THE RELATIONSHIP BETWEEN AIMS, METHODS AND THEIR FINANCIAL ASPECTS IN THE CASE OF SOCIAL INNOVATIONS IN THE FIELD OF DISTRICT HEATING

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Abstract: *In the field of district heating the process of social innovation has been initiated for the betterment of environmental conditionsand contributes to the improvement of the quality of life at the given locations and to the general well-being of the local community. The aim of this study is to present a good practice of social innovation. The technological development and the implementation of professional innovations at the Miskolc District Heating Ltd. established an operational environment of district heat production that, via the model of optimal heat source mix, can serve as an example for the planning of heat-source portfolios at the Hungarian district heating systems. The study shows how it contributes to the accomplishment of the European and Hungarian energy strategy. It also focuses on the use of eco-label and good examples of using renewable energy sources in district heating. The results of the study are applied to prepare a detailed map of the element of social innovation networks in the field of district heating and to determine the indicator groups with a special focus on its financing and economy.*

Keywords: Performance Management; Healthcare; Balanced Scorecard; Public sector.

JEL classification: K32.

1. Introduction

The approaches toward social innovation are numerous and various; there is no one commonly accepted definition of the term. There is a notable difference between definitions in relation to the well-being of the community and the novelty of solutions to social issues. By taking these into account we define social innovation as follows: “Social innovation provide new or original solutions in solving the problems of a community with the aim of improving its well-being” (Kocziszky, Veresné and Balaton, 2017). The balance between social and economic goals is an important part and also a specificity of the notion of social innovation. Its main characteristic is to serve the social good which cannot be achieved without considering the economic approach. (Szegedi, Fülöp and Bereczk., 2015).

Besides fulfilling the sustainability and environmental protection strategies and action plans of the European Union and Hungary, the technological developments carried out in the field of district heating also fit into the definition of social innovation, i.e. by lessening the environmental pressure they contribute to the improvement of the quality of life.

Social innovation among the district heating suppliers falls into several categories. The present study focuses on the role of the environmentally friendly heat source mix.

2. The relationship between aims and methods of social innovation in the field of district heating

The characteristic of social innovation is that "in order to increase the well-being of the community it finds new solutions and, as a tool reflecting on challenges, it results in novel approaches" (Varga, 2017: 7).

Earlier studies concluded that the innovation goals of companies are mainly focused toward financial success (Szabó, 2012); technological innovation in itself does not result in social value (Hortoványi, 2012) and innovation always has economic and non-economic aspects as well (Hetesi, Vilmányi, 2009, Musinszki, 2016).

Based on the hierarchy of human and communal needs Kocziszky, Veresné and Balaton (2017) summed up the potential problems that can be solved through innovative solutions, solutions that can also create social values.

