013–2015 grew by 5.8 pp., but in each of the analyzed year, it was less than zero. We can conclude that the company during that period was unprofitable, which is negative for the enterprise, but dynamics indicates the growth of profitability, which also indicates the profitability of the enterprise in the nearest future.

If we consider return on assets of Biogazownia Ostrzeszów Sp. z o.o., we can say that during that period the coefficient increased by 2.79 pp. and only in 2015 the biogas station became profitable, which is positive for the enterprise, as evidenced by the growing tendency of coefficients for the entire research period.

The highest indicator of return on assets for three years has Biogazownia Prusinowice Sp. z o.o. In 2014, it was 58.61%, which indicates a prominent level of profitability of the biogas station. In this case, it is a high rate of profitability. In 2015, the coefficient of return on assets fell to −16.09, and the main reason for the decline in this coefficient was the decrease in net profit in that year.

Return on assets is highly dependent on the industry in which an enterprise operates. As electric power industry is quite capital-intensive industry this indicator is lower, if we compare it with the sphere of services that does not require large capital investments and investments in working capital.

According to the table, we can say that coefficients of profitability for 2013–2015 tend to growth, which indicates profitability of biogas stations in the future. As we have already mentioned above, coefficients of return on assets is the important indicator of competitiveness of an enterprise, and to determine its level, we have compared coefficients of biogas stations with the main competitors in the renewable energy market. According to this chart, we can see that leading positions on the level of return on assets is held by Biogazownia Drozdowo Sp. z o.o., which indicates its high competitiveness.

4.2 Return on Equity

In this subsection we will calculate and analyze return on equity of biogas stations which are under consideration because it is one of the main coefficient which is used by investors and owners of enterprises. This coefficient shows effectiveness of usage of invested money in biogas stations. The difference between return on equity (ROE) and return on assets is that ROE shows effectiveness not of all assets (as ROA) and only those which belong to owners of an enterprise [13].

We will calculate the coefficient of return on equity using the next formula:

The coefficient of return on equity = net profit/shareholders' equity.

As it was mentioned above, this ratio is used by investors and owners of an enterprise to assess the efficiency of shareholders' equity. The higher index of the coefficient is, the profitable investments are. If return on equity is under zero, there is a reason to think about expedience and effectiveness of investments in the future. As a rule, the ratio of the coefficient is compared to alternative investments of money in stock of other enterprises, loan securities and, in some cases, in a bank.

It is important to indicate that the very high ratio may effect negatively financial stability of an enterprise. From one side, the higher return on equity is, the better it is. But, the high ratio may appear because of very high financial instruments, i.e. a big part of borrowed capital and a small part of equity that negatively effect financial stability of an enterprise. It shows the main rule of business—the bigger profit is, the bigger risk is. Let us calculate and analyze the coefficient of return on equity of Polish biogas stations which are under consideration for 2013–2015 in Table 2.

According to the table we can conclude that investments which were laid-down in Biogazownia Drozdowo Sp. z o.o. were used effectively because the index of return on equity is more than zero even if dynamics is negative and has tendency to reduction. During researched period the coefficient of return on equity decreased by

Table 2 The coefficients of return of equity of Polish biogas stations for 2013–2015 (%)

Enterprises	2013	2014	2015	Deviation (±)
Biogazownia Drozdowo Sp. z o.o.	268.42	114.85	125.15	−143.27
Biogazownia Ostrzeszów Sp. z o.o.	−5.89	−1.09	−28.74	−22.85
Biogazownia Prusinowice Sp. z o.o.	11.47	−117.94	22	10.53
Spółka Rolna Dretyń Biogazownia Sp. z o.o	−11.73	−3.28	−2.67	9.06

Source Own research

143.27 pp. In 2015 the coefficient of return of equity was 125.15% and in comparison with 2014 this index increased by 10.3 pp. The reason of it was increase of equity in 2015 that is positive for the enterprise and indicates effectiveness of usage of capital which is invested by owners of enterprises. The decrease of the index from −5.89 to −28.74% during 4 years is observed in Biogazownia Ostrzeszów Sp. z o.o. It indicates that investments in equity of this company are not expedient because the coefficient of return is less than zero and has a tendency to reduction.

