

Measuring and Analysing the Financial Performance of State-Owned Economic Entities

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SUMMARY

The experts of the State Audit Office of Hungary analysed financial performance measurement issues of state-owned companies (public companies) with the aim to apply the principle of performance as widely as possible during public money spending. In many respects, the same tools can be used to measure and analyze the performance of these companies as for private sector companies, however misrepresentations arising from public sector specialties must be filtered out. Therefore, an adjusted version of the financial indicators has been prepared, using corrective items specifically focusing public sector specificities. To test the adjusted indicators, we prepared an analysis for a group of 148 public companies, the main findings of which are presented in our article. The special conditions, operation or risks of state-owned companies may require different tools and priorities in terms of ownership control. In this article, we try to form relatively homogeneous groups, portfolios - based on adjusted financial indicators- which helps the owner to treat groups of companies differently according to financial capabilities and performance. Classification into groups can draw attention to critical management factors, risks, but also strengths as well. In this way, the development of portfolios can provide a good basis for effective ownership management of companies.

KEYWORDS: performance management, financial performance, performance measurement, clustering, portfolio management

JEL codes: C52, H11, H40, L29, L39

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A well-governed organizational model is implemented through the implementation and operation of an organizational performance management system; this explains the importance of performance management. Performance management covers the entire organization, from planning, through accountability and implementation, to supporting learning and confirmation. The purpose of performance management is to ensure service delivery, an efficient allocation of resources, to improve an organization's task performance and effective use of resources, to support learning in order for employees to acquire new knowledge and perform their tasks more efficiently, and to improve the capacity of organizations involved in task performance and that of their units. (Veresné, 2017). In summary, performance management is the totality of activities related to improving the performance of an organization [Kaiser T. (edit.), 2014.]

MEASURING FINANCIAL PERFORMANCE

As part of performance management, managers specify their performance requirements for an organization during the processes of setting goals and planning, and then create measurement systems to gather information about various elements of performance on an ongoing basis. Finally, the reporting system provides a framework for regular feedback on performance. Performance management is about studying and comparing current results with planned, expected results. In the event of a significant discrepancy between actual and planned results, corrective action must be taken (Szakács, 2012).

A very important area of organizational performance is financial performance. What it means in corporate management, in a narrower

sense, is whether a company has met or achieved its financial goals. At the same time, financial performance in a broader sense means that an organization is financially sound and therefore its liquidity is continuously ensured, the maturity structures of its receivables and liabilities are constantly in line, and its indebtedness is of a safe amount compared to its own funds (Pulay, Simon, 2020).

Indicators used for financial analysis, known from economic literature, are the most suitable tools for measuring financial performance, and they are typically underpinned by accounting data. Indicators can be divided into five groups according to the various aspects of analysis, including groups of indicators measuring liquidity, debt and creditworthiness, profitability, efficiency, and the market (PTE–KTK, 2018).

Liquidity ratios measure companies' solvency and readiness to pay, showing whether a company can meet its short-term liabilities. Debt and creditworthiness ratios indicate the ability to repay loans. The capital structure is analysed through them, as the higher the proportion of debts within all assets, the greater the risk run by owners. Profitability ratios measure the extent to which a company is able to make profit using assets available to it (PT–KTK, 2018). In this article, we use indicators selected from these three groups.

The initial steps of performance management in the public sector in Hungary are linked to the *Zoltán Magyar* Public Administration Development Programme. It has become clear that performance management used in the world of businesses can be applied to public sector institutions and organizations. The method of individual performance evaluation is already widespread, however, organizational and activity-level performance management still has many areas to develop.

Operating well-governed state organizations is a precondition for a “well-governed

state”. A commitment made by leaders of organizations to operate good management systems will contribute to the implementation of the mission of organizations and the ability of organizational processes to perform. (Domokos, Wertherné, 2020). *“The key to developing good governance and laying down the foundations for its balanced future development is a performance-oriented operation of the public sector”* (Domokos, Wertherné, 2020, p. 16). Thus, the design and operation of performance management practices in the public sector creates added value, which requires clear organizational goals and a measurement system to monitor the attainment thereof.

However, the interpretation of financial performance in the public sector has its specificities compared to the business sector. Financial management considerations in the public sector are not primarily driven by profit maximization. *„The behaviour expected from organisations is to increase social utility and to serve the public good, implementing it on a non-profit basis, with a duty to perform tasks. Therefore, the primary purpose of leaders is to perform activities required by law and other obligations.”* (Domokos et al., 2015, p.14). However, there are not only differences from but also similarities to the business sector, as the financial performance of public financial management means, on the one hand, the attainment of the set financial goals, and on the other hand, a balanced financial standing (Pulay, Simon, 2020).

Performance management and performance measurement are inseparable concepts also in the public sector. As part of performance measurement underpinned by quantitative indicators, measures, as well as techniques for measurement and analysis are developed (Iványos, Sándorné, 2016). However, measures used in the business sector cannot be used as they are, and they need to be adjusted to address the specificities of the public sector. Of

course, in addition to financial performance, the analysis of additional performance dimensions is also essential, but this article focuses on financial indicators.

Analyses have been performed by experts from the State Audit Office of Hungary. Adjusted financial indicators have been developed by Gyula Pulay, Tamás Borbély and Diána Orosz. The methodology for portfolio formation has been developed by *István Melcher, Márta Novák and László Nagy*, who also performed analyses according to adjusted indicators and clusters.

ADJUSTED FINANCIAL RATIOS OF STATE-OWNED BUSINESS ASSOCIATIONS

As a starting point, we used financial indicators commonly applied in corporate economics, as shown in *Table 1*.

In view of the specificities of state-owned companies (high proportion of assets under management, or that of assets taken over to operate, in comparison to own assets; implementation of a significant part of capital investments by using subsidies and special rules of accounting related to them, etc.), we considered it appropriate to adjust our indicators according to the following principles.