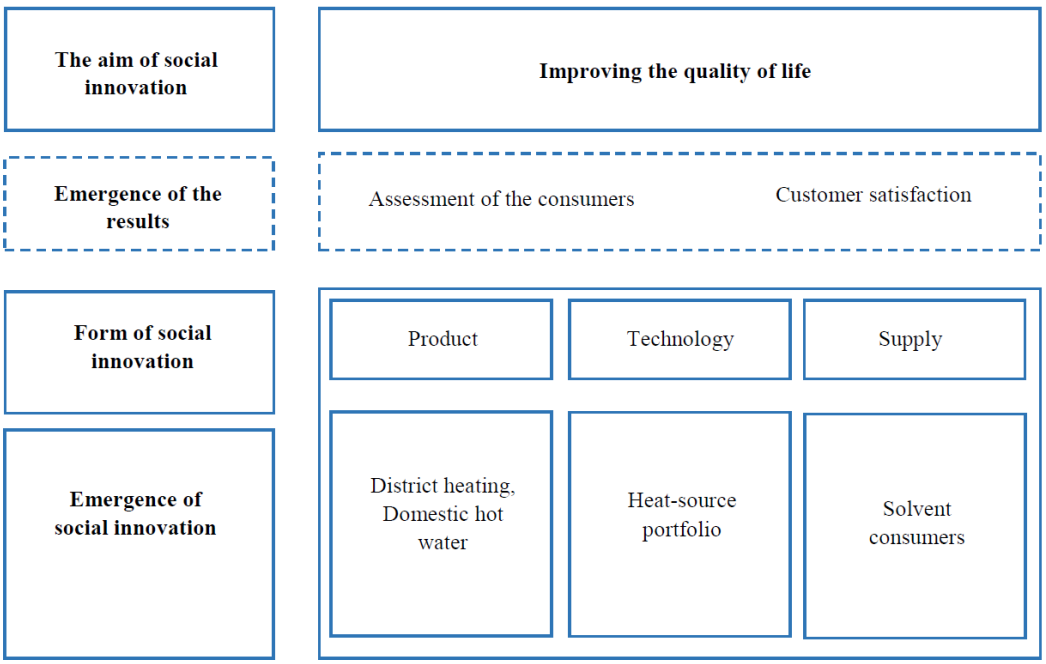

Figure 1: The relationship between aims, methods and their financial aspects in the case of social innovations in the field of district heating

2.1. The "product" of district heat suppliers

"Hungary is not a rich country in terms of extractable energy carriers. Therefore it is in its outmost interest to use energy carriers in effective and responsible ways. Roughly 80% of the energy consumption of the households is for heating purposes (heating, domestic hot water and cooking). Most of it is provided via individual, natural gas heating units, firewood and district heating" (Ministry for Innovation and Technology, 2012)

Although the assessment of district heating varies from country to country ,experts usually point out the following benefits: There are no heat generators per building which means there are no harmful emission sources. District heating emits harmful substances in a concentrated way which is more preferable from an environmental protective point of view (Bauman, 2012). Therefore the development of existing district heating systems, the

increase of their capacities and the “product” supplied can satisfy the society’s need on a higher level, even if the technology does not change.

2.2. Technology used by the district heating suppliers

In the European energy strategy renewable energy sources play an extremely important role. The strategy aims to increase the share of renewable energy to 20% by 2020. By 2030 the target is 32 %, and for 2050 it is 55%.
In accordance with EU guidelines, the Hungarian target of energy from renewable sources in gross final consumption of energy by 2020 should be 13% compared to the 4,3% of 2005. “Among renewable sources priority is given to the use of biogas, bio-mass and the utilization of geothermal energy that serve primarily but not exclusively heat generating purposes.” (Ministry for Innovation and Technology, 2012).

2.2.1. The European energy strategy

Energy is necessary for life. It is needed in our everyday life for heating, lightning, transportation, industries, etc. “The well-being of the people, industrial competitiveness and the operation of the society as a whole depend on secure, reliable, sustainable and economic energy” (European Committee, 2011). Due to this fact appropriate energy carrier management is essential. The EU Energy strategy has been formulated along these basic premises. In the strategy the EU set targets for 2020, 2030 and 2050 (European Committee, 2012).
The energy policy emphasizes the need for sustainable, affordable, competitive and secure energy supply. Due to the limited resources only rational and efficient usage can assure sustainability. If we succeed the resulting profit is manyfold: not only will carbon-dioxide emission be cut, but additional benefits arise as well, like new job creation and cost reduction (European Committee, 2012).
Renewables play an important role in the energy strategy. By 2020 the share of renewable energy shall be increased to at least 20 %. (European Commission, 2018).

2.2.2. Hungarian energy strategy

Historical and technical heritage of the Hungarian formation of district heat supply decisively affects heat producers, heat suppliers and consumers.
Efficiency of heat suppliers is basically influenced by the purchase price, which is affected by the used up

- energy resources and
- energy producing technologies of heat suppliers.
- The Table 1 shows the amount and ratio of used up energy resources by district heat producers.

