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**ANALYSIS OF THE FINANCIAL STATEMENTS OF THE
HUNGARIAN DISTRICT HEATING SUPPLIERS IN RELATION TO
THE CHANGES OF THE REGULATORY ENVIRONMENT**

Theses of the PhD dissertation

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Table of content

1. Aims of the research, tasks.....	1
1.1. The relevance of the research, reseach gap	1
1.2. The logic of my reserach, the structure of the thesis	1
1.3. Preliminary research, basic research question and the aims of the research	3
1.4. Research methodology – literature review, conceptualization, operationalization	3
1.5. Research methodology – empirical research, data processing activities, analysis and application.....	5
2. The methodology of analyzing financial statements	6
2.1. Traditional financial indicators and their limitations	6
2.2. The methodology of environmental analysis.....	9
2.3. The possible application of indicators and environmental analysis in the reserach process	9
3. Research results.....	11
3.1. Database and methodology of the research	11
3.2. Hypotheses presented in the thesis	13
3.3. Theses, new and novel results	15
3.4. The limitations of the research, fields of possible extension.....	27
3.5. Summary.....	28
4. Related publications of the candidate.....	31
5. References	34

1. AIMS OF THE RESEARCH, TASKS

1.1. The relevance of the research, research gap

My thesis focuses on the operational analysis of Hungarian district heating suppliers on the basis of financial indicators. There are several reasons due to which this topic is of *relevance* and importance. On the one hand, the sector plays an important role in the national economy. On the other hand, we have experienced several interesting and exciting changes within the operational and macro level environment of these companies in the last decade. According to my view the analysis of financial statements is a very exciting field to research that gives us insight to information which helps us to understand the sector.

Most of the existing studies and research data focus on the field from a mechanical point of view. The researches by Németh (2008) and Kádárné (2010) analyze the pricing policy of district heating companies. In their theses and the researches they give a detailed description of the regulatory environment of the sector, and provide us with the theoretical and practical bases of pricing policies. In many ways, their works and results serve as a starting point in my thesis. We have to note though that there have been several important changes within the sector within the sector in the last decade, thus the relevance of the topic is without doubt. It is not the aim of my thesis to describe and analyze the theoretical background of the topic, since it has not been influenced by the recent changes. There are several studies and books in which such theoretical background is given. My aim, and the novelty of my research, is to provide an understanding of the specificities of the operational and regulatory environment, to list the changes and build a theoretical framework in which the data may be analyzed.

The *novelty of the research* lies in the fact that the currently existing literature fails to address the issue of management and operation of district heating suppliers from this point of view. There are no summative studies that provide benchmarking data on the bases of which the experts can make a comparative analysis of their own performance or the performance of their companies. By providing such data and research my thesis fills the existing *research gap* as well. The synthesis of my research and the new or novel results contribute to the effective improvement of the sector and assist the efficient use of resources.

The thesis analyzes development trends based on nine years of data (2009-2017) coming from the financial statements of the Hungarian district heating suppliers and the available operational and economic information. We have to note that financial indicators and their comparison could not provide a complete understanding of the performance of companies. Therefore it is of outstanding importance to analyze environmental factors as well, especially since the aim of my thesis is to provide the analysis of a sector not a single company.

In order to provide a complex analysis and draw relevant conclusions it was important to collect all the recent changes of the operational and regulatory environment. The possibility to reveal environmental changes with the help analyzing financial statements has been one of my research questions. I also wanted to focus on answering the question of the possibility of effective operation in a regulatory environment that has changed significantly.

1.2. The logic of my research, the structure of the thesis

When formulating the research plan and carrying out the research I relied on works focusing on the logic of scientific discovery (Popper, 1997) and on the carrying out of scientific research (Babbie, 1986; Ghauri and Grønhaug, 2011; Majoros, 2006, Elster, 1997; Mason 2005). The practical guides and methodological suggestions in these books helped me to formulate my

research plan and provided the framework within which I carried out my research (Figure 1 illustrates the process of the research).

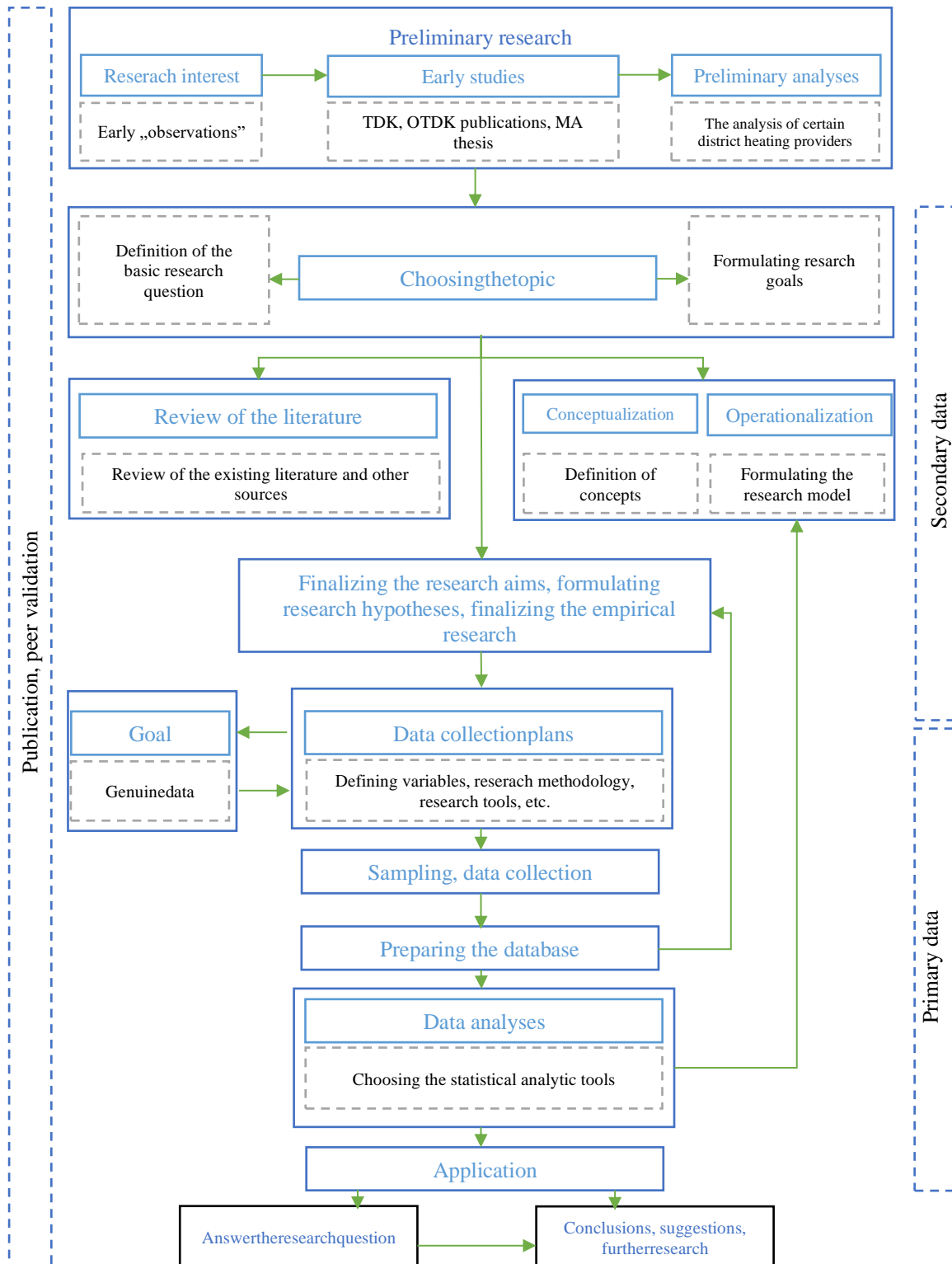


Figure 1.: The research process
Based on: Babbie (1996, p. 128); and Lampek and Horváthné (2015, p.14)

1.3. Preliminary research, basic research question and the aims of the research

My scientific interest toward district heating suppliers started during my university years. I presented my research data on these companies in the form of two OTDK [National Scientific Student Conference] studies focusing on the fee-structure of the suppliers and on the challenges of meeting financial conditions. My undergraduate thesis has been based on the results of these researches as well. After graduating I continued my research on the topic. Therefore these early studies can be understood as the preliminary research of the current doctorate thesis. In 2017-2018 I have been given an opportunity to analyze the financial statements of the ten most important district heating suppliers as a result of which I realized that at the companies there are significant differences in assets, finances, profitability and performance. The analysis was followed by the formulation of my *basic research question* and the definition of the *main goal* of the research, i.e. the analysis of Hungarian district heating suppliers based on financial indicators with a special focus on the changes in the operational and regulatory environment. The main goal of the research is broken down into several *aims and questions* that have been clarified and reformulated after the review of the preliminary research and the existing literature.

Table 1.: The aims of the research, methods and documents used

Aims	Materials	Method
Measurement tools of assets, finances and profitability	Secondary data, literature on analytical tools in Hungarian and English	Literature review
Stakeholders of the Hungarian district heating sector, analysis of their macro level environment	Secondary data, literature on district heating sector in Hungarian and English, rules and regulations, legislation, KSH [Hungarian Central Statistical Office] data	Literature review, statistical tools, document analysis
General study of district heating suppliers based on traditional indicators of assets, finances and profitability	Secondary data, annual financial statements of 2009-2017, e-statements, web pages	Empirical research, indicator groups, tools of descriptive statistics, analysis of annual statements
Special study of district heating suppliers based on the sector-specific economic and mechanical data	Secondary and primary data, mandatory data supply of 2009-2017, web pages, local legislations	Empirical research, indicator groups, tools of descriptive statistics, appendix
Cause and effect analysis	Primary data, special indicators	Variability analysis, cluster analysis, univariate analyses

1.4. Research methodology – literature review, conceptualization, operationalization

The literature review, the analysis of secondary data, the review of the preliminary research and the definition of basic concepts and variables (conceptualization), together with the measurement options of variables (operationalization) have been a constant and parallel process during the working on my dissertation. In the empirical research I aimed to take Elster's views on reasons and rationality (1997) into account, according to which we have to make a distinction between true reasons of causability, correlations, necessary relations and descriptive relations.

I chose deductive thinking as the driving force of my research, i.e. my hypotheses have been formed during and after the review of literature on methodology and district heating suppliers. I tested the validity of my hypotheses by further reviews and quantitative research on primary and secondary data (Babbie, 1986). In terms of the time frame, my research has cross-sectional and longitudinal aspects as well.