■ The value of assets under management, which are recorded among fixed assets and thus among liabilities, was recognised as part of the equity rather than liabilities. The reclassification of assets under management into the category of own equity was carried out due to the nature of the management of the assets concerned. Assets under management are typically made available to a company by the owner or founder, but in several cases this has been done by the local government competent in the area of operation of a

Table 1

FINANCIAL INDICATORS TAKEN INTO ACCOUNT WHEN DEVELOPING INDICATORS FOR OUR ANALYSIS

Type of indicator	Description of indicator	Calculations	Expected value
Indicators of liquidity and solvency	Liquidity ratio	Current assets / Short-term liabilities	Higher than 1.0
	Indebtedness ratio	Debt / Total assets	Decreasing values less than 0.5 are expected
Indicators of capital structure	Debt to equity ratio	Debt / Equity	Decreasing values less than 1.0 are expected
	Equity to total assets ratio	Equity / Total assets	A value equal to or higher than 0.5
	Equity growth ratio	Equity / Registered capital	A value higher than 1.0
Profitability ratio	ROE	Profit as per balance sheet or After-tax profit / Equity	Positive, increasing value

Source: own edited, based on Takács, 2015

company concerned. A company has an obligation to replenish in accordance with the amount of depreciation recognized for assets under management; however, the amount corresponding to the net value of the assets concerned is not part of the real liabilities of such company. If the management of some assets is terminated, their value will be derecognised from among long-term liabilities. As assets taken over for management will form part of all assets used by a company as part of its financial management processes, the company’s return on assets would not be realistic if its profit was compared only to its equity.

■ Grant advances received with the obligation to settle and recognised as cash among debts were neutralized in the financial ratios, thus forming no part of calculations. This is often due to the fact that high amounts of grant funds – which cannot be spent by companies freely, but only for specific purposes – significantly distort indicators of liquidity and capital structure for companies, so these

indicators fail to give a real picture of financial management.

■ Capital increases recorded among liabilities were taken into account as part of equity rather than liabilities. In case of several companies, founders (owners) have increased capital, which was typically recognised as part of registered capital or capital reserves in balance sheets. However, up to the time of registration, funds transferred for the purposes of capital increase had been recognized as short-term debts and, in the following business year, were reclassified into one of the categories of equity. For this reason, we reflected this reclassification in the adjusted versions of financial indicators even before registration took place, so that they are included in the analysis as equity according to their real attributes.

The method of calculating the adjusted financial ratios is described in *Table 2*.

LIQUIDITY RATIO: the ratio of current assets to short-term debts, this is a liquidity ratio in the broadest sense. The adjusted version of the liquidity ratio neutralizes grant advances

Table 2

ADJUSTED FINANCIAL INDICATORS DEVELOPED AND APPLIED AS PART OF THE ANALYSIS

Type of indicator	Description of indicator	Számítás
Indicators of liquidity and solvency	Liquidity ratio	$(\text{Current assets} - \text{Grant advance}) / (\text{S/t liabilities} - \text{grant advance recognised among s/t liabilities} - \text{Non-registered capital increase})$
	Indebtedness ratio (adjusted)	$(\text{Debt} - \text{Value of assets under management} - \text{Grant advance} - \text{Non-registered capital increase}) / (\text{Total assets} - \text{Grant advance})$
Indicators of capital structure	Debt to equity ratio (adjusted)	$(\text{Debt} - \text{Value of assets under management} - \text{Grant advance} - \text{Non-registered capital increase}) / (\text{Equity} + \text{Non-registered capital increase} + \text{Value of assets under management})$
	Equity to total assets ratio (adjusted)	$(\text{Equity} + \text{Non-registered capital increase} + \text{Value of assets under management}) / (\text{Total assets} - \text{Grant advance})$
	Equity growth ratio (adjusted)	$(\text{Equity} + \text{Non-registered capital increase}) / (\text{Registered capital} + \text{Non-registered capital increase})$
Profitability ratio	ROE (adjusted)	$\text{Profit as per balance sheet or After-tax profit} / (\text{Equity} + \text{Value of assets under management} + \text{Non-registered capital increase})$

Source: own edited

(received with an obligation to settle and recognized among short-term debts) that have already been credited to cash by the economic entity. At the same time, it does not take into account non-registered capital increases recognized among short-term liabilities. Values significantly higher than 1.0 are expected.

INDEBTEDNESS RATIO: also describes liquidity and solvency, but from the aspect of indebtedness. The higher the ratio of total debts to total assets in the operation of an economic entity, the higher the share of debt financing (i.e. indebtedness) and the risk of payment difficulties, as debt funds will have to be repaid sooner or later. The ratio was adjusted by the value of assets under management recognised as part of long-term liabilities and the amount of non-registered capital increase recognised among short-term liabilities. Both the numerator and the denominator were

reduced by grant advances recognised among liabilities. It is advisable to make sure that the value does not exceed 50 percent: a declining trend is desirable.

DEBT TO EQUITY RATIO: provides information on the stability of funding by comparing liabilities and equity. In the adjusted version, the value of assets under management recognised among long-term liabilities and the value of non-registered capital increase were reclassified into equity. The numerator was reduced by grant advances recognised among liabilities. It is advisable to make sure that the value does not exceed 100 percent; a declining trend is desirable.

EQUITY TO TOTAL ASSETS RATIO: it describes the structure of capital and is suitable for a general presentation of wealth. Adjusting factors are used to calculate this indicator as well. The value of assets under management

recognised as part of long-term liabilities and the amount of non-registered capital increase recognised among liabilities were added to the value of equity. Both the numerator and the denominator were reduced by grant advances recognised among liabilities. It is advisable to make sure that values show an increasing trend.

EQUITY GROWTH RATIO: shows the evolution of the ratio of equity to registered capital and the amount of the total increase in equity, even for several years. Both the denominator and the numerator have been adjusted by the paid-up, but not yet registered, capital increase. It is favourable if the value of the indicator exceeds 1. An indicator of less than 1 indicates a loss of capital, which, in the long run, will lead to the using up of capital as a result of loss-making financial management practices.

ROE: the return on equity ratio, one of the most frequently used indicators to measure profitability. ROE compares the profit as per balance sheet, or the after-tax profit with equity, thus showing the amount of profit produced on assets provided by owners and on assets accumulated through financial management processes. In the SAO's analysis, the value of the ROE ratio includes not only equity but also the value of assets under management and the value of non-registered capital increase. The value of the indicator is expected to be in the positive range, an upward trend of the indicator is favourable.

The adjusted debt to equity ratio and ROE ratios were not determined when the equity had a negative value. In the first case, because a negative debt to equity ratio is not applicable, and in the latter case, because a negative equity combined with a negative after-tax profit would result in a positive ROE ratio, which would thus lose its real meaning.

Using these indicators, a pooled analysis of data for several years is needed in order to reduce the impact of one-off items affecting data for individual years. For testing these

indicators, a 5-year period (2015 to 2019) was chosen, and adjusted indicators were calculated based on data found in financial statements of 148 companies with a majority state ownership in them. For the 5 years assessed, we analysed the mean value and the standard deviation of the indicators. For the analysis, we typified the companies, forming groups of them according to their activities, size and public services provided. By analysing the results of adjusted indicators covering several years, correlations were identified between some attributes of the companies (activities, size, provision of public services) and their financial management (assessed on the basis of financial indicators of financial management). The main descriptive statistical characteristics of the financial indicators for the total population are presented in *Table 3*.

