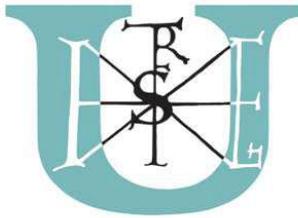


Theses of doctoral (PhD) dissertation

**ANDRÁS SZEBERÉNYI
GÖDÖLLŐ
2020**



**SZENT ISTVÁN
EGYETEM**

**THE POSSIBILITY OF ONLINE COMMUNICATION TO
STRENGTHEN ENVIRONMENTAL AWARENESS THROUGH
THE EXAMPLE OF SETTLEMENTS IN AN AREA**

Theses of doctoral (PhD) dissertation

**ANDRÁS SZEBERÉNYI
GÖDÖLLŐ
2020**

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1. BACKGROUND AND AIM OF DISSERTATION

1.1. Justification and relevance of the research topic

Green energy plays an increasingly important role in our lives today, both worldwide and in our country, as we hear more and more about energy, alternative energy and the environment. The term 'Green Energy' refers to renewable and non-polluting energy sources. 'Renewable energy' refers to forms of energy generated by the transmission of energy and other energy from natural renewable processes. For example, solar energy, wind, river-flow water energy (hydraulic, marine, osmosis energy), biological processes (biomass energy: biodiesel, bioethanol, biogas) and geothermal energy. The importance of environmental awareness and renewable energy sources, as a concept, it is understandable by most people, and with guidance, most people know what they should do to take care of our Earth.

The objectives of the Europe 2020 strategy play an important role in promoting environmental and sustainability factors. At the same time, renewable energy sources, such as those available to EU member states, reduce the EU's energy dependence, which would become more significant with the gradual depletion of own resources. In general, regional policy objectives require the allocation of appropriate instruments, the range of which is quite wide. First of all, highlighting the main directions of territorial development, it can be concluded that one of the priorities is to ensure sustainable development and to promote the development of an ideal economic, urban and spatial structure. These include the ability of people to preserve the values of their homes and to create new ones using local resources and to provide them with continuously increasing trends in appropriate infrastructure, economic and living conditions: that is, to enjoy the place where they live and work.

Research-related objectives highlight the importance of environmental elements, the importance of the use of renewable energies and the development elements related to environmental protection.

Regional policy has an important role to play in providing an appropriate investment framework for the Europe 2020 strategy, in other words to ensure the achievement of the objectives of smart, sustainable and inclusive growth in the European Union. Rural policy is closely linked to the EU's territorial objectives

and regional policy, which aims specifically to serve the above-mentioned objectives from the point of view of rural areas.

A special feature of natural resources is that every person uses it to survive, yet only a fraction of the population does something to protect these resources. Environmental and irresponsible energy wasteful behaviour can lead to a long-term depletion of natural resources and, therefore, alternative energy sources are becoming the focus of attention rather than fossil fuels.

Therefore, environmental protection is also highlighted, the main aim of which is to reduce or eliminate existing damage or to restore, as far as possible, the pre-harmful condition. The increasing use of fossil energy sources and the consequent disappearance of fossil energy sources increase the role of green and renewable energy sources.

In my view, in the future, we will definitely find opportunities in renewable energy sources to try to preserve the renewable capabilities of our land and to provide similar or better environmental conditions for future generations. From 2012 onwards, there have been scenes in Hungary to increase the role of alternative energy production.

In line with the territorial development objectives, the National Rural Strategy for 2020 has the task of strengthening the population-retention and support power of the rural areas. Agriculture is important for this, but at least as important for other sectors as local industry, businesses, tourism, human and social policies in the municipality. The use of green energy can form the basis of this complex approach. As nearly two thirds of the EU's population live in rural areas, it is also an important policy area for my rural development topic. In my opinion, agricultural activities and forestry will continue to play a crucial role in the management of resources in rural areas of the EU. In this regard, renewable energy sources will also play a significant role in the complex development of rural areas in the near future.