In order to fulfill my aims and answer my research questions I had to use secondary data. The sources of secondary data and information and their role in my thesis are shown in Figure 2.

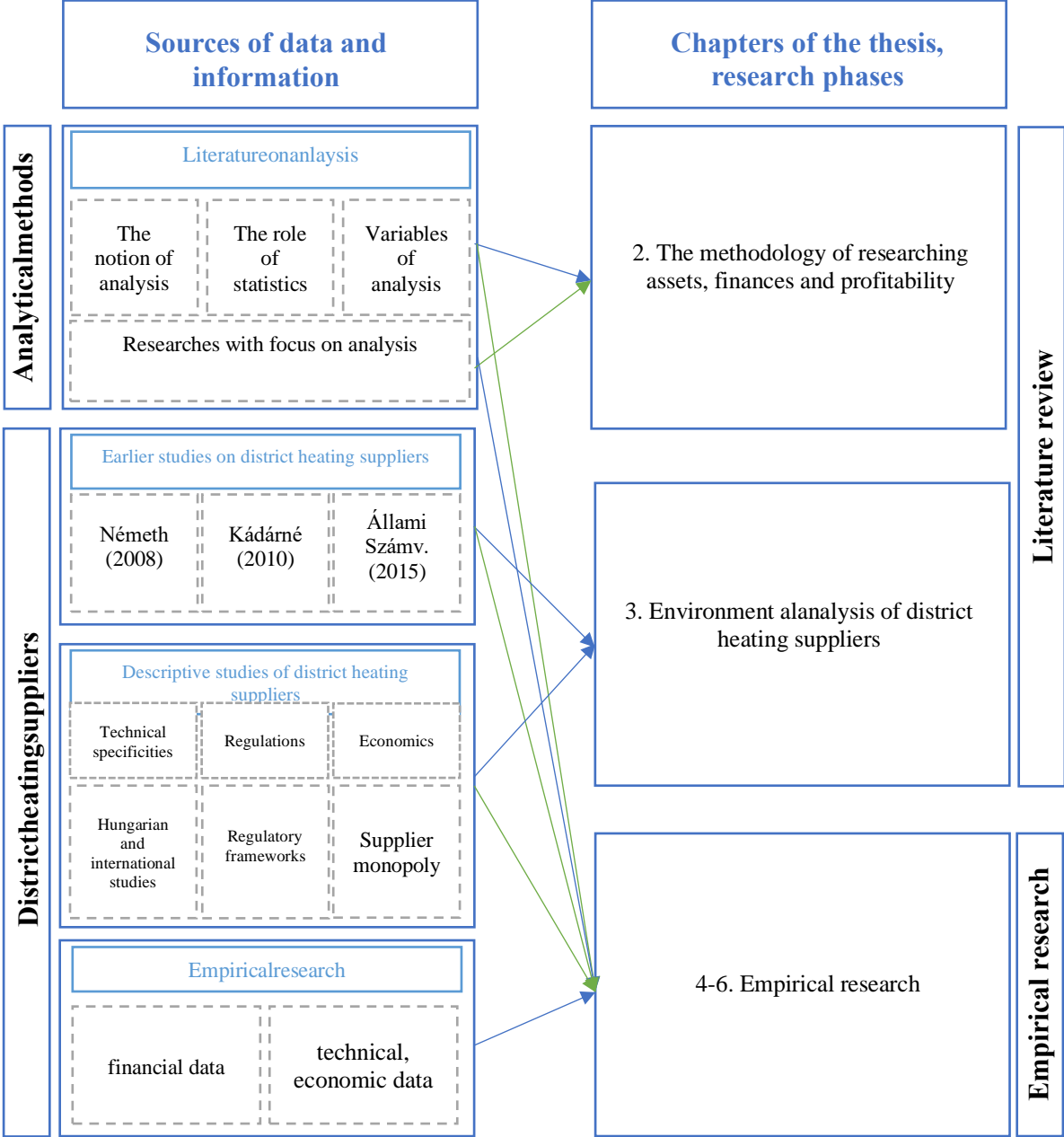


Figure 2.: Secondary data and their use during the research and in the thesis

As the main method of the thesis is financial statement analysis the literature review focuses on the tools of analyzing assets, finances and profitability, their usage and pre-requisites in details. Earlier works on similar studies of a given industry, branch or sector serve as important secondary sources in my research. These studies helped me to gain skills in reviewing the literature and also helped me in the process of operationalization. The applied methodology served as a basis for choosing my methodological tools in the empirical research and helped me to formulate the frameworks on analysis (Majoros, 2004).

In order to carry out an in-depth analysis it was important to know and understand the operational environment of the companies. Therefore an analysis of the regulatory (political and legal) environment of district heating suppliers have been carried out together with the

research of changes, operative conditions (technical and mechanical) and socio-economic characteristics. The examination of technical characteristics has been carried out by reviewing the most recent Hungarian and international publications and research reports.

At the beginning of the research my goal was to analyze the district heating suppliers. After the literature review and during the preparation for empirical research it became obvious that there are significant differences in several characteristics of the companies, including their activities. These differences are so significant that they served as a basis of grouping in variability analysis. Therefore it was necessary to distinguish between companies of district heating profile and of other profiles. In order to make my distinction absolutely clear I came up with a concept that includes both actors. In the research I used the following concept and definition:

- *Companies carrying out district heating supply activities*: each and every entities that carry out district heating supply activities.

In my thesis I also use the notion *entity* when talking about district heating suppliers and companies carrying out district heating supply activities.

1.5. Research methodology – empirical research, data processing activities, analysis and application

Both primary and secondary research has been carried out during the research process. The data and information collected during the secondary research provide an opportunity to show and test the effects of regulatory changes on financial statements. They also give me a chance to examine the correlation between literature-based, expected results and actual results of financial indicators. The hypotheses based on the secondary research form the basis of the primary research. In order to test their validity I needed to create a database. My aim was to form conclusions that are valid for the whole Hungarian district heating sector. Therefore I carried out extensive data collecting activities. To formulate the database I needed the data of annual statements and reports of nine consecutive years (2009-2017). Besides of collecting the data of financial statements I also collected information on the technical and operational characteristics from the public database of the companies in focus. Based on this information I aimed to form industry specific indicators that go further than traditional financial indicators and serve as a basis for understanding the reasons of differences in the economic performance of the companies in focus.

2. THE METHODOLOGY OF ANALYZING FINANCIAL STATEMENTS

In order to reach the goals of a company and its stakeholders and to supervise the process of reaching them it is important to have information (Mabberley, 1999).

Because of its fixed set of rules accounting is suitable to communicate between different players of the economy and also to provide the required information. According to Pál “modern accounting is the language of business, the basic form business communication that has a special ‘grammar’” (2016, p.14.) with the help of which it is possible for all players to have an identical understanding of economic processes. Besides, “effective and reliable business information systems ease and support functions and decision making at the companies” (Zéman and Laskai, 2013, p.14.).

Economic analysis can be regarded as one of the basic methods of gaining necessary information. During the analysis we reveal correlations and factors that have an effect on the economical processes. Therefore such analysis is truly a method of recognition that not only helps but also ensures the acquisition of necessary information (Kresalek, 2011a).

In agreement with Béhm, Bárczi and Zéman according to whom “certain statistical base indicators and statistical methods can be used to measure financial performance and serve as bases of formulating financial indicators” (2016, p.27.) I used indicators in my analysis. To form financial indicators we need information describing the business activity. Accounting is a useful framework in gaining such information. In my view, from an objective point of view accounting must be understood as the “language of business” (Pál, 2016, p.14.) that is a highly useful tool for the players to understand the assets, finances and profitability of a given company.

2.1. Traditional financial indicators and their limitations

Data available through the financial statements provide an opportunity to create the image of a company. “Financial indicators indication the fulfillment of financial goals can show the economic position of the company and help us to understand the economic, causal, market, etc. relations” (Sinkovics, 2010, p.125).

Indicators derived from annual financial statements have several forms, names and classifications. When collecting the most important indicators I have used the following classification:

1. indicators of asset and capital structure
2. indicators analyzing the financial situation (solvency, liquidity, financial structure, liquidity analysis)
3. indicators of profitability
4. indicators of effectiveness
5. indicators of market value
6. additional financial indicators.

Financial indicators can be regarded as the most important sources of information for the relevant parties as they serve as the bases of indicating the economic situation of a given company, its problems and the possibilities of development (Sinkovics, 2010). In order to use them properly though, we have to be clear about their limitations. In terms of the indicators based on traditional financial statements both the Hungarian and international theorists emphasize that we have to be very careful in their application (Fenyves, 2014). Bács et al (2016)

and Musinszki (2016a) summarize the most significant limitations arising from the specificities of annual statements:

- they are not actual, since they do not list the most up-to-date data (Rappaport, 2002), they focus on the performance of the past. The balance sheet consist of data of the record date, usually the 31st of December. Therefore they are not accurate in the time of the analysis (it is especially important in terms of the liquid assets of quick obsolescence, as their value changes quickly),
- the data is not real-time and because of the regulations concerning reports and publications the interested parties are informed late (Kiss, 2016),
- the time-value of money and the risks are not taken into consideration even though the decisions of information-requesting parties are influenced by the financial risks as well (Raar, 2008),
- they are suitable to mark the faults of the past, but cannot prevent them (Musinszki, 2016a),
- short-term interests are reflected in them, since the balance sheet and the profit and loss account contain only 2 years of data,
- due to the short-term focus they do not serve the strategic goals of the company (Johnson - Kaplan, 1991),
- some indicators have a strong correlation therefore they do not contain new information (Kresalek, 2016),
- in an annual report and statement there are several different approaches (Fazekas, 2007), which means that the comparison of companies can lead to false conclusions,
- the information is usually aggregated, and due to their structure they are not suitable for defining the reasons of the given profit and loss (Bács et al. 2016).

To the in-depth understanding, and detailed description of the business activity of an entity the traditional financial indicators derived from the annual reports are not enough. Although some financial-business processes may be identified by their analysis, their use is limited, they cannot be applied in themselves. In order to understand the causal relations we need to know the real processes as well (Sztanó and Korom, 1996).

Besides the review of the Hungarian and international literature on analytical methods I also focused on Hungarian researches that aimed to analyze certain industries or sectors in terms of the traditional asset, finance and profitability indicators. In order to gain a deeper understanding of the topic I analyzed several researches from the past decade to determine the indicators and analytical tools they used.