Calculation results for the adjusted ratios of the 148 companies revealed that values of the liquidity ratio and the ROE ratio showed a high standard deviation within a wide range, and values for the debt to equity ratio and the equity growth ratio also had a significant standard deviation. Ratios measuring indebtedness and equity to total assets had a significantly lower relative standard deviation, and their values varied within a relatively narrow range. Tests revealed that some extreme values significantly distort findings made on the basis of financial indicators, masking processes typical of most of the companies analysed. Therefore, it was reasonable to perform calculations not only for the whole population, but also for the population cleaned of extreme values.

FILTERING OUT DISTORTING ITEMS

Some of the selected companies had outstanding financial indicators due to their services, purpose or special situation, and due to their high weight, they severely distorted

Table 3

MAIN STATISTICAL CHARACTERISTICS OF THE FINANCIAL INDICATORS OF ANALYSED COMPANIES (2015–2019)

Description	Liquidity ratio	Indebtedness ratio	Debt to equity ratio	Equity to total assets ratio	Equity growth ratio	ROE
Mean	19.83	0.26	4.14	0.53	18.27	0.02
Standard deviation	189.48	0.28	23.26	0.35	52.26	0.54
Median	2.55	0.16	0.28	0.61	3.86	0.02
Minimum	0.05	0.00	0.00	-2.85	-31.56	-6.48
Maximum	4 677.42	3.25	302.91	1.00	457.47	8.78
Range	4 677.37	3.25	302.91	3.85	489.03	15.26
Relative standard deviation (%)	955.47	109.66	562.27	65.92	286.06	2 356.58

Note: The liquidity ratio, the indebtedness ratio and the debt to equity ratio cannot have negative values, and their lowest possible applicable value is zero. Results may be in the negative range for the equity to total assets ratio and the equity growth ratio (due to potential negative values of equity), as well as for the ROE ratio.

Source: own editing on the basis of the financial statements of the companies analysed

the picture about the average performance of the groups. In view of this, it was justified to filter out any extreme values of companies when analysing their indicators.

In the procedure we used, cleaning was done separately for each financial indicator, creating a population for each indicator. We first calculated the lower and upper quartiles of the total population and their difference, i.e., the so-called interquartile range. From the lower quartile downwards and from the upper quartile upwards the population was cleared of elements that were outliers by more than three times the interquartile range. The proportion of extreme values eliminated through this cleaning varied significantly between financial indicators. The proportion of values eliminated was the highest for the ROE ratio, but still less than 16 percent. Consequently, the cleaned population for each indicator

contained sufficient data to perform statistical analyses. The proportion of items remaining in the cleaned population was reported everywhere in our analytical results. The main descriptive statistical characteristics of the financial indicators of cleaned populations are summarized in *Table 4*.

After cleaning the population from extreme values, the range of financial indicators has narrowed significantly. The proportion of excluded values was high for the ROE ratio (15.7 percent) in the case of the test. However, apart from this indicator, more than 89 percent of the original values formed part of individual cleaned populations. This means that most of the cases analysed were within a narrow range, so the findings for the cleaned populations belonging to the individual financial indicators were correct for the vast majority of the companies and even more accurate than

Table 4

THE MAIN STATISTICAL CHARACTERISTICS OF FINANCIAL INDICATORS IN THEIR RESPECTIVE CLEANED POPULATIONS (2015–2019)

Description	Liquidity ratio	Indebtedness ratio	Debt to equity ratio	Equity to total assets ratio	Equity growth ratio	ROE
Mean	3.39	0.25	0.49	0.54	5.88	0.03
Standard deviation	3.20	0.25	0.64	0.31	7.35	0.07
Median	2.32	0.16	0.22	0.61	3.28	0.02
Minimum	0.05	0.00	0.00	-0.49	-9.33	-0.18
Maximum	16.69	1.05	2.97	1.00	34.57	0.24
Range	16.65	1.05	2.97	1.49	43.90	0.42
Relative standard deviation (%)	94.27	99.07	131.23	58.49	125.02	233.55
Proportion of excluded values (%)	7.72	0.54	10.49	0.27	9.59	15.66

Source: own edited, based on the financial reports of the companies analysed

the findings for the total population that were distorted due to outlier values stemming from non-normal financial management processes.

Data cleaning was mostly required in the case of the liquidity ratio. The average value of the indicator decreased significantly, to 3.39 from 19.83 in the total population. This was due to the fact that all of the companies with an extreme liquidity ratio were outliers at the upper limit, i.e. they had much higher liquidity than the others. A review of financial statements revealed that this group included companies engaged in financial activities, which companies, by definition, have to have much more liquidity than companies engaged in production or providing services. In addition, there were companies involved in the intermediation of EU funds and, to a lesser extent, domestic subsidies. For this purpose, they had received funds in advance for grant programmes to be announced by them, and those funds were used only gradually. When

a company received some advance against a grant won by it for a capital investment project of its own, we neutralized it when calculating its liquidity; but companies in the above group received grant advances to be intermediated to others rather than advances for their own capital investments.

After cleaning, the average value of the equity growth ratio fell to less than one third of the previous level. All excluded cases – with one exception – fell in the category of companies with surplus capital, i.e. the category where the adjusted equity was more than ten times or hundred times higher than the adjusted registered capital, owing to capital increases, profitable financial management practices, or significant reserves. In 57 percent of the excluded cases, companies were established with the minimum registered capital, for 14 percent of them, the amount of registered capital was ranging between HUF 4 million and HUF 10 million, while only 28 percent

of them had a registered capital exceeding HUF 10 million. And a registered capital of low amount can be easily multiplied at low profitability, in case of a high production value.

After cleaning, the average value of the debt to equity ratio fell to less than one eighth of the average value of the ratio measured in the entire population, which represents a significant improvement. This improvement and the fact that the proportion of excluded values was over ten percent were attributable to 20 percent of the companies, of which 47 percent (14 entities) had an extremely unfavourable debt to equity ratio for an average of four years.

The average value of the ROE ratio was almost the same in the whole population and also after cleaning. Within the total population, the exclusion rate was over 10 percent, where return on equity had extreme values, however, these items set off each other. Of the values of measures in the population, 65 were low outliers and 47 were high outliers. Many entities with a filtered ROE ratio had a low equity value, attributable to a low amount in registered capital and/or a low amount of equity due to loss-making financial management processes.