As time progresses, modern technology is also evolving at a faster pace. With this new technology, we can put even more emphasis on the methods of using green energy. Online communication also contributes to the speed of the flow of information, in which case interactivity is realized. Online communication tools (e.g. an application developed on this subject) can help rural areas through green energy and the general objectives of rural policy, for example

by creating an online interface to assess the potential of the use of local biomass, solar energy, hydropower or wind energy in a regional, rural area breakdown.

This is why I raised the question whether the residents and municipalities in the district selected for my doctoral research, as well as the students examined as a special target group, are all making some contribution to increasing the use of environmentally conscious approaches and renewable energy sources.

1.2. Research objectives

The main purpose of my thesis is to examine the level of environmental awareness, the methods of using renewable energy sources and the practice of using online communication for the municipalities and selected target groups in a selected rural area – in the LAU1 micro-region of Gyöngyös.

- **O1:** In the micro-region of Gyöngyös as a priority group for rural and territorial development, examination of primary, secondary and university students on renewable energy, environmental awareness and environmental protection topics.
- **O2:** In the micro-region of Gyöngyös as a priority group for rural and territorial development, the examination of municipalities and the population on renewable energy, environmental awareness and environmental protection topics.
- **O3:** Exploring the possibilities of online tools and methods to enhance environmental awareness.

1.3. Hypotheses of dissertation

In my dissertation I aim to accept/reject the following hypotheses based on my previous studies, my practical experience and my preliminary research:

- **H1:** Environmental awareness increases in the context of Higher Education. The knowledge, the level of environmental awareness and the online communication tools used by the students in primary and secondary schools under examination are at a lower level of environmental awareness, while the university students in the study have a stronger knowledge and attitudes about environmental awareness, environmental protection and renewable energy.

- **H2:** Local municipalities play a decisive role in influencing the environmental awareness and environmental attitudes of the population in the examined area.
- **H3:** The knowledge of the population living in municipalities on renewable energy and the use of renewable energy sources are low in the examined area.
- **H4:** The means of online communication can provide a good basis for encouraging the environmental behaviour of the target groups examined.
- **H5:** The achievement of the European Union's environmental objectives is facilitated by area and rural development programmes/proposals at the level of the examined area.

2. MATERIALS AND METHODS

The paper is based on the collection and processing of primary results. In the course of the primary research, I used a multi-step system that first defined the basic objectives, target groups and topics of the research. Then, after defining a specific target group I carried out the first primary survey mainly with open questions. This has enabled me to simplify the following target groups and targets into predefined aspects and categorised issues, thus increasing the willingness and efficiency of respondents. I used GIS program, Adobe Illustrator and Google Analytics to display my research results. In the course of the research I also used online communication which significantly accelerated my survey and primary research.

The processing of the questionnaire database was carried out with the help of IBM SPSS Statistics 22. I characterized the results primarily by describing statistics and I also sought to explore dependency relationships, for example by using cross-table analysis. I tested the relationship with the Pearson's Chi-square indicator, and the strength of the relationship was measured by the Association co-efficients Cramer's V, Gamma, and Eta.

2.1. Student survey

The first part of the complex primary research focused on the environmentally conscious lifestyle and the attitude of primary, secondary school students, as well as university students living and studying in the micro-region of Gyöngyös, the results of which supported the original idea of continuing the research of local municipalities in the micro-region, as these institutions have been involved in a number of green and renewable energy developments. The reason I chose these groups is because the current age group of 14-25 years is already actively affected by the consequences of the environmental issues that appear to be increasing in the future. In my opinion, they will be able to master the knowledge that will solve the environmental difficulties that have arisen.

The research presented in the dissertation was preceded by an examination. In doing so, it was found that most of the tenders and projects implemented, included the installation of solar panels – in case of hospitals, houses of culture, schools – or the recycling of biomass. Preliminary research has also enabled them

to be more thematic in the targeted reduction of topics and related issues, thereby allowing problems of online communication and the impact and level of influence of social media to be included in research. One of these is to explore the means by which social media can draw the younger generation's attention to the importance of an environmentally conscious lifestyle or the importance of environmental protection.