In cases of Biogazownia Prusinowice Sp. z o.o. coefficient of equity for the period 2013–2015 has a tendency to increase. In 2015 this coefficient was 22% that is 10.53 percentage points (pp) bigger in comparison with 2013. Positive tendency is also observed in Spółka Rolna Dretyń Biogazownia Sp. z o.o. In 2015 the coefficient was −2.67% that is 9.06 pp. higher in comparison with 2013. But, this index is less than zero. We can say that invested capital is used effectively.

We can explain the huge difference between ROA and ROE by the fact that all biogas stations are parts of their parent companies, so own capital is small and the result of calculations shows a big difference between this ratios.

4.3 Liquidity Ratio

4.3.1 Quick Liquidity Ratio

Quick liquidity ratio characterizes the ability of an organization to pay off its short-term liabilities. The coefficient of quick liquidity is calculated by division of liquid deducting inventory by short-term liabilities. This could be also written as:

The coefficient of quick liquidity = (prepayments and deferred current assets + short-term financial assets + short-term accounts receivable)/short-term liabilities [14].

Another version

The coefficient of quick liquidity = (circulating assets − resources)/short-term liabilities. This coefficient shows possibility to pay off current liabilities, if the

Table 3 The coefficients of quick liquidity ratio of Polish biogas stations for 2013–2015

Enterprises	2013	2014	2015	Deviation (±)
Biogazownia Drozdowo Sp. z o.o.	59.9	0.80	20.39	−39.51
Biogazownia Ostrzeszów Sp. z o.o.	47.05	1.18	0.80	−46.25
Biogazownia Prusinowice Sp. z o.o.	–	1442.50	1247.08	1247.08
Spółka Rolna Dretyń Biogazownia Sp. z o.o	0.67	2.47	2.09	1.43

Source Own research

situation will be really critical, one may offer that inventory holdings have not liquidating value.

Holdings are seemed to be the least liquid assets. It is very difficult to convert them into cash [15] (Table 3).

The higher quick liquidity ratio is, the better financial condition of the company is. It is obvious that in Biogazownia Drozdowo Sp. z o.o. the coefficient is more than 1 in 2013 and 2015. The value of 1.0 and more is a norm. It indicates the ability of the enterprise to fulfill short-term liabilities using all current assets.

At the same time, the coefficient may differ in different branches. When the coefficient is less than 1, liquid assets do not cover current liabilities, as a result, there is a risk to lose paying capacity that is a negative signal for investors. Such type of situation we can observe in Biogazownia Drozdowo Sp. z o.o. in 2014, in Biogazownia Ostrzeszów Sp. z o.o. in 2015 and in Spółka Rolna Dretyń Biogazownia Sp. z o.o in 2013.

It should be mentioned that the coefficients of quick liquidity of Biogazownia Ostrzeszów Sp. z o.o. during the researched period tends to reduction. The main reason was increase in short-term liability in 2014 and 2015 in comparison with 2013 to 3394.54 thousand zloty and 1178.54 thousand zloty accordingly.

Researching dynamics of liquidity ratio of Spółka Rolna Dretyń Biogazownia Sp. z o.o. for 2013–2015, one may indicate that they approached the most to normative values and during the researched period of time increased to 2.09 that shows the ability of the biogas station to fulfill its short-term financial liabilities in time.

4.3.2 Cash Ratio

Cash ratio is financial ratio which is used to analyze liquidity of a company calculating the coefficient between all cash assets, cash equivalent assets and all current liabilities. Cash ratio characterizes the ability of a company to pay off current liabilities (and in what part) using liquid calculating assets and other free assets. Current amount of cash and also its equivalents—market securities, deposits and other absolute liquid assets are taken into consideration [14].

Cash is current monetary funds which are saved in a cash register of an enterprise. Cash register is formed by initial part of cash and difference between intake and outlay. Because current reserves do not bring profit, entrepreneurs try to reduce them to the minimum which is reasonable for paying for clients, counteragents and other current expenses [14].