Table 2.: Reserach based on traditional financial and accounting indicators

Author (year)	Industry, sector	Research goal, question	The role of traditional financial, accounting indicators in the research
Böcskei (2008)	hotels operating in Hungary	to assist the effective use of financial support in the tourism by analyzing the effectiveness of health tourism investments	examination of 341 hotels in a period of 10 years on the bases of stars, assets, finance, profitability and effectiveness
Závecz (2015)	electricity supply	trends and regulations of investments compared to pricing policy in electricity supply	Return on investment at 6 companies; the value of outside sources; annual cash-flow analysis
Sápikné (2017)	construction, industry, commerce, agriculture. hotel, transports, etc.	The characteristics, performance and competitiveness of the Hungarian large enterprises	the analysis of 1455 companies based on their publicly available business reports in the average of 10 years, using the most important indicators (12 indicators – 3 factors)
Vinklerné (2017)	swine husbandry	analysis of the macro level environment via financial indicators, profitability	analysis of 17 individual and 5 collective swine farms, 26 indicators classified into 5 groups analyzed in a period of 7 years
Felsmann (2014,2018)	energy trade sector	sector level, company-specific differences in management, the effect of stakeholder expectations on performance	examination of 22 energy trading companies for 8 years by using 8 indicators
Kulcsár (2018)	SME sector	risk indicators at Hungarian and Romanian companies	analysis and comparison of 172 companies from Hajdú-Bihar and 173 from Bihar for 4 years trough 10 indicators
Zsidó (2018)	food retailers	analysis of the financial performance	examination of 246 and 1092 companies by cluster analysis by using 13 indicators
Vancsik (2019)	competitiveness of the SME sector via clusters	the profitability and competitiveness of SMEs in cooperations	examination of 285 companies for 6 years by using 7 indicators

The works listed above strengthened my view that it is possible to carry out the analysis of the Hungarian district heating sector by using traditional indicators of assets, finance and profitability. The literature review also served as a guide in carrying out the empirical research.

2.2. The methodology of environmental analysis

The literature review presented above shows that statistical analysis is suitable to form financial indicators. Indicators and ratios become meaningful data, i.e. data reflecting reality, only if “we use them to describe reality in a short, quantitative way and with the support of additional knowledge on the given field of interest” (Vita, 2000, p.17). Therefore, in order to form meaningful data from the indicators, the second part of my literature review focused on the environment of district heating suppliers.

At successful companies the environmental analysis is a fundamental requirement. The constant attention toward changes, the analysis of responses is essential, just like the flexibility in strategy. The environment of entities may be divided into segments in which different opportunities are present to influence changes (Balaton, 2014). In order to focus on the methodology of environmental analysis we have to analyze the external environment of a company. It is similar to the application of innovative cost systems that avoid the limitation of traditional cost calculations (Musinszki, 2016b). Firstly, I identified the boundaries of the relevant industry, branch and sector, analyzed the sector, the direct and indirect competitors, identified the macro level factors and described the expected changes in the future (Ince, 2007; Sütő et al. 2017; Zéman and Tóth, 2017).

2.3. The possible application of indicators and environmental analysis in the research process

During the first phase of the secondary research I focused on the literature review. I examined the Hungarian and international publications with the aim to:

- learn about the methodology on analyzing assets, finances and profitability
- discover the possible applications of statistical methods
- collect the indicators used in analyzing assets, finances and profitability
- describe the possibilities of measuring and analyzing environmental factors.

To summarize my findings and prepare for the empirical research I arrive to the following conclusions:

- General rules and correlations between information can be described by using statistical methods, but it is not suitable to describe causal relations.
- By uncovering causal relations it is possible to find root causes that influence the assets, financial situation and profitability of the *companies* carrying out district heating supply activities regardless of their management and internal control mechanisms.
- Indicators calculated from financial statements are less suitable to be used in decision-making processes of the future, but are suitable to uncover correlations. Therefore they are suitable to fulfill the research goal and answer the research questions of the thesis and they can help in describing the factors that influence the district heating suppliers.
- Besides the traditional assets, finance and profitability indicators, in order to fully analyze the situation of companies carrying out district heating activities; we need additional indicators/ratios that regard the specificities of the industry (intensity). To formulate and interpret such indicators it is essential to understand the environment of the business entities.

Therefore, in the framework of the secondary research, I not only draw on the existing literature, but also use additional data. In this chapter the main goal is to describe the Hungarian district heating sector. This is carried out in a structured form with the application of a special filter. The specificities of the sector in the period of nine years are listed in accordance with the followings:

- political and legal factors,
- technological and environmental characteristics,
- economic and social effects,
- social innovations in relation to technological and social factors.

Information gathered during the secondary research ensures the possibility to test the effect of changes in the regulatory environment on the financial statements.

Based on the secondary research I concluded that the indicators coming from the financial statements and annual reports of the district heating suppliers are suitable to describe the effects of influential factors on business activities. Additional indicators formed with the help of information available through published technical and financial data and reports broaden the perspective and extend the limits of my research.

3. RESEARCH RESULTS

3.1. Database and methodology of the research

I carried out an empirical research based on representative sample to analyze the operational and management characteristics of the district heating sector. The methods used in choosing the data and sample were applied in accordance with the general recommendations of statistical and analytical publications and theories. At first I defined the population. Currently there are 89 entities¹ operating in 93 settlements in Hungary. They are the population of the research. Based on the general data collection among the population I defined the sampling method. In this phase I realized that, due to objective reasons, I do not have the opportunity to research all companies. One of these objective reasons was the lack of suitable data in the databases. Another reason was that the preliminary statistical analyses showed that some companies had extreme values that could bias the indicators. There are two reasons of lack of data and extreme values. On the one hand, there are companies that transformed several times in the last decade, the structure of stakeholders changed. At some of the companies it was impossible to follow the line of predecessors and successors. Therefore they were excluded from the sample. The exclusion of these companies is justifiable from an accounting point of view, since cease with successor practice is not considered as “normal” business procedure. The data from the years before and after the succession could not add to the true and valid picture of the sector of interest. On the other hand there were companies the data of which was not available in the required details. Thirdly, companies that are licensed to provide district heating to a single institution, building or district were also excluded, since district heating supply takes up only an insignificant part of their main business activities.

After careful consideration I included 72 companies to the sample. Before sampling I researched the available data and information of the companies. In order to carry out the empirical research I needed the annual reports (balance sheets) of the entities. These served as the *first class of data*. Currently there is no database in Hungary that contains these data broken down to balance sheet line items, so I had to collect these data individually. The *second class of data* was gained from the technological and management data that has to be prepared on an annual basis by the district heating suppliers in accordance with Appendix 4. of the Government Decree No. 157/2005 (VIII.15) on the implementation of Act XVIII. of 2005. From 2012 district heating suppliers are required to publish this information.

I used several databases to collect the required information, such as:

- Company Information and Electronic Company Registration Service of the Ministry of Justice (<https://e-beszamolo.im.gov.hu>),
- web pages of the companies in terms of the balance sheets and information on technology and management,
- interviews and questionnaires sent directly to the companies in order to gain information on the technology and management.

Because of the time and energy I spent with collecting preliminary data I decided to use the whole population as sample and create a database that is complex. The type, source and use of data collected during the research are shown in the following figure.

¹ Based on the publication „Hungarian District Heating Sector” of 2017 published by Magyar Energetikai és Közmű-szabályozási Hivatal (MEKH) and the Magyar Távhőszolgáltatók Szakmai Szövetsége (MaTáSzSz).

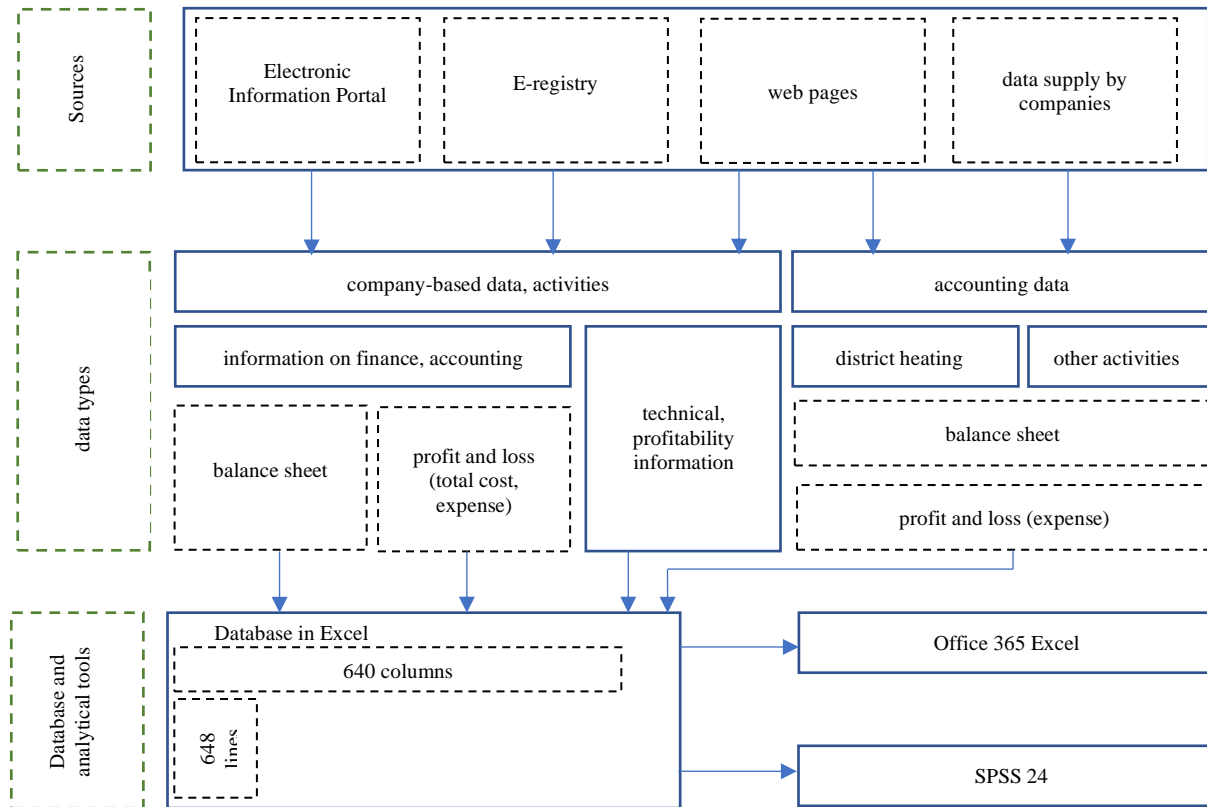


Figure 3.: Sources and types of data and the analytical tools used in the empirical research to create the database

It is important to point out that the sampling was representative of the whole population. I choose to examine the population along the sold heat, regional distribution and the number of consumers. The deviation among the 89 suppliers is large in terms of sold heat and the number of consumers, so the 72 companies that made up my sample provide 93% of the whole amount of sold heat. Therefore the conclusions drawn are reliable in terms of describing the situation and characteristics of the whole population.