In terms of the structure of the research, I first started by asking the students of secondary school by questionnaire from Class 9 to Class 12, break down into classes, and the next step was the primary school Class 8. As final step I asked the university students in the micro-region. In view of the representativeness of the research, I tried to find and assess all grades of all secondary schools in the district, which were influenced by the willingness of respondents and the cooperation of schools on several levels.

In particular, cross-table analysis and variance analysis (ANOVA test) were used as statistical methods for the processing of student results. ANOVA assumes from H_0 , that gives the averages of responses which are the same in all samples. If during the study the significance level between the explanatory variables (e.g. gender, class) and the explanatory variables (e.g. level of environmental awareness) is less than 0.05, then H_0 is rejected as it can be statistically demonstrated that, for example, there is a difference in the level of environmental awareness between groups according to demographic characteristics. The obtained results are presented in cross-table and textual descriptive statistics. Several studies have been carried out in the course of the study, but in the dissertation I present only those results which are closely related to my assumptions about students.

For the proper presentation of the information received from the open questions, I applied a word cloud illustration method, where the strong, significant terms were highlighted.

2.2. Municipal survey

The second important element of the dissertation was the 25 municipalities in the micro-region of Gyöngyös. In case of municipalities, I also carried out the research at micro-region level, where all municipalities were involved in the research and therefore, the results can be considered to be 100% representative

in terms of their proportion. The questionnaire replies were made in person and individually, as it also gave me the opportunity to conduct an extended interview-kind type method, where further useful information was shared by the relevant municipal leaders on the topics of the questionnaire.

The structure of the questionnaire already uses more specific questions in terms of topics, in particular concerning the general and targeted use of renewable energies and the sources of the investments made in this respect – if there were any – as well as the size of these investments and the possibilities for applying for tenders in this regard. I also included the use of renewable energy sources for municipalities; reducing energy consumption and hence their environmental burden; increasing environmental behaviour; analysing current environmental problems at local level and the opportunities offered by online communication and social media tools for communication with the public.

At the time of the visits to the municipalities, there were several cases where two or more smaller municipalities were assigned to a larger one at the municipal level, in which cases I considered it reasonable to fill out separate questionnaires for the concerned municipalities.

2.3. Residential survey

The third step of primary research is the residential survey during which I also tried to be representative at micro-region level. In order to achieve this I applied stratified sampling techniques that could be classified as random sampling techniques in the residential survey based on gender and age criteria. At the level of settlements, I examined the rates of gender and age, and on this basis, I took the sample proportionally.

After the municipal examination the results obtained by the population also serve as a reflection of the approach given by the management of the settlements examined and the approach of the population to renewable energy, environmental awareness and environmental protection.

Table 1 shows the methods of analysis and the distribution of the corresponding number of elements for all target groups involved in primary research.

Table 1: Distribution of participants in primary research (%)

Questionnaire replies	Target group		Method	Sample size
Student survey	Primary school students	Class 8 (32.8%)	A standardised questionnaire of 39 questions, in significant quantities in the form of personal interviews, in small numbers in online versions, supplemented by oral interviews.	N = 516 (32.82%)
	Secondary school students	Class 9 (11.6%), Class 10 (15.3%), Class 11 (10.7%), Class 12 (10.3%)		N = 752 (47.84%)
	University students	BA and MA students (19.3%)		N = 304 (19.34%)
Municipal survey	The local municipalities of the 25 settlements in the micro-region of Gyöngyös.		A standardised questionnaire of 23 questions, in the form of personal interview, supplemented by oral interviews. All municipalities participated in the survey.	N = 25
Residential survey	The residents of the 25 settlements in the micro-region of Gyöngyös.		A standardised questionnaire of 37 questions using gender and age stratified sampling techniques in the form of personal and online interviews (51% female, 49% male).	N = 458
Corporate survey	Companies located in the micro-region of Gyöngyös.		A standardised questionnaire of 31 questions, in the form of a personal interview, supplemented by an in-depth interview of 12 questions.	(not included in the study)

Source: Own research and compilation, 2020 n= 2055

3. RESEARCH RESULTS

In my research I formulated five hypotheses. The processing of the research results also reflects the order of the primary research, in which I tried to keep the logical structure in mind. As regards the results, I present first the research results for primary, secondary school and university students in the micro-region of Gyöngyös, then I present the results of local municipalities in the second part. Finally, in the last part I show the results of the residential survey and their context.