As the model Cash Ratio measures only the most liquid assets regarding to current liabilities, this ratio is researched as the most conservative liquid ration [14].

In other words, ratio demonstrates the ability of a company to pay its current liabilities not laying on selling its inventory holdings and getting bill receivable. It characterizes the ability immediately to pay off current short-term liabilities of enterprises—that is, availability of resources which can satisfy demands of creditors in the critical situation. As a result, this ratio is taken into consideration by future providers in relatively short terms of crediting. Absolute liquidity of an enterprise is less important for strategic investors [3].

The formula of cash ratio:

CR (Cash Ratio) = cash and cash equivalents/short-term liabilities [14].

Let us calculate absolute liquid cash ratio of Polish biogas stations which are under consideration in Table 4.

According to this table, we can conclude that for 2013–2015 biogas stations were able to pay off current liabilities at the expense of liquid working capital and other free assets. Considering dynamics of coefficients of monetary liquidity of Biogazownia Drozdowo Sp. z.o.o., we can conclude that the liquidity is growing rapidly, in 2015 this ratio was 12.4, which is 10.8 more than in 2013.

We can observe the reverse trend considering dynamics of liquidity ratio of Biogazownia Ostrzeszów Sp. z. o.o. In 2015 it was 0.74, which is 43.53 less than in 2013. Despite apparent easiness of the analysis (the higher ratio is, the better it is), it is not so simple. From the one hand, of course, the more part of the short-term liabilities the biogas stations can instantly pay off, the more stable it will be.

From the other hand, large cash balances are evidence of their inefficient usage. That is, if in 2015 the coefficient was 0.74, which is closer to the normative value, the better it is. If there is a constant growing balance of financial resources in financial activities of biogas stations, it is expedient either to reinvest in the same activity, for example, to build another biogas station, or to reward shareholders or employees.

Table 4 The cash ratio of Polish biogas stations for 2013–2015

Enterprises	2013	2014	2015	Deviation (±)
Biogazownia Drozdowo Sp. z o.o.	1.60	0.77	12.40	10.80
Biogazownia Ostrzeszów Sp. z o.o.	44.27	0.76	0.74	−43.53
Biogazownia Prusinowice Sp. z o.o.	22.27	–	78.66	56.39
Spółka Rolna Dretyń Biogazownia Sp. z o.o	0.58	2.46	2.08	1.50

Source Own research

It is also important to note here that decline in the absolute liquidity ratio can point not only at deteriorating solvency and liquidity of Biogazownia Ostrzeszów Sp. z o.o, but at increasing of efficiency of usage of assets. This often happens when the value of the coefficient is much higher than the normative value, which we notice in this case.

Considering coefficients of cash liquidity of Biogazownia Prusinowice Sp. z o.o. and Spółka Rolna Dretyń Biogazownia Sp. z o.o we can also conclude that the financial situation of these biogas stations has improved.

5 Conclusion

Recent years have shown a significant development of the biogas industry in Poland. Over the past couple of years, the number of biogas units has almost doubled, which may indicate profitability of investments. Also, an analysis of the profitability ratios shows the high profitability and effectiveness of the biogas plants for 2013–2015. Liquidity ratios also show a high level of solvency of biogas stations on short-term debts.

Also, a high liquidity ratio is observed in almost all biogas stations, this indicates that management is not operating effectively enough. This indicates the availability of unused cash, excess inventory that exceeds current needs. The indicators of profitability make it possible to assess the effectiveness of the management of the enterprise using its assets.