Regarding the equity growth ratio, the debt to equity ratio and the ROE ratio, the majority of companies in the group of companies with three or more filtered items are characterized by low capitalisation. Cleaning resulted in hardly any change in the values of the indebtedness ratio and the equity to total assets ratio.

RESULTS OF THE ANALYSIS OF THE ADJUSTED INDICATORS

An analysis of the 148 companies selected for testing revealed several interesting correlations. For an analysis *based on activities*, we formed

groups of companies. Health, education and social activities were classified into the so-called human services group. State-owned companies tend to perform tasks directly related to the operation of the state, thus many of them carry out unique activities. As a result, not all companies could be classified into a sector according to their activities, and we had to use a category called ‘others’ and a category called ‘project implementation organisations’. In the case of project implementation organizations, the implementation of a project is an activity that requires special funding. Organizations performing unique tasks were placed in the ‘others’ category, and they represented 7.4 percent, i.e. less than one tenth of all companies. The distribution of companies according to groups of activities is shown in *Figure 1*.

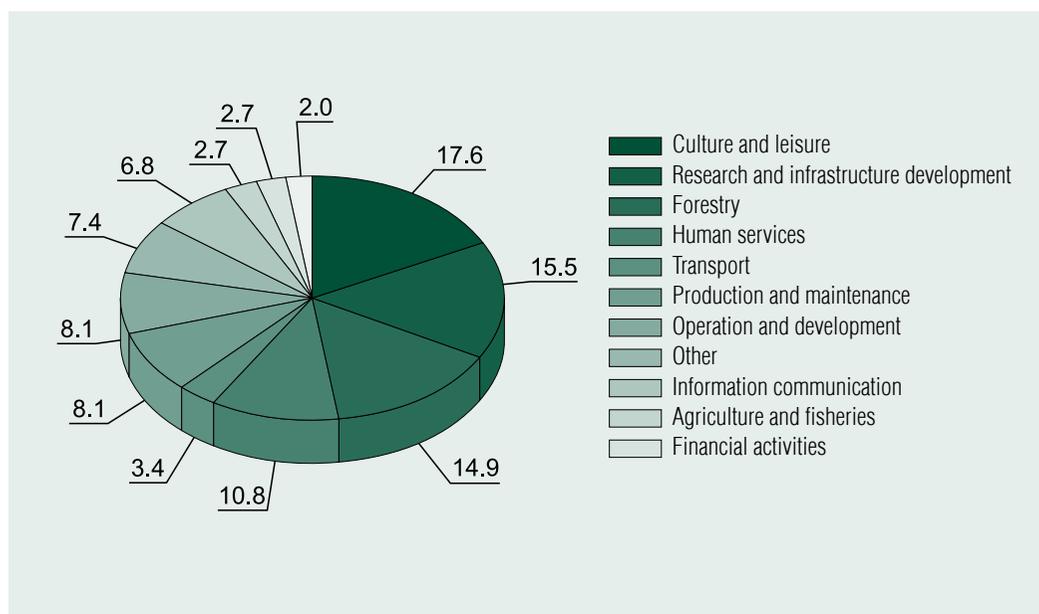
Irrespective of the area of activities, all companies were characterized by a favourable level of liquidity and, with the exception of project implementation organizations, a favourable level of indebtedness. Companies providing financial services had the most favourable liquidity, indebtedness, debt to equity, and equity to total assets ratios.

In terms of the debt to equity ratio, however, significant differences could be identified between groups of companies formed by field of activity, which, however, decreased significantly after the exclusion of extreme values; and values improved considerably, falling within the expected range. All this indicates that differences in the average values of financial indicators by area of activities are not due to the nature of activities alone, but to the fact that, in some areas of activities (e.g. project implementation organizations, transport, research and infrastructure development, human services, etc.), a high proportion of the companies had ratios of extreme value.

The profitability of companies, with the exception of financial services, showed a positive but low value in various areas of

Figure 1

DISTRIBUTION OF THE ANALYSED COMPANIES BY ACTIVITIES, %



Source: own edited

activities. Irrespective of the area of activity, extremely high or low values for the return on assets ratio were typically due to low capitalisation.

For an analysis by size, companies were classified based on the balance sheet total and the average number of employees at the end of a given business year. Rules of classification were defined according to the provisions of Act XXXIV of 2004 on Small and Medium-sized Enterprises and Supporting their Development (SME Act). Although the companies analysed cannot be considered SMEs due to their ownership structure, the classification set out in the legislation can be used in the analysis. The proportion of companies falling within each group is shown in parentheses (Table 5). Micro-enterprises include any enterprise with less than 10 employees and/or a balance sheet total of up to EUR 2 million (3.38 percent). Small enterprises have less than 50 employees

and/or a balance sheet total that is the HUF equivalent of maximum EUR 10 million (14.19 percent). Medium-sized enterprises have less than 250 employees and/or a balance sheet total that is the HUF equivalent of maximum EUR 50 million (45.95 percent), while large enterprises have more than 250 employees and/or a balance sheet total that exceeds the HUF equivalent of EUR 50 million (36.49 percent).

Groups formed by size were characterized by an expected level of payment capacity and an acceptable level of liquidity and indebtedness. At the same time, as far as financial indicators are concerned, there are significant differences in terms of the debt to equity ratio and the equity growth ratio, between the groups of companies of different sizes.

The group of medium-sized companies is characterized by the most favourable financial standing, with three out of six indicators

Table 5

AVERAGE VALUES OF FINANCIAL RATIOS BY SIZE OF COMPANY IN GROUPS CALCULATED FOR THE TOTAL POPULATION

Category by size	Liquidity ratio	Indebtedness ratio	Debt to equity ratio	Equity to total assets ratio	Equity growth ratio	ROE
Expected range	> 1.0	<0.5	<1.0	> 0.5	> 1.0	> 0.0
Micro						
value of ratio	3.53	0.45	1.35	0.31	3.81	0.12
cleaned ratio	3.53	0.28	0.34	0.47	3.81	0.06
remained in population (%)	100.00	91.18	84.62	94.12	100.00	69.23
Small						
value of ratio	7.22	0.27	2.63	0.50	19.45	-0.07
cleaned ratio	4.45	0.27	0.52	0.50	9.44	0.04
remained in population (%)	91.40	100.00	87.10	100.00	93.81	59.14
Medium-sized						
value of ratio	12.34	0.22	1.57	0.57	27.13	0.03
cleaned ratio	3.45	0.22	0.49	0.57	6.01	0.03
remained in population (%)	89.39	100.00	94.17	100.00	83.67	88.05
Large						
value of ratio	36.30	0.28	8.46	0.51	8.25	0.04
cleaned ratio	2.93	0.28	0.48	0.51	4.74	0.03
remained in population (%)	95.29	99.62	84.58	100.00	96.62	90.12
Remained in population in total (%)	92.28	99.46	89.51	99.73	90.41	84.34

Note: Values at which the number of elements remaining in the cleaned population did not reach 85 percent of the total number of elements per area in the total population were highlighted in bold.