3.1. Results of student survey

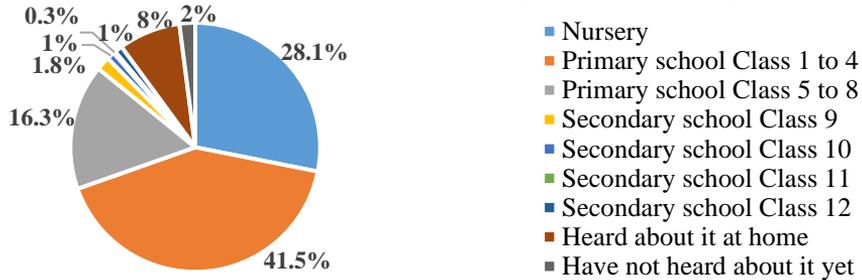
According to the logical structure of the survey – containing 39 questions for primary, secondary and university students – it first addresses issues relating to environmental and renewable energy, followed by communication and, in particular, issues relating to online communication. In the last part the results of questions can be found relating to their combined overlap. The students who replied to the questionnaire by gender were 43.4% male and 56.6% female.

When presenting the results, I will only address the differences among the groups if I have observed significant characteristic differences. In the course of the research, I used cross-table analysis and ANOVA statistical methods to examine my hypothesis for students based on the level of classes. If this is not indicated separately, there was no statistically significant differences among the examined groups. I will present the results along my hypotheses.

On the basis of the open question it can be concluded that a significant part of the students first thinks about environmental protection, restoration of environmental factors and elimination of littering and excessive waste. The question of whether they had learned and when they first learned about the environmentally conscious lifestyle at school or elsewhere (Figure 1). On the basis of the results obtained, most of the students interviewed had heard about the environmentally conscious lifestyle as early as nursery (28.1%) and in elementary school (41.5%). 16.3% of them first heard about it in class 5 to 8 of primary school. Among the students interviewed, only 0.3% were those who studied relatively late (in secondary school Class 11), while 8% of the students heard about it for the first time at home. 2% of them have not yet heard of an

environmentally conscious lifestyle, which may seem almost unbelievable – today, when so much climate disaster happens.

Figure 1: Distribution of students interviewed according to when they first learned about the environmentally conscious lifestyle (%)



Source: Own research and compilation, 2020

Based on cross-table analysis (Table 2) the younger age group has previously received more intensive environmental education compared to their older counterparts, which can be explained by the increasing importance of awareness raising in the curricula and activities outside the class in recent years. Overall, there is, however, a weak but significant relationship between the class in which the students are in and when they first met the environmental approach.

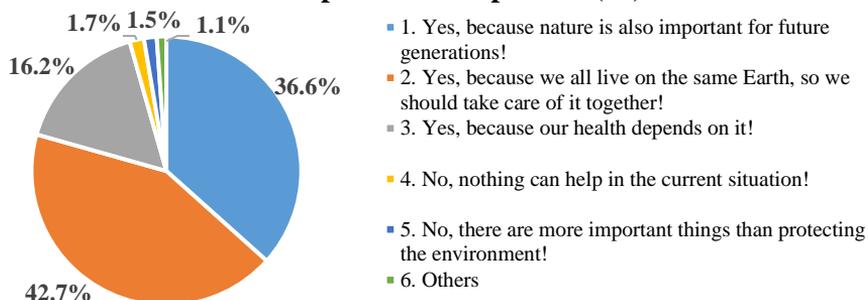
Table 1: Pearson's Chi-square test for student class and when they first learned about environmentally conscious lifestyle