Table 1: The amounts of fuel used for electricity production

Energy sources	The amounts of fuel used for electricity production					
	[TJ]	[%]	[TJ]	[%]	[TJ]	[%]
	2014		2015		2016	
Total energy source consumption	**64,415**	**100**	**64,299**	**100**	**63,494**	**100**
Natural gas	40,877	63.46	43,510	67.67	44,786	70.54
Fuel oil	285	0.44	165	0.26	149	0.23
Heating oil	1	0.00	9	0.01	5	0.01
Propane-butane gas	2	0.00	1	0.00	4	0.01
Landfill gas	15	0.02	11	0.02	7	0.01
Sewage sludge-gas	46	0.07	50	0.08	59	0.09
Recuperated gases and waste heat	5,269	8.18	6,194	9.63	4,679	7.37
Biomass	6,844	10.63	9,821	15.27	10,024	15.79
Coal products	7,794	12.10	1,254	1.95	812	1.28
Communal waste	3,281	5.09	3,283	5.11	2,968	4.67

Source: Hungarian Energy and Public Utility Regulatory Authority (2018). Data of the Hungarian district heating sector 2017.

Hungarian heat production decisively uses fossil fuels, in particular with the amount and ratio of gas usage. A rise could be observed in the usage of gas in the last three years, on the other hand it is pleasing that the ratio of the use of biomass is also on the rise. In their study, Petrovics and Szilágyi present that, besides the positive impact on the environment, the use of renewable energy sources, such as biomass, might also have economic considerations (Petrovics and Szilágyi, 2013).

The relationship between energy resources and energy producing technologies is deterministic. Table 2 shows the performance of technologies utilising renewable energy resources.

Table 2: District heating capacity of renewable technologies

Renewable energy source-based energy producing technologies	Nominal district heating capacity					
	2014		2015		2016	
	MW	[%]	MW	[%]	MW	[%]
Landfill gas based technology	1.89	0.20	1.89	0.20	1.89	0.19
Sewage sludge-gas based technology	0.23	0.02	0.23	0.02	0.23	0.02
Solar energy based technology	0.60	0.06	0.60	0.06	0.60	0.06
Thermal water based technology	115.50	12.48	119.28	12.75	177.86	17.82
Biomass based technology	807.03	87.22	813.33	86.96	817.73	81.91
Total nominal district heating capacity of renewable energy source-based heat producing facilities	**925.25**	**100**	**935.32**	**100**	**998.31**	**100**

Source: Hungarian Energy and Public Utility Regulatory Authority (2018). Data of the Hungarian district heating sector 2017.

Hungary's National Strategy on Energy Efficiency created in 2015 determines the main action points that contribute to the district heat efficiency and the changes in the ratio of energy resources. „Besides the energy efficiency modernisation of buildings, primary side energy efficiency modernisation of Hungarian district heat supply systems, their placement on renewable basis, as well as the their combined development (primary side energy efficiency modernisation and focus on renewables)" appear as priority actions in KEHOP (Environment and Energy Operational Programme) for 2014-2020 (Ministry for Innovation and Technology, 2017).
In line with the aims of the National Energy Strategy the district heating sector carried out several innovative investments to develop an environmentally friendly, efficient and energy-saving district heating system in the last couple years.
District heating also has its disadvantages:

- It is a large-scale system which means the construction and maintenance of the system is more expensive than the installation of per building production units.
- The large system has a significant heat loss and needs high pumping energy. Compared to the natural gas supply the construction and maintenance costs are higher.
- It is a complex system due to which disconnecting individual households is rather difficult. Because of the adjustment of heat water, the capacity is not always available in its full. (Bauman, 2012)

2.2.3. The recognition of environmental-conscious practice: district heating eco-label
The district heating eco-label was introduced by the Magyar Távhőszolgáltatók Szakmai Szövetsége (MaTáSzSz) [Professional Association of Hungarian District Heat Suppliers] in August 2017 with the aim of making the environmental effect of district heating evident for the consumers, just like in the case of the household appliances. Based on the admirable utilization of renewable energy and the consequent decrease in CO2 emission the AVAS and downtown district heating system got the district heating eco-label. The label classifies the given system in terms of energy-efficiency, use of green energy and CO2 emission. A district heating system is considered good if it works efficiently and in a cost-saving manner. A growing proportion of the Hungarian district heating systems is like that now. Via the developments that started in the last couple years and go on even today the district heat supplier made a significant progress toward increasing energy-efficiency and the utilization ratio of renewable energy sources.
The aim of the further developments is to have the whole Hungarian district heating industry provide competitive and reliable services with an increasing ratio of environment-friendly, renewable energy in its mix (Magyar Távhőszolgáltatók Szakmai Szövetsége, 2017).