Source: own edited, based on the financial reports of the companies analysed

receiving the best values. Only the value of the debt to equity ratio was out of the expected range.

Within the entire population, micro-companies had the worst liquidity, indebtedness and capitalisation, while their debt to equity ratio and profitability were the best. The worst profitability was shown by small companies. However, after filtering out extreme values, a group with a stable financial standing and low profitability could be identified.

The average values of the financial indicators have changed in most cases after the exclusion of extreme values. Financial ratios converged significantly in the case of groups formed by size within the population which had no extreme values. Within cleaned populations, all groups had a favourable and acceptable debt to equity ratio, and a low but positive profitability. In the case of the equity to total assets ratio, values for groups formed by micro-sized companies did not reach the expected level.

Data revealed that the financial performance of companies is not determined by size alone. In fact, differences in terms of size measured in the entire population are attributable to extreme cases.

We also examined the group in terms of the provision of public services. In many cases, state-owned companies providing public services are subject to stricter rules, and the pricing of services they provide is not determined by market conditions. An analysis of them allows us to identify relationships between the provision of public services and the financial indicators that characterize their financial management practices. Two thirds (68.24 percent) of the analysed organizations provided some public services.

Companies providing public services are basically characterized by lower liquidity. The fact that indebtedness and capitalisation relative to the balance sheet total were lower

for public service providers than for entities not providing public services can be attributed to a significantly higher (more than two-fold) proportion of accruals and deferrals relative to the balance sheet total. These companies used non-refundable grant funds to implement a large part of their capital investment projects, with grant funds recognized among deferred income under accruals initially and on the assets side later, in proportion to the depreciation of machinery and equipment procured as part of the implementation of those projects. Thus, in economic terms, accruals represent a long-term source of funds for asset growth realised by using non-repayable grant funds.

Profitability is, to a small extent, lower in the group not providing public services, despite the fact that general corporate economic rules require such companies to maintain long-term sustainable operations from their own funds and to generate income for their owners.

After cleaning, there was only a small difference between the values of average indicators of public service providers and non-providers. The groups formed on the basis of the provision of public services within the population cleaned of extreme values are characterized by favourable payment capacity and capital structure, at low profitability.

An analysis of the equity growth ratio for the 148 companies examined showed that some of the companies (12 percent) were severely under-capitalised compared to the size of their economic activities (equity to total assets ratio was below 0.1). This may be due to the fact that a company was established with only the minimum required registered capital and it failed to increase its equity by profits, or it may be due to the fact that it has used up its equity due to loss-making financial management practices. A low amount of equity of state-owned companies carries a serious fiscal risk, as this means that in the event of loss-making financial management practices, a situation

Table 6

AVERAGE VALUES OF FINANCIAL INDICATORS FOR GROUPS FORMED ACCORDING TO THE PROVISION OF PUBLIC SERVICES

Description	Liquidity ratio	Indebtedness ratio	Debt to equity ratio	Equity to total assets ratio	Equity growth ratio	ROE
Expected range	> 1.0	< 0.5	< 1.0	> 0.5	> 1.0	> 0.0
Entities providing public services						
Value of ratio	5.61	0.25	5.65	0.49	20.37	0.06
Cleaned ratio	3.33	0.24	0.48	0.50	5.93	0.03
Remained in population (%)	95.62	99.60	87.32	99.60	90.32	85.28
Entities not providing public services						
Value of ratio	49.06	0.28	0.87	0.62	13.71	-0.06
Cleaned ratio	3.55	0.27	0.51	0.62	5.78	0.02
Remained in population (%)	85.41	99.15	94.25	100.00	90.60	82.30
Remained in population in total (%)	92.28	99.46	89.51	99.73	90.41	84.34

Source: own edited, based on financial reports of the companies analysed

can very quickly occur where the state, as owner, has to replenish their equity. The need to reduce risks raises the necessity of corporate portfolio clean-ups and the termination or reorganization of non-viable companies.

The analysis using adjusted indicators clearly showed that the set of indicators was suitable for describing and measuring the financial management and financial performance of the selected group of state-owned companies. This confirms that the indicators developed can be widely used within the public sector.

PORTFOLIO FORMATION THROUGH CLUSTER ANALYSIS

In the case of state-owned companies, one of the guarantees of accountability and responsible asset management is substantive ownership control (Domokos, 2019). Public companies can play their socio-economic role effectively if their owners set a strategy to follow and define clear performance requirements. The achievement of targets can be facilitated by continuous monitoring and evaluation of results (Domokos, Várpalotai, Jakovác et al., 2016).

And “in the case of owners who exercise ownership rights over several companies, portfolio

management may be a practical solution” (Boros, Gergő, Bándi et al., 2018, p. 68). According to economic literature, a portfolio is a set of assets held by an individual or an institution. During portfolio management, the holder of assets diversifies the portfolio in order to increase return (Pearce, 1993). As a basic precondition to this, companies must be classified into portfolios, i.e. groups differentiated according to their treatment.

In order to support the need to differentiate treatment according to financial attributes and performance, we attempted to form relatively homogeneous groups, portfolios according to adjusted financial indicators of the 148 companies. We considered a group to be homogeneous where, based on their attributes, group members were more similar to each other than to members of other groups.

Regression calculations confirmed that changes in financial indicators of the companies cannot be explained by their size, provision of public services or activities, therefore we turned primarily to analysing financial characteristics when forming portfolios. We carried out a cluster analysis to create portfolios using the database cleaned of extreme values and applied for financial indicators before. The idea of analysing all data for the whole population was discarded because the convergence condition was not fulfilled because of some outliers. We also formed clusters, using the five-year database and data of the last year, 2019.

The formation of clusters was carried out by using the SAS Enterprise Guide software and the Fastclus procedure, according to the so-called K-means method, by forming disjunct clusters. As a first step in applying the K-means method, the software selected K number of starting centroids based on a predetermined number of clusters. In this procedure, K is the predetermined number of clusters. The model then classified each data point into a cluster,

whose centroid was the closest to it, and these clusters represented the starting clusters. The model then updated the centroid of each cluster, based on the points assigned to the cluster. The steps of assigning and updating were continued alternately (iterations) until a situation where no points changed clusters or the centroids remained unchanged.