Indicators	Value	Asymp. Sig. (2-sided) (p)
Pearson's Chi square (χ^2)	311.960	0.000
Cramer's V	0.199	0.000
Weak relationship		

Source: Own research and compilation, 2020

In case of questions and explanations on the importance of environmental protection, one answer could be indicated, of which five responses were formulated by me and four more suggested by the students. Based on the overall results (Figure 2) it can be said that 42.7% of students care about environmental protection, because we all live on the same Earth, we are obliged to take care of it together. According to another 36.6% of students, environmental protection is important because nature is just as important for future generations as it is for us now. In a small percentage, students believe that nothing can help the current situation (1.7%) and that there are more important things than environmental protection (1.5%).

Figure 2: Distribution of respondents according to whether they consider the environmental protection important (%)



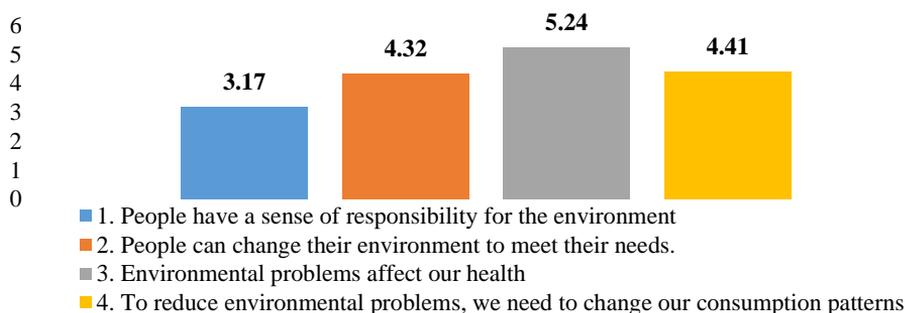
Source: Own research and compilation, 2020

Cross-table analysis has shown that there is a weak but significant relationship between assessing the importance of class and environmental protection ($\chi^2=93.444$; $df=25$; $p=0.000$; Cramer's $V=0.109$). Based on the results obtained, Class 8 students marked the first two answers in a much higher proportion than university students. Therefore, compared to Class 8 students, the university students consider environmental protection less important (or useful).

The results for some of the statements (Figure 3) regarding the environment and its problems show that students have the least sense of responsibility for the environment (3.17). Characteristics related to human needs (4.32) and changes in consumption patterns (4.41) were considered to be somewhat more typical.

Of the four statements, the impact of environmental problems on our health was assessed at an average of 5.24, which also points out that students are aware at such a young age that increasing environmental problems causes many chronic diseases for people.

Figure 3: Average assessment of students for certain environmental claims

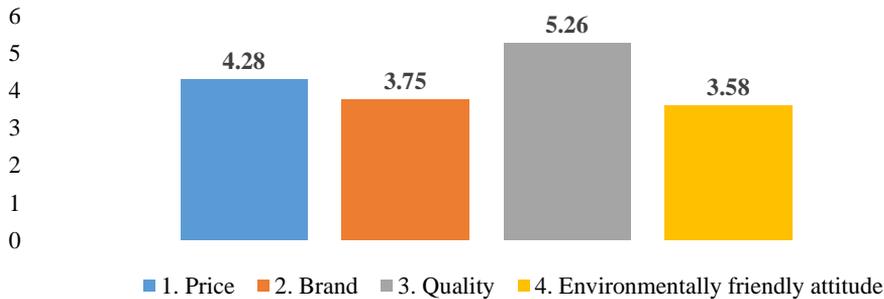


Note: On a scale from 1 to 6 (where 1 = least characteristic ... 6 = most characteristic)

Source: Own research and compilation, 2020

I also examined how important each of the listed product features is to students when shopping. In terms of results (Figure 4), the least important aspect is environmentally friendly attitude (3.58), which is an interesting result in the means of results mentioned above. Based on the average of the results obtained, the brand is either not very important (3.75) for them. In contrast, the price of products is a slightly more significant aspect (4.28), but quality (5.26) is what they are interested in the most when they are buying a product. The results obtained therefore show that the relationship between price and quality is not a negligible factor, as they make a significant contribution to decision-making during purchases.