2.2.4. Energy strategy at district heating suppliers – the example of MIHŐ Ltd.
Miskolc aims to become a sustainable, healthy and viable city. In relation to these goals a Sustainable Energy Action Plan has been formulated in which the city targeted a 40% decrease in CO2 emission by 2030.
The city is committed to the use of renewable energy. In line with this goal the local district heating supplier carried out significant innovative developments in the last couple years. The MIHŐ Miskolc District Heating Ltd is the second largest heat supplier of the country (Cselédes, 2009). Thinking in terms of environmental awareness nowadays most of its energy mix contains energy from the deponent gas naturally occurring at the recultivated dumpsite, from wood chip biomass and from geothermal energy coming from 2300m deep

extraction wells. In terms of the economy at large, the Miskolc district heating system contributes to the geothermal energy targets of the National Energy Strategy by almost 10 percent.
More than 155 000 people reside in Miskolc. The number of households supplied by the district heating supplier is more than 31 000, more than 50 percent of which are targeted by the developments. By using these innovations 25 719 200 m3 of natural gas is substituted and the emission is lessened by 48 812 metric tons of CO2.
Further utilization of renewable energy is planned by increasing the number of district heating consumers. Since 2015 several large consumers joined the district heating network, which increased the number of buildings heated by green and renewable energy. Consequently, the city's rate of harmful emission decreased. For the Miskolc district heating system these new additions to the district heating network equal the extra heat quantity necessary to supply a small or middle-sized town.
In Miskolc, 55% of the total amount of energy used for district heating is from renewable (mainly geothermal) sources. With the successive investments, Hungary's largest geothermal energy capacity system was delivered. The project provides an amount of 800-1100 TJ of energy from geothermal energy of 12,000 TJ to be achieved by 2020 in the National Energy Strategy.
Beside the environmental benefits we shall also mention the environmental awareness-raising effect of the use of green energy on the local community. High investment costs appear as a negative factor in renewable energy use, but these investments are given a high priority in line with the National Energy Strategy. The service is provided at a price set by the energy agency for consumers, so high investment costs are not enforced in the fees. The sources of the investments are partly financed by the European Union. It may be an incentive for district heat suppliers that they will have to use their profit above the profit cap (2% of gross book value) to invest in increasing the energy efficiency or reducing the cost of district heating.
By looking at the numbers it is without doubt that the efforts toward environmental conscious energy supply have a remarkable role in social innovation.In recognition of its innovative pursuit, the city and the Miskolc District Heating Ltd won the Üzleti Élet a Környezetért Díj [Businesses for the Environment Prize] (2011), the Innovációs Nagydíj Kiemelt Elismerése [Innovation Grand Prix – Outstanding Achievement] (2011), the Észak-magyarországi Regionális Innovációs Nagydíj [North-Hungarian Innovation Grand Prix] (2010) and the Magyar Minőség Háza Díj [Hungarian Quality Prize] (2010). In 2017 the company received the eco-label as well.

2.3. The "service" provided by district heating suppliers, contribution to the consumers' safety of wealth

The biggest change in the economic environment of district heat suppliers had been based on Act LIV. of 2013 on the enforcement of utility cost reduction, and as a result the price of the district heating system has been reduced by 20 per cent, despite the highest utility expenditure of families is still that of the district heating fee. Therefore the consumers are very sensitive to any changes and questions regarding district heating. Because of the different financial situation of families within one residential building, the needs of the families are different too. Due to the specificities of the technology, i.e. technological reasons such differences in needs cannot be met. Payment in equal amounts applied at several suppliers is a great help for the consumers. In this case consumers are allowed to pay the full amount in 11 equal parts and, after providing data on the actual consumption, make a balancing payment in the 12^{th} month of supply. As the costs of district heating become predictable, the special arrangement contributes to the solvency of the consumers.