The analysis of the proportion of district heating supply and other business activities within the portfolio of the company opened up new possibilities. I had the chance to create two databases in regard of the 72 companies in focus. My primary database is made up of data coming from the company-based balance sheet and profit and loss report: these are referred to as data from “normal reports” in the thesis. When not indicated otherwise, my calculations, figures, tables and conclusions are based on this database. The secondary database is made up of data coming from the company-based balance sheet and profit and loss report at 40 companies “with district heating profile” and from the report, balance sheet and profit and loss report after accounting unbundling at 32 companies with “other profile”. These data are referred to as data containing unbundled accounting information as well. This database provided an opportunity to analyze district heating supply activity in its narrower sense.

The *technical procedure of the analysis* was carried out using the Excel program in Microsoft Office 365 ProPlus and SPSS 24. The data of the annual reports and balance sheets were uploaded to an Excel file. The final Excel has 648 lines (72 companies, 9 years) and 640 columns (the columns, i.e. variables, contain the data and the indicators).

3.2. Hypotheses presented in the thesis

The first part of the thesis focuses on the most important characteristics of the district heating sector with regard of three factors of the operational environment. It serves as a basis for reflecting the main goal of the thesis, i.e. the analysis of the Hungarian district heating sector with the help of financial indicators and a special regard of the changes in operational and regulatory environment, and also to form hypotheses. The understanding of the operational and regulatory environment helped me to define the scope of the empirical study.

I use the financial indicators described in the previous chapters complemented with the special indicators of the district heating sector.

Figure 4. shows the relationship of the hypotheses, showing the environmental factors, the focal points of the analysis, the applied methods and the independent variables of the empirical research.

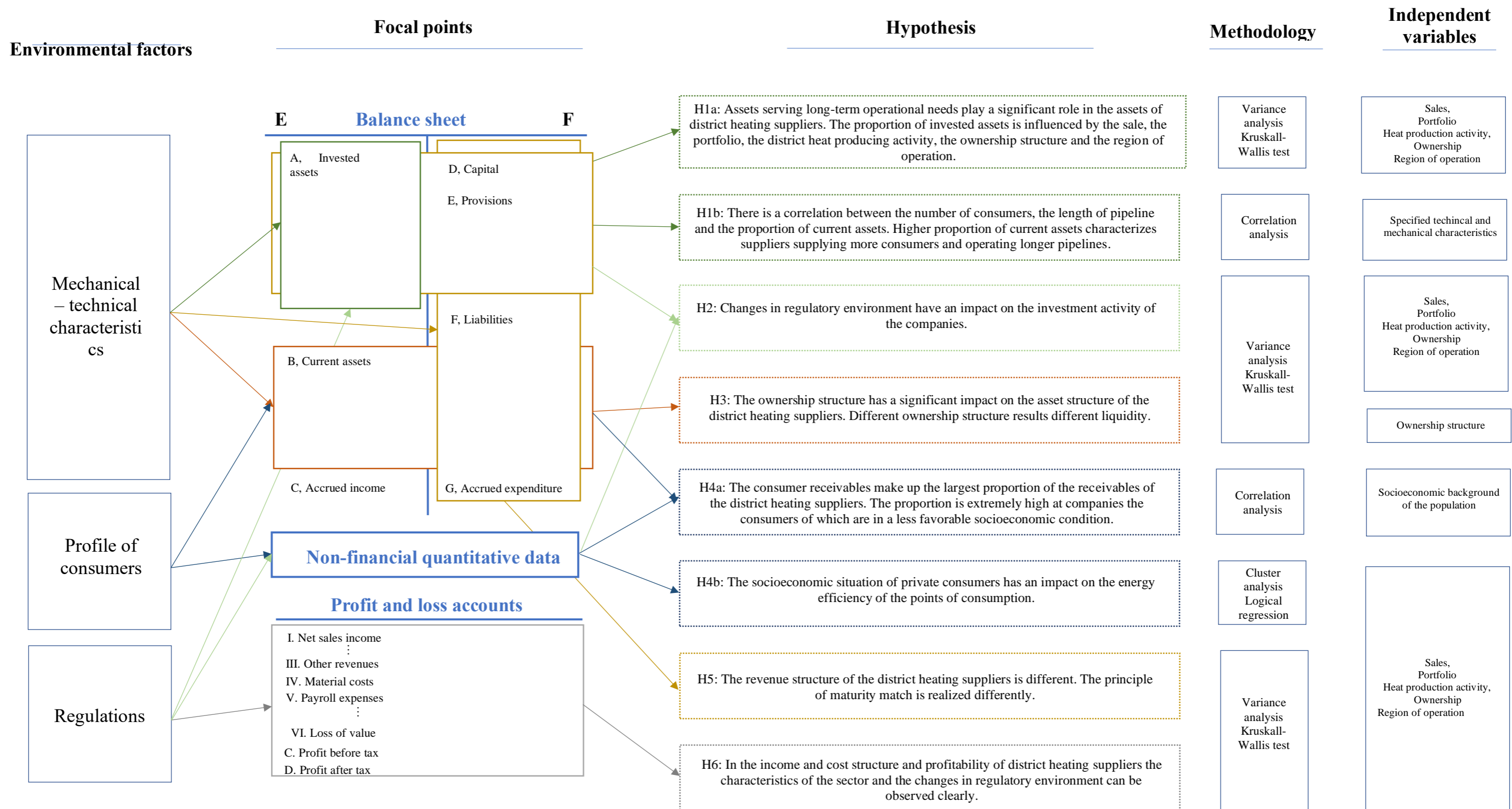


Figure 4.: Environmental factors, focal points, hypotheses, the methodology used in testing the hypotheses and the variables

3.3. Theses, new and novel results

The first group of hypotheses deals with questions arising from the technological characteristics of the sector and related to the assets structure of companies carrying out district heating supply activities (**H1a and H1b**).

In the asset structure of district heating suppliers' assets permanently influencing operation play a significant role (according to the normal reports the average proportion of invested assets is 65%). Consequently, their replacement and maintenance require significant inputs and responsible management decisions.

The proportion of invested assets varies at the companies greatly. One of the reasons for deviation is that the invested assets and their yearly changes of the FŐTÁV Zrt. are significantly different from that of the other companies. Besides the different asset structure of the FŐTÁV Zrt., I found five other characteristics along with classification is possible. In general, the higher the heat supply capacity the higher the invested assets proportion is. The FŐTÁV Zrt. is an exception. From 2013, although the FŐTÁV Zrt. is the largest supplier, the proportion of its invested assets is the lowest. Companies with other profile (whose other, non-district-heating, activities make up the portfolio in a larger portion) have a higher proportion of invested assets in their asset structure than those with mainly or exclusively district heating activities. Companies that do not carry out heat producing activity have an average of 5 % less invested assets proportion. The assets structure of private district heating suppliers also differs significantly from that of the companies owned directly or indirectly by local governments. Depending on the year we can see an invested asset percentage that is lower by 13-20 percent. The variance analysis carried out during the testing of H1a hypothesis and the results of the Post Hoc tests are summarized in the following chart:

Table 3.: Summary of the variance analysis of the proportion of invested assets and the results of Post Hoc tests

Description	Independent variables				
	Activity	Sales	Region	Heat production	Ownership
Significant differences within the groups in percentage	67%	78%	56%	56%	89%
strength of the correlation (Eta) in the significant years	0,411	0,428	0,532	0,428	0,542
Minimum value of strength in correlation (Eta) in the significant years	0,33	0,36	0,311	0,32	0,45
Maximum value of strength in correlation (Eta) in the significant years	0,47	0,48	0,57	0,47	0,64
Significant grouping factor, not only FŐTÁV Zrt.	17%	43%	0%	80%	80%
Ranking	4.	3.	5.	2.	1.

There are differences among the district heating suppliers in relation to the region of service. According to the normal reports, the average proportion of invested assets at suppliers in the South Transdanubia region is more than 10 % lower than the national average, while according to the unbundled reports the Central Hungarian suppliers have the lowest proportion (by 20%). After examining the suppliers I concluded that the reason for differences in the proportion of invested assets is not due to regional technological specificities. The reason of it should be found in reasons defining the proportion of current assets. The ANOVA studies and Post Hoc tests used to test H1a hypothesis helped me to gain a deeper understanding of the assets structure. In order to ensure reliability I used robust statistical procedures as well. The Kruskal-

Wallis test is based on the comparison of medians and does not assume a normal distribution of the residuals. The Kruskal-Wallis test confirmed the results of the variance analysis.

Based on the research **H1a hypothesis was modified**

T1a: Invested assets make up the largest proportion of the asset structure of companies carrying out district heating supply activities. Deviation of the proportion of invested assets is significantly influenced by the ownership, the heating production activity (or the lack of it) and the extent of sales. The profile and the region of service, except in the case of the special asset structure of the FŐTÁV Zrt., do not explain the deviation of the proportion of invested assets.

The activity of companies carrying out district heating supply tasks may be examined by indicators that characterize the entities independently from the data of the balance sheet and the profit and loss report. Appendix 4. of the Government Decree No. 157/2005 (VIII.15) on the implementation of Act XVIII. of 2005 specifies the data that should be provided by district heating suppliers annually. The length of the pipelines and the number of private consumers are among the data to be published. **H1b** hypothesis concentrated on these indicators, together with the correlation between the regional concentration of private consumers and the proportion of current asset.

The correlation analysis did not support **H1b** hypothesis, therefore it shall be **rejected**.

T1b: Indicators describing the performance of a company (length of pipelines, number of private consumers, regional concentration of private consumers) shows no correlation with the proportion of current assets (and the proportion of invested assets and consequently the asset structure). Higher performance is related to bigger current asset stock, but it also means more assets in general.

My hypothesis formed on the basis of literature review, i.e. the invested assets make up the largest proportion of the asset structure of companies carrying out district heating supply activities, was proven. Therefore their replacement and maintenance require significant inputs and responsible management decisions. *The importance of the statements of H1a and H1b hypotheses and the conclusive theses* is that they provided an opportunity to assess the proportion of assets serving long term needs at the companies and also allowed to determine the factors that influence the proportion of the assets. As the reserve of the proportion of invested assets requires significant inputs the answer to H1a and H1b also helped to formulate the hypothesis on asset replacement (H2).