Figure 4: Average assessment of students for certain product characteristics during the purchase process



Note: On a scale from 1 to 6 (where 1= least characteristic ... 6= most characteristic)

Source: Own research and compilation, 2020

ANOVA statistical method has also been used to examine whether there is a relationship between class number and product characteristics (Table 3). The results obtained show statistically that the preferences 'Price', 'Brand' and 'Environmentally friendly attitude' are affected by age specificity and not by 'Quality'. In my opinion, one of the reasons for this is that university students are already largely self-sustaining, while primary school students are more dependent on their parents and have no income of their own. There is also a further correlation with the environmentally friendly attitude, where primary school students are more concerned with this characteristic (3.9) than university students (3.2), which further strengthens the result that primary school students have a closer attitude to environmental awareness than university students.

Table 3: Relationship between product characteristics by Class (ANOVA test)

Description		Sum of Squares	df	Mean Square	F	Sig.
Price	Between Groups	65.291	5	13.058	7.118	.000
	Within Groups	2861.910	1560	1.835		
	Total	2927.201	1565			
Brand	Between Groups	70.193	5	14.039	7.837	.000
	Within Groups	2788.986	1557	1.791		
	Total	2859.179	1562			
Quality	Between Groups	13.711	5	2.742	3.130	.008
	Within Groups	1372.075	1566	.876		
	Total	1385.786	1571			
Environmentally friendly attitude	Between Groups	189.503	5	37.901	20.018	.000
	Within Groups	2964.911	1566	1.893		
	Total	3154.414	1571			

Source: Own research and compilation, 2020

In the research section on online communication, I was also curious about the topic on which students are most informed about social media interfaces. There were up to three answers to the question, but in addition to the ones listed in advance, they could also enter additional categories (e.g. KPOP, dancing, Formula 1, economic news, funny videos etc.).

An important topic for the dissertation is the news on nature and the environment, which only 8.4% of students are interested in. Based on the results it can be concluded that the students consider themselves environmentally aware, trying to contribute to environmental protection in a number of ways (especially primary school students), but only a very few of them are aware of this subject, which suggests that the majority of their knowledge is acquired in educational institutions within the framework of the subject classes. In my opinion, reading habits can vary according to age, so students can learn from different sources by many categories. Environmental issues (and related sustainability, renewable energy etc.) are among in the more complex topics, especially if they came into contact with this topic in later period (e.g. after Class 11-12 or at the university).

Therefore, I considered it necessary to examine by statistical method the relationship between the students' classes (age) and their reading habits with regard to environmental aspects. The result proved to be interesting because, as unexpected, there is no statistically verifiable significant relationship between the students' class and their reading habits ($\chi^2=74.346$; $df=25$; $p=0.216$; Cramer's $V=0.067$). This means that regardless of class (and age) each tested group has similar reading habits.

The students explained this by their interest in green and renewable energy articles which they considered not to be the main priority of the media and because of the SEO system (which examines the user's searching habits based on keywords and displays the news according to them), these topics are more difficult to access. The most readable news includes information technology (27.5%), online games (33.1%), fashion (44.1%), sports (53.5%), and daily news (38.8%), which is typically presented by social media platforms categorized by the user.

My next question is already the cornerstone of my concrete future goal – the development and install of an application for environmental protection, sustainability and renewable energy – in which I was wondering if students had ever met an application for environmental protection and renewable energy. According to the results, 10.4% of the students are not only meeting with this kind of application, but regularly using it as well. Another 27.1% of them have already met it in some form – possibly even tried it – but are not using it. A significant proportion of students (62.5%) have never encountered an application dealing with such a subject, which makes it likely that they have not even been interested in such an application at the search level. There is a significant potential for economic and service management in such an application, provided that it has a sufficiently built structure and information content. The main point is therefore to build, promote and customize the application in such a way that the 62.5% of the potential students can be exploited.