When selecting the financial indicators to be set as factors for forming clusters, we did not use a preliminary hypothesis, but tried to take into account as many factors as possible during the formation of clusters. With a large number of variations, we tried to find the closest possible correlation. We tried to form four, six and 10 clusters by specifying two, three, and four factors. As part of the software-based clustering process, six of the 32 possible versions were used to select the version promising the best result.

The criteria used in the validation process were as follows. Cluster centroids within a cluster and data points between clusters move at each iteration step, and convergence means moving towards the optimal state in the process. Full convergence is achieved if no point changes cluster or the centroids do not change. The Fastclus procedure looks for sufficiently good clusters, so it can give results before full convergence is achieved (iterations stop) if the maximum relative change of cluster centroids is less than or equal to the convergence criterion. Among the versions of clusters formed, in 11 cases the procedure did not achieve full convergence, therefore these versions were discarded.

From the aspect of population, the Fastclus procedure is designed to be used primarily for large data sets (populations of at least 100 elements), and results received for a small data set can be very sensitive to the order of data. Of the versions of clusters formed, therefore, 10 versions were discarded due to a possible sensitivity.

In the Fastclus procedure, during clustering, the software generates a so-called cubic clustering criterion that characterizes the cluster version obtained. A value higher than 2 or 3 indicates good clusters; a value between 0 and 2 indicates possible clusters, while a high negative value indicates an outlier among clusters. Of the versions of clusters formed, 20 versions did not meet the criterion.

After the three filtering processes mentioned above, six cluster versions remained, which were evaluated for compactness and separation as criteria for a good cluster. An important attribute of clusters is the maximum distance of each value from the centroid of a cluster; if this value is low, the given cluster is regarded as compact. One version was discarded because it proved to be insufficiently compact. Another important attribute of clusters is their ability to be separated from each other as much as possible, i.e. cluster centroids should be as far apart as possible. If this value is high, then the

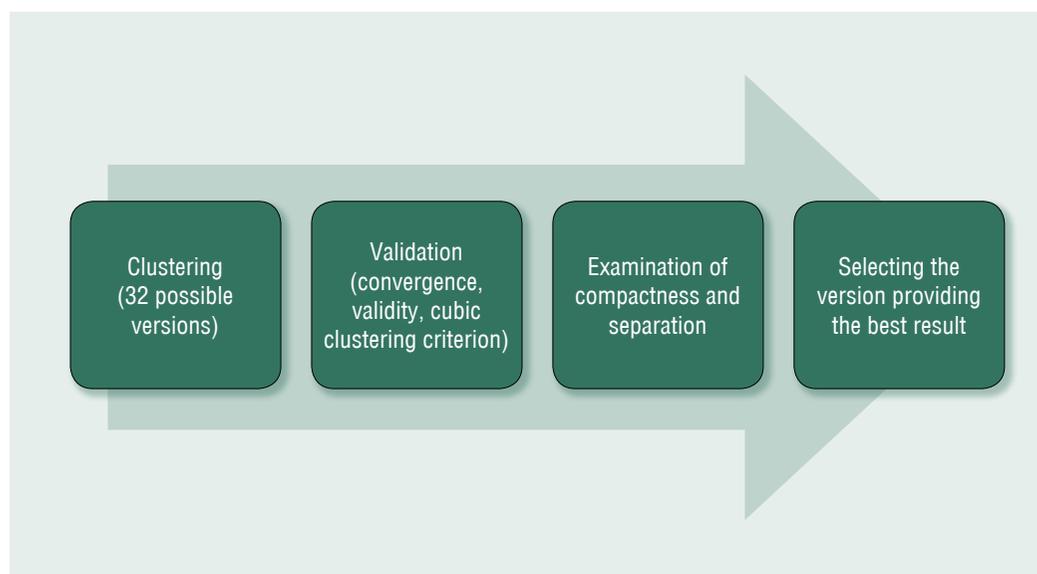
given cluster is regarded to be separated from the cluster that is the closest to it.

Pseudo-F-statistics is an indicator of the quality of cluster formation, its high value indicates that clusters are separated, in which case individual clusters are well separated from each other. The version with the best value in terms of compactness and separation, as well as Pseudo F-statistics was considered to be the optimal one. The multi-aspect cluster versions expected from the combined effect of several factors did not give good values, typically the versions developed with a higher number of clusters, but less factors taken into account produced better results. The selection process is shown in *Figure 2*.

Taking into account the validation criteria, the selected version was the one containing data for year 2019, 148 companies, 6 clusters, and 2 factors (formed based on the ratios of indebtedness and debt to equity). The selection of ratios producing the best cluster

Figure 2

THE PORTFOLIO FORMATION PROCESS



Source: own edited

Table 7

ATTRIBUTES OF CLUSTERS FORMED (2019)

Serial number of clusters formed	Number of elements	Average indebtedness ratio	Average debt to equity ratio
		Expected value	
		lower than 0.5	lower than 1.0
1.	75	0.08	0.12
2.	33	0.25	0.52
3.	12	0.41	1.29
4.	28	0.75	2.45

Source: SAS software, own edited

was supported by the fact that the relationship between these two indicators produced the highest values for the regression coefficient and the determination coefficient.

The data of two of the clusters were very close to each other and the number of elements in them was small (four and six), so these two clusters were merged with the cluster closest to them in terms of attributes, as proposed by the software. Thus, four clusters were obtained, the data of which are shown in *Table 7*.

In the case of the four clusters selected on the basis of financial indicators, we also examined the correlations between size, activity and provision of public services within the groups. In addition, the data filtered for serving as indicators during the selection process were also taken into account in the detailed analysis of the clusters. Based on the results of the cluster analysis, the characteristics of the four clusters can be summarized as follows.

CLUSTER 1 – those with the best indebtedness and debt to equity ratios

The vast majority of companies, 51 percent, are found here. These companies had the best indebtedness and debt to equity ratios

among the groups in 2019, on average. The standard deviation of the indebtedness ratio of the group was 0.08 on average, and that of the debt to equity ratio was 0.12 on average, which shows a group with low indebtedness ratio and low debt to equity ratio. In the cluster, the indebtedness ratio ranged from 0 to 0.2 and the debt to equity ratio ranged from 0 to 0.31. Other indicators typically showed values equal to or higher than the expected value, with only 0.04 to 0.12 percent of them showing worse than expected values. With the exception of 9 of the 75 companies in the group, the capitalisation reached or exceeded the value of 0.5, which is considered optimal, and the liquidity ratio was higher than one in all but three cases, and the equity growth ratio was higher than one in all but five cases. The equity growth characterising the group was supported by good profitability, underpinned by an average ROE of 0.12 calculated for the group. ROE was negative in only 12 cases. Companies doing financial activities with exceptionally high liquidity were also included in this cluster.