The maintenance and operation of current assets require a responsible management decision, which was examined in hypothesis **H2**. The assets of the companies carrying out district heating supply activities grew only by 19 percent during the nine years of the study, which means an annual average of 2,23% (if we take only the assets directly related to the district heating supply activity the growth is 26 %, which is an annual average of 3,22%). Comparing the data to the consumer price index we can conclude that the extent of replacement does not exceed the rate of inflation (annual average consumer price index in the period of study: 2,32%; in the whole period: 20,09%). We can conclude that the replacement of assets in the district heating sector in the time period of the study only slightly exceed the extent of accounted depreciation, which is a major concern. According to my calculations, in the period of the study the investment activity in the sector, considering the average age of the assets used in the district heating supply, was not satisfactory. The current regulatory and support system does not encourage replacement, improvements and modernization.

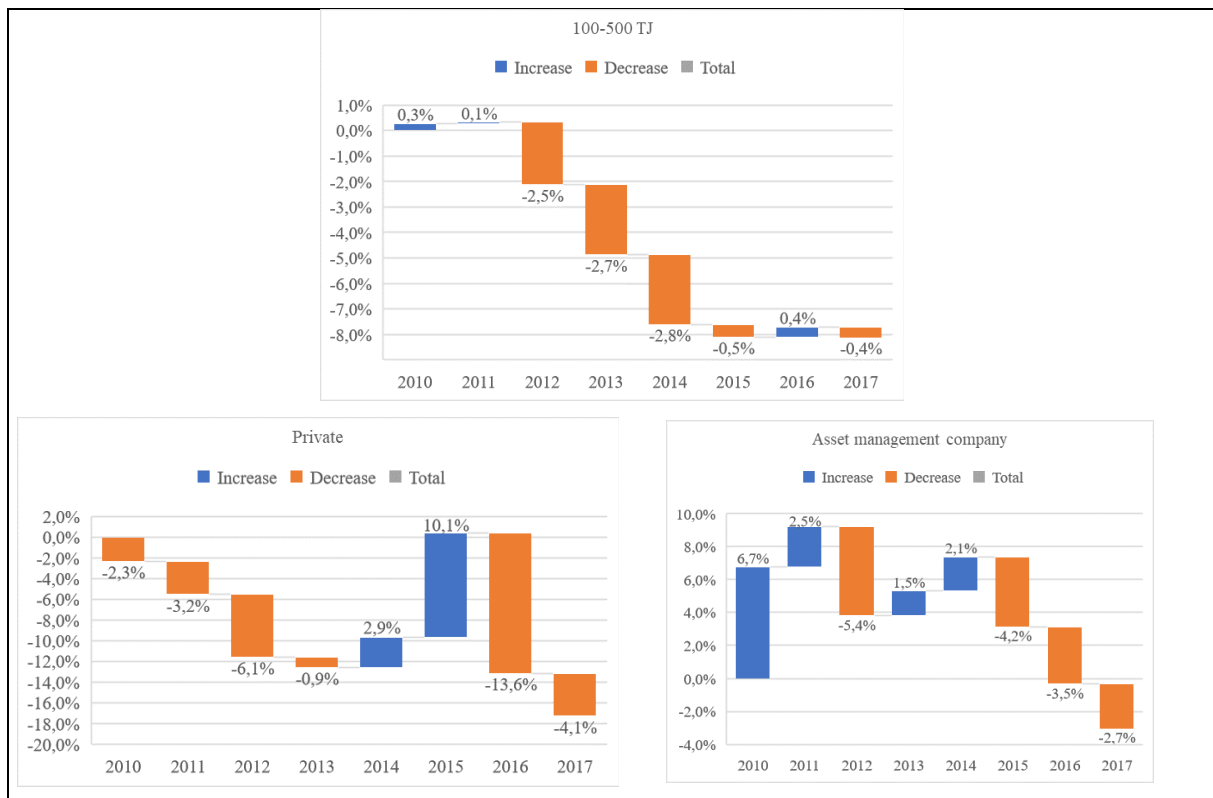


Figure 5.: Companies experiencing loss in current asset in the time period of the study

The situation at 100-500 TJ, private and asset management companies is of major concern. *The importance and novelty of the statement of the H2 hypothesis and the conclusive theses* is that it sheds light to the regulatory environment of the district heating suppliers that has to be changed in order to ensure sustainable, long-term, and safe operation. I have successfully identified three types of companies that require attention in terms of asset replacement. In my view the research and the conclusions are suitable to be used by the regulated in making decisions in the future. I **accept** the statements of hypothesis **H2**.

T2: Changes in the regulations influence the investment activities of the companies. In general, from 2014 the investment activity of the companies decreased. The regulatory environment does not encourage the entities to make the necessary investments, which is of major concern in terms of sustainable, long term and safe operation. Companies with 100-500 TJ annual sales, private companies and asset management companies experienced a decrease in assets in the time period of the study.

Hypothesis H3 focuses on the role of ownership in current assets. Annual reports served as the bases of the analysis, while the independent variable of the variance analysis was the type of ownership. In the researched period the average proportion of current assets in the whole population was 22-34%. There are differences in the proportion of current assets in relation to the type of ownership. According to the normal report, at private companies the proportion is almost double. Companies owned directly (local government) or indirectly (asset management) by local governments have a similar proportion of current assets, make corresponding changes and follow the same tendencies. In district heating supply the role of stock is insignificant. The high proportion of accounts receivable is prominent. There is a correlation between the type of ownership and the proportion of receivables (moderate-strong positive correlation). Private companies and companies owned directly by the local government have higher than the average

total liabilities. In the district heating sector the average current ratio is 1,43; the quick ratio is 1,34; while the cash ratio is 0,36. In order to maintain solvency the private and asset management companies have to pay extra attention to their liquidity.

Table 4. : Liquidity ratios in the district heating sector by ownership

Metrics	Owner	2009	2010	2011	2012	2013	2014	2015	2016	2017
Current ratio (current assets/ current liabilities)	Local government	1,23	1,40	1,29	1,42	1,53	1,51	1,70	1,68	1,52
	Private	0,95	1,08	1,45	1,28	1,11	1,18	1,15	1,22	0,92
	Asset management	1,01	0,93	0,95	1,00	1,04	0,98	1,10	1,19	1,24
	Loc. gov. (FŐTÁV)	1,69	1,00	1,32	1,62	2,40	1,86	2,75	2,83	1,84
	Mean	1,22	1,15	1,28	1,37	1,53	1,45	1,68	1,75	1,45
Quick ratio (marketable securities+cash & cash equivalents+accounts receivable/ current liabilities)	Local government	1,10	1,24	1,16	1,30	1,41	1,38	1,53	1,54	1,42
	Private	0,89	0,95	1,24	1,19	1,04	1,10	0,99	1,14	0,84
	Asset management	0,96	0,91	0,93	0,98	1,02	0,96	1,08	1,15	1,21
	Loc. gov. (FŐTÁV)	1,59	0,95	1,29	1,56	2,31	1,79	2,64	2,74	1,80
	Mean	1,13	1,05	1,18	1,28	1,45	1,36	1,56	1,65	1,38
Cash ratio (cash and cash equivalents/current liabilities)	Local government	0,30	0,32	0,28	0,40	0,41	0,34	0,47	0,66	0,72
	Private	0,08	0,13	0,15	0,29	0,15	0,18	0,16	0,18	0,15
	Asset management	0,17	0,49	0,06	0,06	0,18	0,17	0,35	0,30	0,31
	Loc. gov. (FŐTÁV)	0,41	0,17	0,02	0,03	0,68	0,50	0,83	1,06	0,67
	Mean	0,24	0,28	0,15	0,24	0,37	0,32	0,46	0,59	0,55

The *practical value* of the analysis and the conclusions in relation to *hypothesis H3* is that the margin of safety has been identified at the different company groups.

Based on the analysis I **accept** the statements of hypothesis **H3**.

T3: Ownership has a significant influence on the proportion of current assets. The ratio of current assets is higher than the average at district heating suppliers that are majority-owned by private individuals. Different ownership means different margin of safety. In terms of liquidity companies owned by local governments are the safest, while private and asset management companies have higher liquidity risks.

Related to the thesis above, it is an interesting research question if the range of customers, the social and financial background of the consumers influences the accounts receivables.

As a result of my analyses it became obvious that the region of operation serves as a basis for classification. We could find any correlation between the region of operation and the technological specificities though. Therefore we need to take a look at another factor, i.e. the different socioeconomic status of the consumers in the regions. Hypothesis H4a examined the

relationship between the socioeconomic status and its changes of the regional populations and the asset structure (and especially the proportion of receivables) of the district heating suppliers. In order to describe the socio-economic status of the consumers I used the traditional indexes, such as the rate of people receiving social benefits per capita, the rate of unemployment per capita, the rate of activity per capita and the rate of personal income tax per capita. I found that these simple indexes fail to describe the population in the depth needed, therefore I used a more complex indicator as well. The LHDI index was calculated on the years of 2011 and 2016 as follows:

$$LHDI = \sqrt[3]{HI * EI * WI},$$

where LHDI is the regional/local-HDI index, HI is the regional health index, EI is the regional educational index and WI is the regional wealth index.

The regional LHDI-index calculated upon the formula above is shown in the following figure.

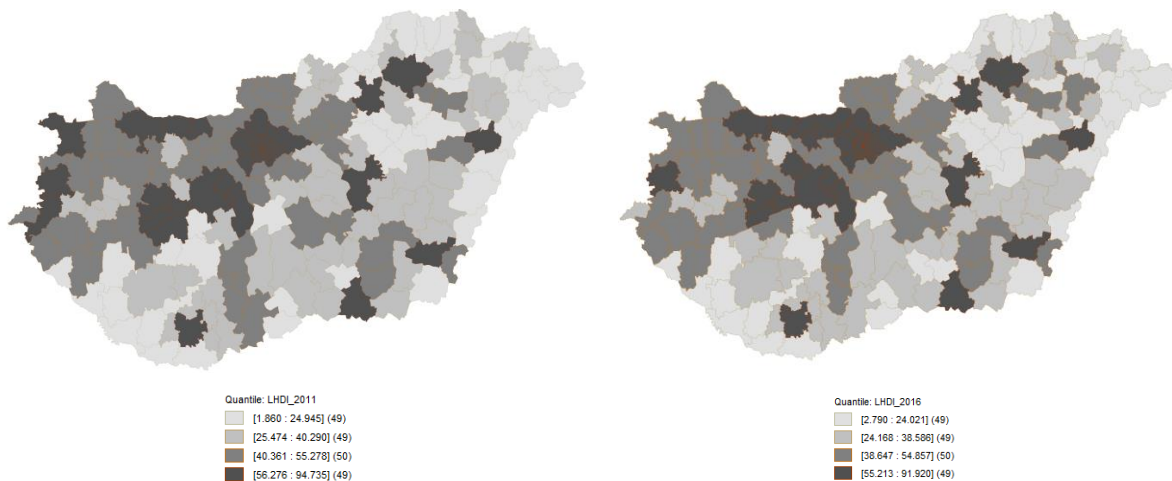


Figure 6.: Regional LHDI index in 2011 and 2016

Source: ksh.hu

Based on the calculations we can conclude that:

- in terms of the LHDI index there are regional differences. Regional centers and municipalities have higher indexes
- the regional differences did not decrease from 2011 to 2016 (no significant changes were traceable in the average LHDI, in the county specific LHDI or in the deviation) and
- the wealth component of the LHDI had the highest traceable increase in general.