The local municipal institutions are an integral part of the development of the environmentally conscious approach of students, so I will present the primary research results for local municipalities in more detail in the following sub-chapter.

3.2. Results of municipal research

Local municipalities must also become increasingly involved in promoting renewable energy developments, as an example for local residents. Thus, one of the main objectives of my primary research is to examine the attitude of all the municipalities in the micro-region in this regard.

The prepared questionnaire for municipalities asks of the renewable energy sources, use of forms, implementation of resources, the investments and proposals, measured in the first part, and the questionnaire in the second part I've covered the soil and water quality, the recycling collection methods, air quality heating period, the local level of environmental protection and renewable energies support for the approach, as well as to the municipalities used in online communication and social media potential for the population to communicate. In terms of settlements, all 25 municipalities in the micro-region contributed to the questionnaire, so this part of my primary research can be considered to be fully representative.

Two (8%) of the 25 settlements examined are towns and twenty-three (92%) are villages. Several villages in the district have consolidated municipalities, for which I filled out as many questionnaires as each village belongs to that municipality. Thus, according to this method, 56% of the municipalities examined have self-government and 44% do not have self-government.

I wondered whether the municipalities or the maintained institutions use one of the renewable energy sources mentioned in my list and, if so, which type and where (Table 4). In case of the municipality interviewed, three energy sources are used, most of the cases these are the biomass and solar energy. The possible answers included geothermal, water and wind energy, but none of them were used by the municipalities concerned at the time of the primary research. It is important to mention that in the course of the information received by personal conversations, several people pointed out that the energy generated by the sun (mainly solar panels) is the energy that can be used, followed by biomass. In addition, the results show that biomass is mainly used in municipal buildings, Mayor's offices, health houses, nurseries, schools, integrated community and service spaces and medical stations. 20% of the 25 surveyed municipalities do not use any renewable energy sources.

Table 4: Distribution of renewable energy sources used by local municipalities involved in the research by place of use

Type of energy source	Place of use
<i>Biomass</i>	<ul style="list-style-type: none"> - municipal buildings - Mayor's offices - hospitals - gymnasiums (built-in heating) - integrated community spaces - nurseries - castle - medical stations - primary and secondary schools - service spaces
<i>Biogas</i>	<ul style="list-style-type: none"> - sewage treatment plant - swimming pool buildings
<i>Solar</i>	<ul style="list-style-type: none"> - solar panels in the buildings of nurseries and primary schools - solar panels and solar collectors on municipal buildings for water heating
<i>Do not use</i>	<ul style="list-style-type: none"> ➔ five municipalities who do not use any renewable energy sources

Note: More than one answers could be marked!

Source: Own research and compilation, 2020

I examined the source of these improvements and investments from which the municipalities had implemented them. Due to the nature of the open question, the respondents could give a variety of funding form as answers. As mentioned above, 20 municipalities participated in renewable energy projects and 35 investments in renewable energy were made, categorised as follows:

1. European Union tender source (23%) ➔ for 8 local municipalities
2. KEHOP tender source (14%) ➔ for 5 local municipalities
3. TOP tender source (9%) ➔ for 3 local municipalities
4. National tender source (34%) ➔ for 12 local municipalities
5. Source of local municipalities (20%) ➔ for 7 local municipalities

The development and investments in renewable energy were made to a significant extent (34%) from a national tender source (e.g. Széchenyi 2020) with an average subsidy level of 70-90%, in which case the remaining 10-30% had to be covered by the municipalities from their own resources. If a municipality fail to comply with the proposal properly during the evaluation process – not only it has to pay back the amount of the application, but it can also expect for a penalty in addition to this from the bureau.