From a financial point of view, the indicators of the companies belonging to the

group are good, the financial management, liquidity and capitalisation of the companies are adequate.

CLUSTER 2 – those with their indebtedness and debt to equity ratios falling within the expected range

The second largest proportion of companies, 22 percent, belongs to this group, based on 2019 data. The companies in the group have better-than-expected average indebtedness and debt to equity ratios, but these values are lower than those of the first group. In the cluster, the indebtedness ratio was between 0.02 and 0.4, and the debt to equity ratio was between 0.33 and 0.79, which, in both cases, was adequate and within the expected level. The liquidity and equity growth ratios of most companies were also favourable. The liquidity ratio was higher than the expected value (i.e. one) in all but three cases, and the equity growth ratio was higher than the expected value (i.e. one) in all but one cases. However, the debt to equity ratio was lower than 0.5 for almost half of the companies (in 16 cases). However, a lower-than-expected average debt to equity ratio (0.46) was coupled with a ROE that was negative for only 4 of the 33 companies, and the operations of those companies typically showed positive results.

The financial ratios of the companies in the group reach or even exceed the expected level. Capitalisation problems are relevant in the group, but the operations of these companies still meet the requirements identified for general companies in the financial literature.

CLUSTER 3 – companies with acceptable indebtedness, but lower-than-expected debt to equity ratio

The lowest proportion of the population, 8 percent, fell into this cluster. The average indebtedness ratio is within the expected value, but in three cases it is between 0.55 and 0.58,

which is outside the expected range. With the exception of two companies, the value of the debt to equity ratio exceeds the expected value limit of one. Even the two exceptions, having a value of 0.82, also approximate 1 from below. Liquidity appeared to be adequate excepting four cases, but capitalisation for this cluster fell into the ‘to be monitored’ category because the indicator was below 0.5, except in one case, where it was 0.53. The equity growth ratio was appropriate in all cases, averaging at 6.37. The profitability of the companies shows the average ROE value of 0.04.

The members of the group do not yet have a debt problem, but the proportion of assets financed from debt is higher than expected. Loan charges and a possible further increase in this proportion could mean that such companies become increasingly dependent on external financiers. Nevertheless, their equity is well above the registered capital, and their liquidity and profitability are at an acceptable level.

CLUSTER 4 – those with unfavourable indebtedness, unfavourable debt to equity and unfavourable equity to total assets ratios

Nearly one fifth, 19 percent of the total population belongs to this cluster. Both the average indebtedness and the average debt to equity ratios fell outside the expected range in 2019. The group was characterized by an average indebtedness ratio of 0.75 and a debt to equity ratio of 2.45, with the values of group members spreading around them. The values indicated worse-than-expected indebtedness. The value of liabilities exceeded twice the equity, which is twice the value expected in literature, and capitalisation – based on the equity to total assets ratio of 0.10 – shifted towards liabilities. A review of partial values showed that the same was true for these indicators, except in one case where, although the indebtedness ratio was of the

expected value, the debt to equity ratio and the capitalisation were unfavourable. In addition, in 16 cases within the cluster, the debt to equity ratio was of an extremely poor value, and, in one case, no value was calculated, having regard to the negative equity coming from the applied methodology. The equity to total assets ratio ranged between -0.43 and 0.32. At the same time, with a high indebtedness ratio, liquidity was adequate in almost half of the population (46 percent). The equity growth ratio was below the expected level in 4 cases. ROE was negative in 4 cases, of which 3 were extremely bad.

The group is associated with a problem of indebtedness and a low equity ratio, but most of the companies in the group – 81 percent – still have adequate liquidity and positive profitability, which requires a strong portfolio control by the owner, concerning this group. If the group's indicators do not improve over several years, companies may have financing problems and their ability to meet their obligations may be jeopardized, with potential further consequences to ensue.

The activity-based analysis of the clusters revealed that the financial indicators of financial service providers are the most outstanding, so they were classified into cluster 1. Companies active in forestry, agriculture and the fishing industry also had appropriate financial indicators, and they were classified into the first two clusters. The most unfavourable financial indicators were those of project implementation organizations, which – with one exception – were included in cluster 4. It is also worth noting that the vast majority of companies providing human services or information and communication services were classified into the first two clusters, so a smaller part of them have a worse financial ratio.

Examining the relationship between the number of employees and groups of clusters, it

is worth noting that companies with less than 10 employees were typically included in cluster 1, a fact partly attributable to their activities (25.0 percent of them were financial service providers). Also, almost half of the companies with more than 250 employees were included in cluster 1.

In the context of clusters and the provision of public services, it should be noted that while the proportion of public service providers and non-public service providers within cluster 1 was balanced (51 percent and 53 percent, respectively), 20.8 percent of all public service providers were classified into cluster 4. This proportion is higher than for non-public service providers, so the proportion of public service providers is the highest within cluster 4 (80.77 percent).

The analysis of the clusters according to size shows that micro-enterprises with a low number of employees were included in cluster 1. A large proportion of medium-sized companies had good financial ratios, with 82.3 percent of them classified into the first two clusters. Small and large companies were nearly equally distributed among the clusters, but 50 percent of the companies were large in cluster 4.

Based on the results of a detailed analysis of the clusters, we believe that the clusters selected on a mathematical basis can provide the owner with useful information for the definition of the aspects of future portfolio management.

The analysis of the clusters identified a group of companies requiring special attention, which is characterized by over-than-expected indebtedness and unfavourable capitalisation. The group includes four of the five limited liability companies with an equity growth ratio of less than 0.5 or of negative amount. These companies were classified into cluster 4. 81 percent of group members provide public services. Among these companies in cluster 4,

which require close and continuous ownership control, 36 percent had a low registered capital (between HUF 3 and 5 million), 29 percent had a negative or minimum after-tax profit in the period analysed, and 25 percent had a negative or minimum profit reserve, while 32 percent had debts in excess of twice the equity.

At the same time, a large group with 108 members was observed, representing 73 percent of the companies analysed, which had good financial ratios describing their financial management, a strong liquidity, a capitalisation meeting expected levels and typically positive profitability. These companies belonged to clusters 1 and 2. The data of the group do not indicate any critical management factors or risks.