In order to examine the correlation between the socioeconomic status of the consumers and the proportion of receivables I analyzed the relation between the indexes describing social, financial and economic status and the proportion of consumers' receivables. Based on my calculations, hypothesis H4a is proven, there is a correlation between the social, financial and economic situation of consumers and the proportion of consumers' receivables. District heating suppliers operating in regions where the average social, financial and economic situation of the consumers is better the average consumers' receivables are lower.

The statements arising from this hypothesis are *novel in terms of the district heating sector* and contain *important information for the regulatory bodies* as well. In the time period of focus several regulatory changes have taken place in the sector that decreased the fees regardless of the financial status of consumers. The results of the current research may be used for decision making processes in the future. A support system considering the financial situation of the consumers could help in improving the financial situation of the district heating suppliers.

Based on the analysis I **accept** the statements of hypothesis **H4a**.

T4a: Besides the unique characteristics of evaluating consumer receivables in accounting policy, it is obvious that the socioeconomic status of private consumers influence the proportion of receivables. Entities operating in regions where the economic and social status of the consumers is higher have lower rate of average consumers' receivables. Therefore the financial status of the consumers has an influence on the financial status of the district heating suppliers.

Hypothesis **H4b** examined the relationship between the social and economic status of the population and the efficient energy use and the possibility of a criterion (among the analyzed ones) that can explain the connection. *It is important*, since the higher number of energy efficient points of consumption means less sold heat per capita, i.e. the expenses are lower (based on the revenues and the energy used). Therefore the energy efficiency has a direct influence on the profitability of the company. During clustering I was able to identify two clusters in term of the energy use. The first cluster of companies is “companies supplying less energy efficient point of consumption”, where average specific annual heat consumption of the tenth of lowest and highest heat consumers is higher and the number of consumers with cost allocators is lower. Consumers with cost allocators are consumers who can lower their heat consumption and the fee paid. The second cluster of companies is that of the “companies supplying more energy efficient points of consumption” that have indicators opposite to the ones mentioned above. In terms of the research it was important to examine if there is a criterion to characterize companies supplying energy efficient points of consumption.

I used cross tabs to examine the relationship between ownership, the extent of sales, region of operation and the clusters. The logistic regressive analysis aimed to examine the effects of the LHDI index described above. All results pointed toward independence, the variables do not correlate.

Based on the analysis I **reject** hypothesis **H4b**.

T4b: Based on the energy efficiency the points of consumption form two different clusters. The socioeconomic situation of the private consumers does not correlate with the energy efficiency of the points of consumption. Regions with consumers of lower socioeconomic status do have energy efficient consumption points.

Hypothesis H5 focused on the revenue structure of district heating suppliers. The horizontal and vertical studies emphasized the role of two indexes. In the revenue structure of the district heating suppliers the highest proportion is that of their own capital, the average of which exceeds 50 % in all years of the study. The proportion of own capital at companies with other profiles (companies that supply district heat to an extent that is below average) is lower. The main reason for the significant difference between companies with district heating profile and companies of other profile is the capitalization of the FŐTÁV Zrt. and its changes. In the time period of the study the capitalization of companies with district heating profile was 76,2% that is 8 percent higher than that of the companies of other profile. The average capitalization of the largest district heat suppliers (above 1000 TJ and FŐTÁV Zrt.) was 62%, which is 18 percent higher than that of the other suppliers. From 2010 the capitalization of Western Transdanubian, Northern Great Plain, Central Hungarian district heating suppliers and the FŐTÁV Zrt. became different than that of the others. The average capitalization of these companies exceeds that of

the others by an average of 19 percent. Since 2013 the lowest capitalization is to be seen at the Southern Great Plains region. There is no significant difference between companies that produce heat (average capitalization 49%) and those that do not have heat producing activity (average capitalization 51%). At private companies the proportion of won capital is significantly lower, compared to the other companies by 23 percent in general. The strongest criterion for classification is the region of operation, since it has shown the strongest correlation in the nine years of focus. With the help of the ANOVA analysis and Post Hoc tests carried out in examining hypothesis H5 I was able to gain a deeper understanding of the asset structure.

Besides the vertical study of the revenue structure I also carried out a horizontal analysis of the capital structure by using two indexes of the coverage of invested assets. At larger suppliers and at companies with district heating profile the finance is more conservative. They operate with a coverage of invested assets that is 8 percent higher than the average at the companies with other profile. To take sales as the criterion for grouping is better than taking the activities. The largest suppliers (FŐTÁV Zrt. and companies above 1000 TJ annual supply) operated with a *higher maturity match* in the years of the study. The almost golden rule finance strategy of the South Transdanubian and Central Hungarian suppliers is the closest match of the FŐTÁV Zrt. Southern Great Plains and Central Transdanubian companies make up the other end of the scale, since the coverage of invested capital comes from their own capital in an average of 54% (the coverage index is 86% if we take the long-term sources into account as well). It means that they have a more aggressive financial strategy.

Table 5.: Summary of the findings of variance analyses and Post Hoc test sin relation to capitalization (based on normal reports)

Description	Independent variable				
	activity	extent of sales	region	heat production	owner
Significant differences within the groups in percentage	56%	100%	100%	44%	67%
Strength of the correlation (Eta) in the significant years	0,43	0,47	0,54	0,39	0,47
Minimum value of strength in correlation (Eta) in the significant years	0,31	0,42	0,47	0,33	0,37
Maximum value of strength in correlation (Eta) in the significant years	0,56	0,56	0,60	0,46	0,62
Significant grouping factor, not only FŐTÁV Zrt.	40%	75%	75%	0%	83%
Ranking	4.	2.	1.	5.	3.

I found a significant difference between the groups in relation to ownership. Companies owned by local governments usually go along the golden rules financial strategy, while private companies have more aggressive finance strategies in the time period of the study.

Based on the analysis I **accept** the statements of hypothesis **H5**.

T5: The revenue structure of the district heating suppliers is significantly influenced by the region of operation, the extent of sales and the ownership. In general, companies with district heating profile, larger sales, heat production activity and non-private ownership have higher coverage. According to the long term coverage proportion index the most conservative financial strategy is that of the FŐGÁZ Zrt.'s.

The aim of hypothesis **H6** was to show the effect of changing operational and regulatory environment on profitability. It is true in terms of the whole sector that net revenue does not covers expenses since 2011. In the sample population the net revenue did not even cover expenses related to staff and maintenance from 2012. Since 2012 the income loss due to fixed pricing is covered by the energy support, which is listed under other revenues in the accounting record.

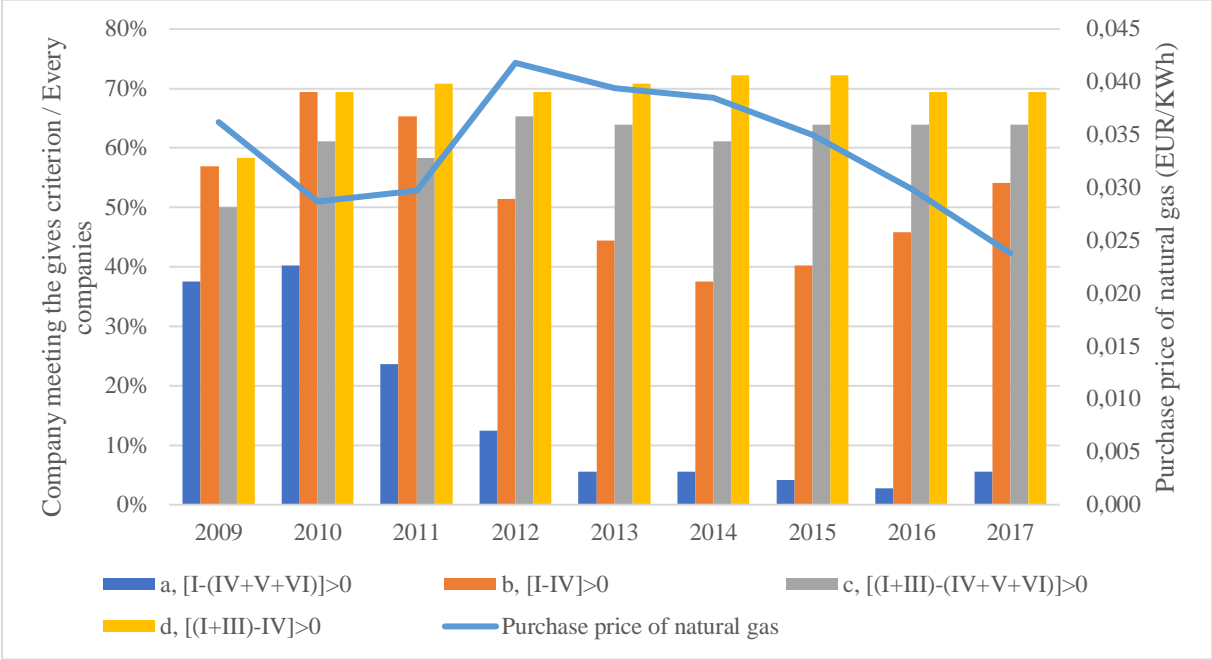


Figure 7.: Companies with positive balance in the sample population after summarizing all items of income and expenses
Based on the normal reports

In 2010 it was true in terms of 40% of the companies in focus that the net income of sales exceeded the sum of material, and personal expenses and depreciation. By 2017 the number changed to 6% (15% of the data of 210). The changes in financial support (other revenues) compensated the loss in income. From 2010 the proportion of companies at which the income from all items exceeded the expenses of all item and depreciation was above 63% in average. The analyses of profit and loss accounts show that most of the expenses of the companies carrying out district heating supply activities are that of material expenses (82% in average). Most of the material expenses (based on normal reports 75%, based on unbundled accounts 77,5%) are of material costs 90 percent of which is related to the production or purchase of heat. Consequently, independent of the companies capacity to produce heat the world market prices of natural gas influence the expenses and, as a result, the profitability.