References

1. Alayi, R., Shamel, A., Kasaeian, A., Harasii, H., Topchlar, M.A.: The role of biogas to sustainable development (aspects environmental, security and economic). J. Chem. Pharm. Res. **8**(4), 112–118 (2016). http://www.jocpr.com/articles/the-role-of-biogas-to-sustainabledevelopment-aspects-environmental-security-and-economic.pdf
2. Kucher, O.: Problems of management and marketing in the enterprises activity of agriculture. In: Scientific Achievements in Agricultural Engineering, Agronomy and Veterinary Medicine, Issue 1, pp. 31–41 (2017) (ISBN: 978-83-65180-17-9)
3. Szymanska, D., Lewandowska, A.: Biogas power plants in poland—structure, capacity, and spatial distribution. In: Sustainability, №7 (2015). doi:https://doi.org/10.3390/su71215846
4. Hindls, R. Economic statistics or statistical methods in economics? In: Statistika **94**(4), 67–72 (2014). https://www.czso.cz/documents/10180/25609550/32019714q4067.pdf/1508a283-be63-40e2-bcf2-d3c4338563f5?version=1.0 (Prague, Czech Republic)
5. Yakubiv, V.: Accounting and analytical methods of diagnostics improvement for enterprises' organizational development. In: Economic Annals XXI **3–4**(1), 68–71 (2015). http://soskin.info/userfiles/file/2015/3-4_1_2015/Yakubiv.pdf
6. Rejman-Burzyńska, A., Maksymiak-lach, H., Jędrysik, E. The energy potential of biogas—an estimation of biogas production resources in Poland. Chemik **67**(5), 450–453 (2013). http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-96596d4f-9b77-4160-bd8742d51ba20a27/c/5_13__Burzynska_GB.PDF

7. Pazera, A., Slezak, R., Krzystek, L., Ledakowicz, S., Bochmann, G., Gabauer, W., Helm, S.: Biogas in Europe: food and beverage (FAB) waste potential for biogas production. In: 2nd International Scientific Conference Biogas Science Energy and fuels. American Chemical Society (2015). https://doi.org/10.1021/ef502812s
8. Baum, R., Wajszczuk, K., Pepliński, B., Wawrzynowicz, J.: Potential for agricultural biomass production for energy purposes in Poland: a review. Contemp. Econom. **7**(1), 63–74 (2013). https://doi.org/10.5709/ce.1897-9254.74
9. Chodkowska-Miszczuk, J., Szymańska, D.: Gricultural biogas plants—a chance for diversification of agriculture in Poland. Renew. Sustain. Energy Rev. **20**, 514–518 (2013). http://dx.doi.org/10.1016/j.rser.2012.12.013
10. Foged, H.L., Johnson, L.K.: The environmental technology and bioenergy sector in Poland. Market description. In: Innovation Network for Biomass, pp. 6–7 (2010). http://www.inbiom.dk/Files/Files/Publikationer/bioenergy_market_description_poland_web.pdf
11. Rosicki, R., Rosicki, G.: Biogas, agricultural biogas and biogas plants in Poland—selected statistical and legal aspects. Fac. Political Sci. Journal (2013). https://repozytorium.amu.edu.pl/bitstream/10593/11340/1/Biogas,%20agricultural%20biogas%20and%20biogas%20plants%20in%20Poland%20-%20selected%20statistical%20and%20legal%20aspects.pdf
12. Alghifari, E.S., Triharjono, S., Juhaeni, Y.S.: Effect of return on assets (ROA) against Tobin's Q: studies in food and beverage company in Indonesia stock exchange years 2007–2011. Int. J. Sci. Res. (IJSR) **2**(1) (2013). India Online ISSN: 2319-7064. https://www.ijsr.net/archive/v2i1/IJSRON2013372.pdf
13. Reuters, T.: Tax and accounting. Financial analysis CS: sample reports (2008). https://cs.thomsonreuters.com/ua/acct_pr/fina/cs_us_en/pdfs/fina_sample_reports.pdf
14. Kirkham, R.: Liquidity analysis using cash flow ratios and traditional ratios: the telecommunications. J. New Bus. Ideas Trends **10**(1), 1–13 (2012). http://jnbit.org/upload/JNBIT_Kirkham_2012_1.pdf
15. Costea, C.D., Hostiuc, F.: The liquidity ratios and their significance in the financial equilibrium of the firms. In: The Annals of The "Ştefan cel Mare" University Suceava, vol. 9, No. 1, pp. 252–261. Fascicle of The Faculty of Economics and Public Administration (2009). http://www.seap.usv.ro/annals/ojs/index.php/annals/article/viewFile/176/18