Between the two groups, a small group could be identified, where ownership control should focus on preventing indebtedness problems. This is related to companies in cluster 3. Group members typically do not provide public services (66 percent) and have no assets under management. None of the three companies that had negative profitability were public service providers, however, it would be justified to impose a higher return on equity requirement on them or to consider winding up or reorganizing them.

SUMMARY

Today – in an economic environment characterized by waves of the Covid-19 epidemic and changes in energy prices in world markets –, performance management and thorough methodological measurement are of key importance. The State Audit Office of Hungary considers it one of its strategic goals to promote and support an increased use of performance measurement when public funds and public assets are utilized. The application of performance management in the public sector can be facilitated by thought-provoking, advisory materials. The adjusted financial ratios presented in this study are well suited to support the measuring of financial performance as part of performance management efforts of companies in majority state-ownership or municipal ownership. Clustering can provide a useful tool for those exercising ownership rights over multiple companies, enabling them to build intra-company portfolios and to support portfolio management efforts by companies. In this study, the experts of the State Audit Office of Hungary intended to offer useful aspects and tools for both nationally owned companies and those exercising ownership rights. ■

REFERENCES

BOROS A., GERGŐ J., BÁNDI I., KOC SIS E., HAJDICS A. A., SZÓLIK E. (2018). *Az állami vagyongazdálkodás*, Nemzeti Közszolgálati Egyetem [Public Asset Management, National University of Public Administration]

DEBRECENI B. (2016). *Klaszterezési módszerek minőségellenőrzése, klaszterezési módszerek összehasonlítása*. Miskolci Egyetem, Miskolc,

[*Quality control of clustering methods, comparison of clustering methods*. University of Miskolc], <http://midra.uni-miskolc.hu/document/24470/19450.pdf>

DOMOKOS L., NYÉKI M., JAKOVÁC K., NÉMETH E., HATVANI Cs. (2015). Kockázatelemzés és kockázatkezelés a közszférában és a közpénzügyi ellenőrzésben. *Pénzügyi Szemle*, [Risk Analysis and

- Risk Management in the Public Sector and in Public Auditing. *Financial Review*, 2015/1, <https://www.asz.hu/hu/penzugyi-szemle/kockazatelemzes-es-kockazatkezeles-a-kozszferaban-es-a-kozpenzugyi-ellenorzesben>
- DOMOKOS L., VÁRPALOTAI V., JAKOVÁC K., NÉMETH E., MAKKAI M., HORVÁTH M. (2016). Szempontok az állammenedzsment megújításához. *Pénzügyi Szemle* [Renewal of Public Management. *Financial Review*] 2016/2, pp. 185–204
- DOMOKOS L. (2019). *Ellenőrzés – a fenntartató jó kormányzás eszköze*. [Control - a tool for sustainable good governance] Akadémiai Kiadó, Budapest
- DOMOKOS L., WERTHERNÉ SZ. D. (2020). A számvevőszéki teljesítmény mérésének modellje, a teljesítménymenedzsment fő területei. *Pénzügyi Szemle* 65(1.különszám) [Audit Performance Measurement Model and the Main Areas of Performance Management. *Financial Review*, 65 (2020/Special Edition)] https://doi.org/10.35551/PSZ_2020_k_1_1
- GYIRES B. (2012). Tananyagtár, 8. fejezet, Klaszteranalízis: Alapvető fogalmak és algoritmusok, Online: <https://gyires.inf.unideb.hu/KMITT/a04/ch08.html> [Curriculum, Chapter 8, Cluster Analysis: Basic Concepts and Algorithms]
- IVÁNYOS J., SÁNDORNÉ K. É. (2016). A kockázatkezelés teljesítménymutatókon alapuló mérési és értékelési módszerei. *Pénzügyi Szemle*, [Risk Management Measurement and Evaluation Methods Based on Performance Indicators. *Financial Review*] 2016/2
- KAISER T. szerk. (2014). *Hatékony közzolgálat és jó közigazgatás – nemzetközi és európai dimenziók*. Tanulmánykötet, Nemzeti Közzolgálati Egyetem, [Efficient public administration and good public administration - international and European dimensions. Study volume, National University of Public Administration], <https://docplayer.hu/175448-Hatekony-kozszolgalat-es-jo-kozigazgatas-nemzetkozi-es-europai-dimenziok-szerkesztette-kaiser-tamas.html>
- PEARCE, D. W. edit. (1993). *A modern közgazdaságtan ismerettára*. Budapest Közgazdasági és Jogi kiadó [*Repository of modern economics*. Budapest Economics and Law Publishing House]
- PULAY GY., SIMON J. (2020). A közpénzügyi gazdálkodás makrogazdasági teljesítményének mérése, *Pénzügyi Szemle*, 65(1. különszám) [Measuring the Macroeconomic Performance of Public Finance Management, *Financial Review*, 65 (2020/Special Edition)], https://doi.org/10.35551/PSZ_2020_k_1_2
- SZAKÁCS G. (2012). *Teljesítménymenedzsment*. Nemzeti Közzolgálati Egyetem, Közigazgatási Vezetői Akadémia [*Performance management*. National University of Public Administration, Academy of Management]
- TAKÁCS A. (2015). *Vállalatértékelés a magyar számviteli környezetben*. SALDO [Company valuation in the Hungarian accounting environment]
- VERESNÉ S. M. (2017). “Jó gyakorlatok” – Etikus vezetés, integritás és teljesítménymenedzsment a közzférában. Az Állami Számvevőszék és a Miskolci Egyetem közös konferenciája 2017. január 26. [«Good Practices» - Ethical Leadership, Integrity and Performance Management in the Public Sector. Joint conference of the State Audit Office of Hungary and the University of Miskolc January 26, 2017]
- PÉCSI TUDOMÁNYEGYETEM Közgazdaságtudományi Kar (2018). *Vállalati Pénzügyek Kézikönyv*. Pécs Tudományegyetem, Ulbert J. szerk. [University of Pécs, Faculty of Economics (2018). *Corporate Finance Handbook*. University of Pécs, Ulbert J. ed.], <https://kktk.pte.hu/file/kiadvanyok/konyveink>

SAS/STAT Software FASTCLUS Procedure,
Online: <https://support.sas.com/rnd/app/stat/procedures/fastclus.html>

SAS/STAT® 13.2 User's Guide The FASTCLUS
Procedure, Online: <https://support.sas.com/documentation/onlinedoc/stat/132/fastclus.pdf>