Since 2012 a significant portion of the incomes of district heating suppliers comes from other revenues, i.e. from the financial support of energy. In a way, the two incomes complement each other.

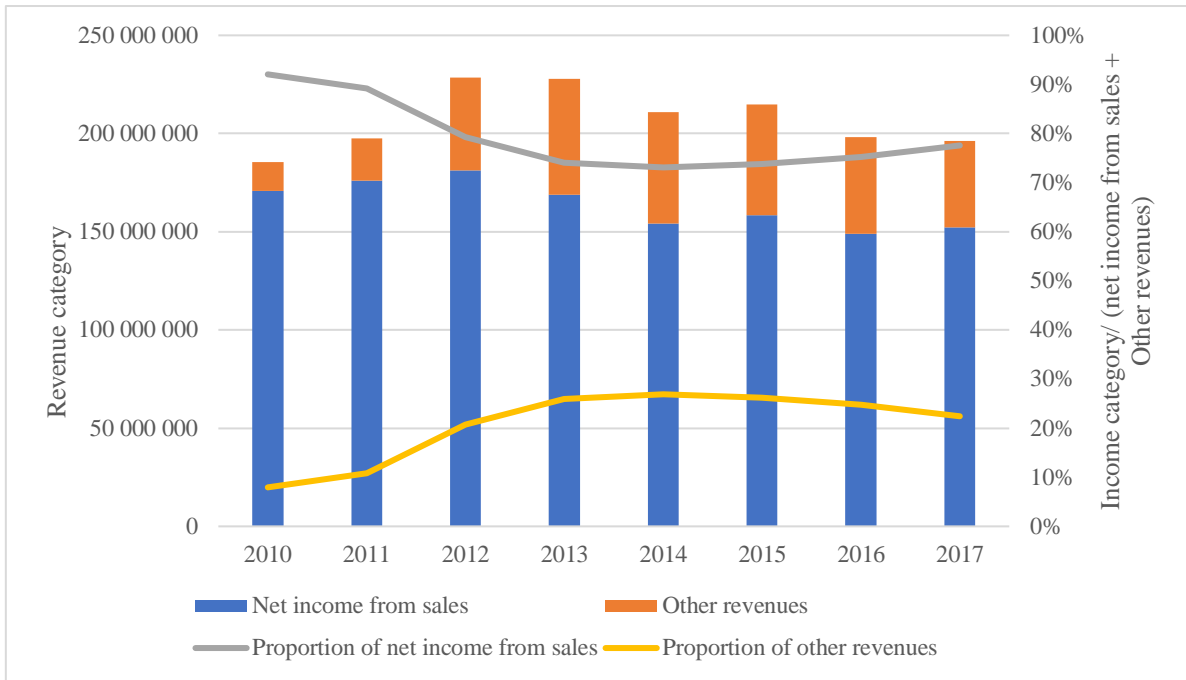


Figure 8.: Accounts aggregates of net income of sales and other revenues (in thousand HUF) and the changes in proportion
Based on normal reports

In general, the companies had low profitability in the time period of the study, but there were years with significant changes. It was important to pay attention to the changes in legislation in the given period (more than 25 acts and government decrees were reviewed).

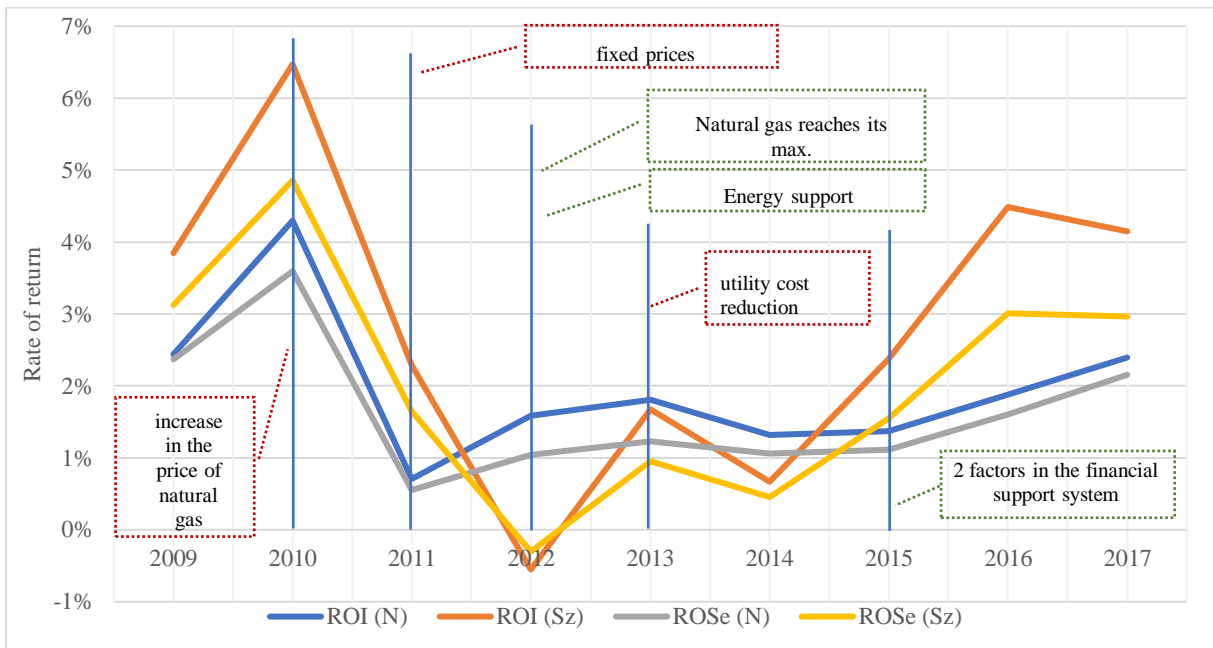


Figure 9.: Average rate of return at the district heating suppliers
Based on normal and accounting unbundled reports

Testing the hypotheses I arrived to new and novel results, as

- I was able to come to conclusions valid for the whole sector:
 - o low profitability is a general characteristic,
 - o the proportion of other revenues and material costs is high,
- I was able to identify four changes in the regulations that had traceable impact on the profitability of the sector,
- I was able to identify factors that has no impact on the profitability
- the suppliers were not able to handle the income loss due to fixed prices and the reduction of utility costs on their own. Complementary income comes from financial support, i.e. external market players participated in financing the district heating supply.

The four most important changes in the regulations that had traceable impact on the profitability of the sector:

- Fixed prices. Act XXIX. of 2011 on the modification and amendment of the acts on energy fixed the energy fees of private consumers and institutions of special status at the price effective of 31 March 2011. The price of heat sold to private consumers and institutions of special status, as the highest administrative price, is determined by the Minister of National Development on the basis of the recommendation of the Hungarian Energy and Public Utility Regulatory Authority. Its impact on the district heating suppliers has been prominent a year later, in 2012.
- The transformation of energy support system. Since 2012 the loss of income arising from the administrative prices has been compensated by financial support, named energy support. The extent of the support is calculated by taking the net cost of public utility provision into account, i.e. it cannot exceed the difference between the costs and incomes related to public utility provision. The calculation takes a reasonable profit into account as well that is calculated upon the companies own capital. in terms of the reasonable profit a limit has been determined that equals 2% of accounted gross asset value related to district heat production and supply as shown in the audited accounting unbundle of the 31st of December of the year before the given year.
- Utility cost reduction. The most significant change in the economic conditions of district heating suppliers came with Act LIV of 2013 on the enforcement of utility cost reduction. Due to the act, in several consecutive phases, the consumers realized 20% of savings. From January, 2013 the base fee and heat fee decreased by 10%, and by November 1 by an additional 11,1%. Due to Act LIV of 2013, compared to the prices of December 2012, the gas, electricity and district heating expenses of consumers decreased by 20 % that was followed by an additional 3,3% decrease On October 1, 2014.
- Additional change in the support system as a result of which the operational support of district heating suppliers has had two factors since October 1, 2015. This change resulted in higher profitability at the companies in focus.

When analyzing profitability I also focused on the relation between profitability and ownership structure. I assumed that due to the complex regulations the benefit of monopoly cannot be observed. In order to test the hypothesis I calculated five return index based on normal and unbundled reports. On the basis of my research we can conclude that even though there are differences in return at the companies of different ownership structure, they cannot be classified into homogenous groups. The internal variation is high and the ownership structure does not influence profitability. Based on the analysis I **accept** the statements of hypothesis **H6**.

T6: A special characteristic of the district heating sector is its low profitability and the high proportion of other revenues and material costs. The structure of revenues (net sales income vs. other revenues) and the profitability of the companies depend highly on the changes in legislation. There is no significant difference between the profitability of companies of different ownership structure. Due to the complex regulatory environment private or mostly private companies cannot utilize the benefits of monopoly. The income loss arising from the fixed administrative prices and the reduction of utility costs could not be complemented by the companies themselves. Supplementary incomes were realized via external financial support.