3. Financial sources of social innovation in the field of district heating

In my previous research in which I analyzed the financial situation and profitability of Hungarian district heating suppliers (7 companies) in a defined period of time (5 years) I concluded that there are significant differences between the economic specificities of companies working in the same industrial sector (Süveges, 2018). Currently in Hungary district heating (in some forms) is located in 94 different municipalities, thus the surveyed 7 suppliers represent 60% of the total amount of sold energy, which can be considered as a representative sample. There was a big difference in the profitability of entities (the relative standard deviation of ROE indicators was 50% -250%, the relative standard deviation of the ROA indicators was 48% -150%, the relative standard deviation of the return on capital ratios was 200-250%), but there was also a high dispersion of the leverage ratios (the relative standard deviation of the indicators was 150% -670%). This result is not supported though if we take a look at the financial sources of social innovation. The Hungarian district heating suppliers have two primary financial sources of innovation:

1. internal resources, that is the amount above acquisition limit
2. support by the European Union, Cohesion Funds, external resources

3.1. The amount above acquisition limit as internal resource

The Decree of the Minister of National Development no. 50/2011 (September 30) on determining the price of district heat that is sold to district heating suppliers and the charge of district heating supply provided for household consumers and specially treated institutions determined a limit on acquisition for the district heating suppliers. Accordingly, the financial results coming from activities falling under the jurisdiction of the Act on district heating and listed in the audited annual financial statement of the district heating supplier cannot exceed the arithmetical product of gross asset value of the financial statement considered at the time of pricing and profit, which is defined at 2% by the Decree. The Decree also says that "the supplier shall spend the profit above acquisition limit on development resulting in a more efficient district heat production or supply or on developments that reduce costs" (Decree 50/2011. IX.30 by the Ministry for Innovation and Technology). Accordingly, profit exceeding 2% of the gross asset value shall become a committed reserve and used for energy efficiency development within two years.

3.2. Tenders for district heat producers and/or district heat suppliers as definite external resources

In the previous periods several calls for tenders have been issued for district heat producers and suppliers. These tenders are summarized in the following chart:

Table 3: Calls for tender for the Hungarian district heat producers and suppliers

Nr.	**KEOP-2012-5.4.0**	**KEHOP-5.3.1-17**	**KEHOP-5.3.2-17**
Name of the tender	Modernization of the district heating sector by the potential of using renewable energy sources	Energetic modernization of the district heating sector	Meeting the local heating and cooling needs by using renewables
Year	2012	2017	2017
Amount at disposal (billion HUF)	6,6	25,07	19,89
Extent of support	100%	100%	1
Minimum amount of support (Mill. HUF)	10	83	20
Maximum amount of support (Mill. HUF)	1000	3125	2500
Supported activity	Energetic modernization of the district heating supply	Developments resulting in the decrease of primary energy usage and of the emission of greenhouse gases	Development of district heating/district cooling supply and district heating production system using renewable energy sources, increase of current capacities

Source: Author's own presentation

In addition to the tenders mentioned above, another two special so called retrospective, call for tenders have also been published: in 2013 the KEOP-5.4.0/12-2013 Retrospective and in 2015 the KEOP-5.4.0/12-2015 Retrospective with a total sum of 10,4 billion forint. Retrospective tenders were ex-post financial support given for developments, carried out from internal resources and meeting the technical, energetic and environmental requirements of the tender. It means that the support was not given for new developments but for older ones. In 2013 the support was 50% and in 2015 100 %.

4. Conclusion

The current study aimed to emphasize the importance of sustainable energy utilization among the pillars of energy policy. It describes the most important EU guidelines and the respective Hungarian Energy Strategy.

Besides the relationship between aims, methods and their financial aspects in the case of social innovations in the field of district, the identification of external and internal resources by which social innovations may be carried out has also been presented

In addition to the obligation to spend profit exceeding the 2% of gross asset value on development increasing energy efficiency, the sector welcomed pre-financing and ex-post tenders financing energy efficiency developments as external resources.

Further research focuses on the competitiveness of the energy industry with a special emphasis on the stimulating and regulatory measures leading to more cost-effective, sustainable energy consumption.

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Bio-note

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