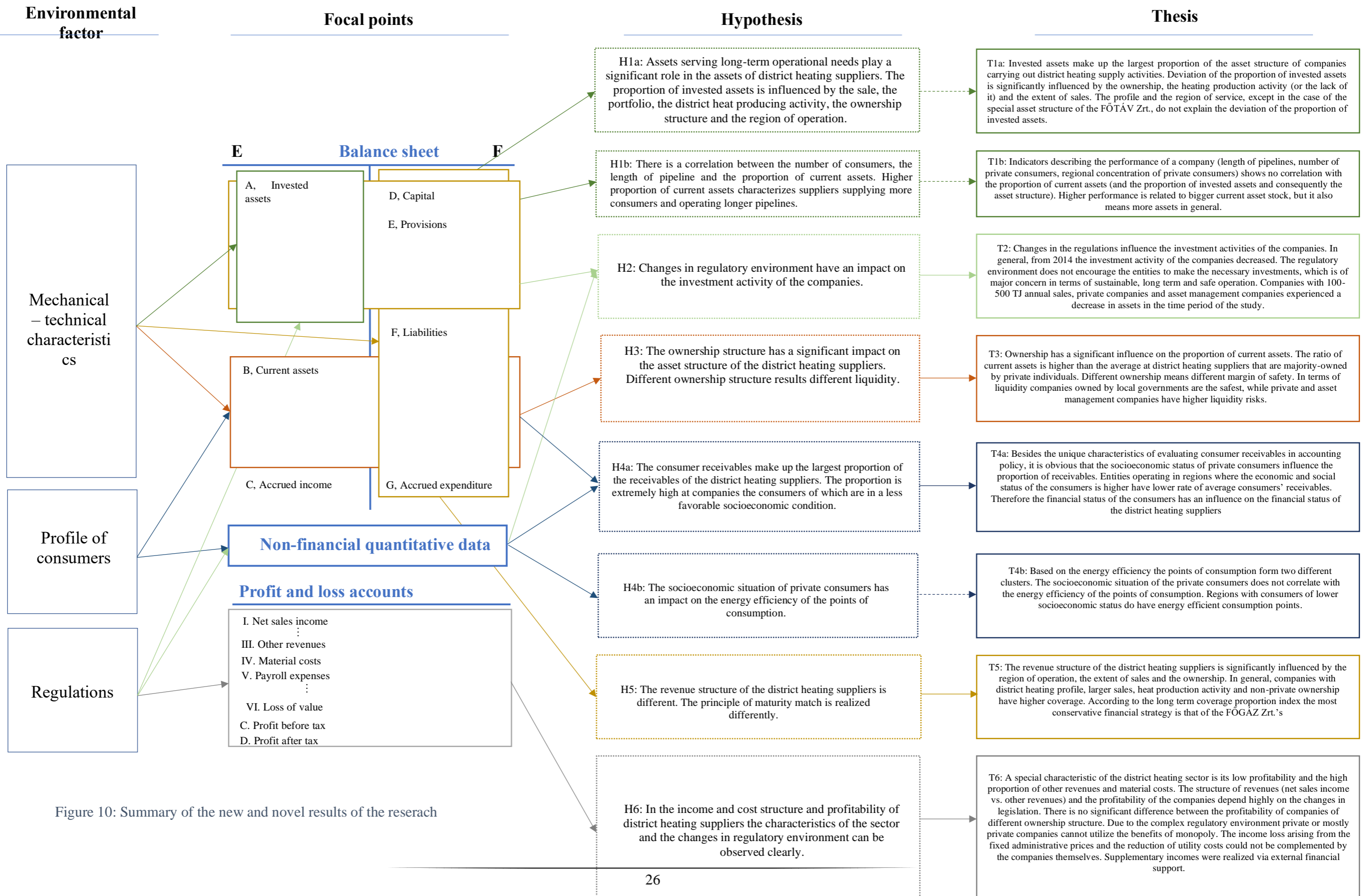


Figure 10: Summary of the new and novel results of the research

3.4. The limitations of the research, fields of possible extension

During the research process it has been a challenge to provide a complex picture of economic specificities and give an in-depth analysis of the data. My intention toward balance may be understood as a limitation of the research, although it has not influenced the fulfillment of the research goal. Therefore I consider these as possible extensions of my research, i.e. further fields of interest.

Further research is possible in three fields:

1, Broaden the current research perspective by carrying out research at specific companies with bringing the available appendixes into focus

- In the hypothesis focusing on consumer receivables I found a correlation between the socioeconomic status of the population and the proportion of consumer receivables. Further research may point toward the processes of evaluation in accordance with the accounting policies of the companies and what kind of specificities can be noted in terms of taking out these items of the balance sheet. The analysis of appendixes in the given nine years extended the frameworks of the current research but it is indeed a possibility to broaden the perspective.
- In my analysis regarding revenue structure and coverage I regarded own capital in its accounting form “*D. own capital*”. A more detailed examination of the appendixes and of “*G. Accrued expenses*” and the re-classification of its items into the own capital may provide an opportunity to find new research questions.
- When analyzing profit and loss and the profitability it became obvious that most of the expenses come from material costs, including the cost of energy. The specific study of the appendixes gives us an opportunity to see the long-term contracts related to fossil energy sources (e.g. the contracted value of natural gas and its fixed price) and how they impact profitability.
- In my analysis of investments, replacement has been in focus. In the future, by examining the appendixes, it is possible to focus on other issues of investment.
- Decree of the Minister of National Development no. 51/2011 (September 30) published a limit of profit. The complete collection of accounting unbundling reports will provide the opportunity to analyze the companies that reach the profit limit and how it influenced their investment activities. The complete collection and the appendixes will make it possible to see the sources of investments and to draw conclusions in the future.

2, Description of the district heating suppliers of the neighboring countries and the comparison of them with the Hungarian suppliers by using financial indicators.

3, The analysis of companies of other public utility networks (e.g. running water) and the comparison of them by using financial indicators.

In accordance with the views of my workplace, the Institute of Finance and Accounting, I continuously paid attention to the practical value of my research and findings. According to my view and hope the new and novel conclusions of the research may be used by the following persons and applied in the following fields:

- *Stakeholders, parties of interest in the district heating sector.* Experts and professionals managing district heating supply know and understand the strength and weaknesses of their own companies but have limited resources to learn about the situation of other entities operating on similar branches of the economy. I hope that the research on district heating suppliers and its results may serve as benchmarks for managers in gaining a deeper understanding of the situation of their own companies by comparing their data

and performance to others or to the average of the sector. I think that professionals working on the regulations of the district heating sector know the situation of the sector well, but I also believe that an external analyst may call attention to certain factors that may have been overlooked before. If only one of my conclusions made the regulators think, or if I was successful in calling attention to some of the risks of the sector my work has reached its goal.

- *Students in higher education.* I teach students in bachelor and master programs as well. At both levels we analyze information coming from balance sheets and reports. I think that I can use my research, the analytical tools, and the conclusions in lectures and seminars.
- *Students in talents nurturing programs.* As the vice president of the Elemér Hantos College at the University of Miskolc, Faculty of Economics I take part in nurturing talents programs. One of the most exciting and rewarding experience is to take the students to competitions. In these competitions the students have to solve the real problem of an actual company. Teams that are prepared in a sector or branch by analyzing it in details have significant advantage compared to other teams. Although it has been our goal for a long time, it still is a gap we have to address. When writing my thesis I learnt how to break up a complex analysis to subcategories and subfields. I believe that the analytical tools used in my research will be useful in nurturing talents programs and I will be able to teach my students the ways and modes of addressing complex issues.

3.5. Summary

My thesis focuses on the operational analysis of Hungarian district heating suppliers on the basis of financial indicators. I chose this topic because of its importance in the national economy – it has nearly 680 000 consumers – and because of the possibility of my research to contribute to the goals of the National Energy Strategy. In order to provide a complex analysis and draw relevant conclusions it was important to collect all the recent changes of the operational and regulatory environment. The possibility to reveal environmental changes with the help analyzing financial statements has been one of my research questions. I also wanted to focus on answering the question of the possibility of effective operation in a regulatory environment that has changed significantly. The novelty of the research lies in the fact that the currently existing literature fails to address the issue of management and operation of district heating suppliers from this point of view. There are no summative studies that provide benchmarking data on the bases of which the experts can make a comparative analysis of their own performance or the performance of their companies.

The aim of the research was to show how financial statement analysis can reveal the effects of the changes in the environment and to find out if companies can operate profitably when the regulatory environment changes significantly. I chose deductive thinking as the driving force of my research, i.e. my hypotheses have been formed during and after the review of literature on methodology and district heating suppliers. I tested the validity of my hypotheses by further reviews and quantitative research on primary and secondary data. The first part of my thesis focuses on three aspects of the most important characteristics of the district heating sector. The international outlook helped to validate the research. The climate changes and the prevention of further problems call attention to district heating suppliers. The literature review helped me to formulated hypotheses related to the main goal of the research, i.e. the operational analysis of Hungarian district heating suppliers on the basis of financial indicators with a special focus on the changes in operational and regulatory environment.

The thesis analyzes development trends based on nine years of data (2009-2017) coming from the financial statements of the Hungarian district heating suppliers and the available operational and economic information. At first I defined the population. Currently there are 89 entities operating in 93 settlements in Hungary. Based on the general data collection among the population I defined the sample (72 companies) and collected the data. It is important to point out that, since the sample is representative of the whole population, the conclusions drawn are reliable in terms of describing the situation and characteristics of the whole population. The results and conclusions of my research are useful for professionals managing district heating supply and for institutions responsible for regulating the sector. The results may serve as benchmarks for managers in gaining a deeper understanding of the situation of their own companies by comparing their data and performance to others or to the average of the sector. The complex picture of the sector may call the decision makers' attention to the operational risks of the entities.

The first part of the research focused on the technological-mechanical characteristics of the sector by analyzing the asset structure of the companies carrying out district heating supply activities. We can conclude that invested assets make up the largest proportion of the asset structure of companies carrying out district heating supply activities. In order to ensure sustainable, long-term, and safe operation it is important to replace these assets on a regular basis. According to my calculations though, in the period of the study the investment activity in the sector, considering the average age of the assets used in the district heating supply, was not satisfactory. The current regulatory and support system does not encourage replacement, improvements and modernization. The situation at 100-500 TJ, private and asset management companies is of major concern, since at these companies the research found capital loss in the given time period.

Another key issue in normal operation is the problem of solvency. In terms of liquidity companies owned by local governments are the safest, while private and asset management companies have higher liquidity risks. Companies supplying consumers of less favorable financial conditions operate on higher risks as well. Besides the unique characteristics of evaluating consumer receivables in accounting policy, it is obvious that the socioeconomic status of private consumers influence the proportion of receivables. Entities operating in regions where the economic and social status of the consumers is higher have lower rate of average consumers' receivables.

Because of their role in the national economy, it is an important reliability of the decision makers to ensure the continuous operation of the district heating suppliers. Their exposure to the changes in the regulatory environment is very high. It is true in terms of the whole sector that net revenue does not cover expenses since 2011. In the sample population the net revenue did not even cover expenses related to staff and maintenance from 2012. The suppliers were not able to handle the income loss due to fixed prices and the reduction of utility costs on their own. Complementary income comes from financial support, i.e. external market players participated in financing the district heating supply. Low return is a characteristic of district heating suppliers. In the current regulatory environment they cannot cover their expenses and the replacement of assets on their own.

I was able to fulfill the goals of the research. I believe that the synthesis of the research and the new and novel results can contribute to the effective development of the sector and can help in improving the use of resources. I arrived to conclusions in terms of the methods of analysis as well. Financial indicators derived from balance sheets and reports are suitable to describe the effects of influencing factors on the operation of district heating suppliers. The inclusion of

indicators considering the specificities of the industrial sector, technical-mechanical information published mandatory and accounting unbundled reports to the analytical process may extend the limits of the research. Therefore I recommend their application in the further analysis of the sector.

4. RELATED PUBLICATIONS OF THE CANDIDATE

Articles published in scientific periodicals

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