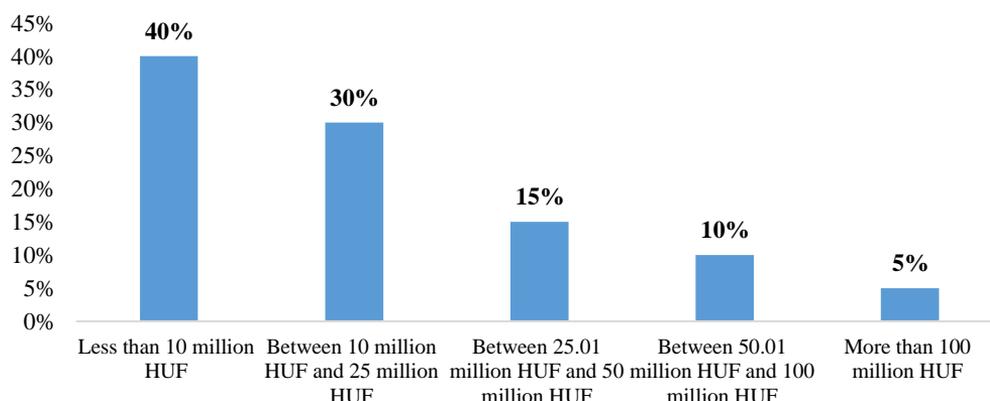
The European Union's funding was the second most used tender source (23%), which in several cases enabled 100% tendering support, for instance, for Mátraszentimre and Nagyréde settlements. This also fully covered other costs – such as contacting professionals, calling for proposals, assessing the condition of

the buildings concerned, installing, maintaining solar panels, dealing with mandatory periodic or warranty problems. In case of financing forms, 20% of all tenders were made in terms of local municipalities sources, most notably in terms of upgrading biomass and heating technology. Combined funding has also been used, for example in Markaz (TOP 3.2.1-16 + use of own municipal funding sources) in Gyöngyös (EU + KEHOP + national tender source + own municipal funding sources) and in Vámosgyörk (EU + KEHOP + own municipal funding sources), where tenders for complementary renewable energy could be implemented.

Figure 5 shows how large the number of investments already realized in local governments. The question in the questionnaire was made up of six responses, of which five can be seen in the figure. The last option was “Not planning”, but it is not relevant in case of this figure now.

Based on the figure it can be stated that the 40% of the local governments the amount of investments were less than 10 million HUF, which in numbers mean 8 municipalities. In case of 30% of the local governments the amount of investments have been done between 10 million HUF and 25 million HUF, the 15% of the amount of investments have been implemented between 25.01 million HUF and 50 million HUF, further 10% of the amount of investments have been executed between 50.01 million HUF and 100 million HUF.

Figure 5: Distribution of the average amount of investment types in case of the asked municipalities (%)



Source: Own research and compilation, 2020 n = 20

There was only one municipality that exceeded the aggregate value of the investment amount of 100 million HUF. Based on this figure may also be asked about the problems of the use of renewable energies in tenders. In most of the cases, the lack of own resources and financial problems have been highlighted by local municipalities as a major problem. Other mentioned issues were the lack of public procurement referrals, the aforementioned experts and the lack of supervisory work (e.g. it can not be an energy producer, or can only be audited by energy analysts at certain times), difficulties in eligibility of costs, handling the failures of the devices already installed, long transaction times in general (can be weeks or even months), and the fact that municipalities have a duty to settle each year at the managing authority.

It can be seen that the majority of municipalities consider it important to invest in renewable energy in their urban development strategy, which is motivated not only by the extent or size of future tenders, investments, but also by supporting the use of renewable energy sources for the population at local level. The results obtained on this question are interesting, of which three groups have been separated. The first (60%) concerns municipalities who support the use of renewable energy through different methods. Such methods, for example, are supported by statements from the public in the event of a public tender, or help cover a certain proportion of the costs when installing solar panels, using biomass or boilers. The second group (24%) belongs to municipalities who do not support it, and the main reason is that the municipalities do not have allocated money. The third group (16%) includes municipalities who have no knowledge neither of the mentioned of initiatives.

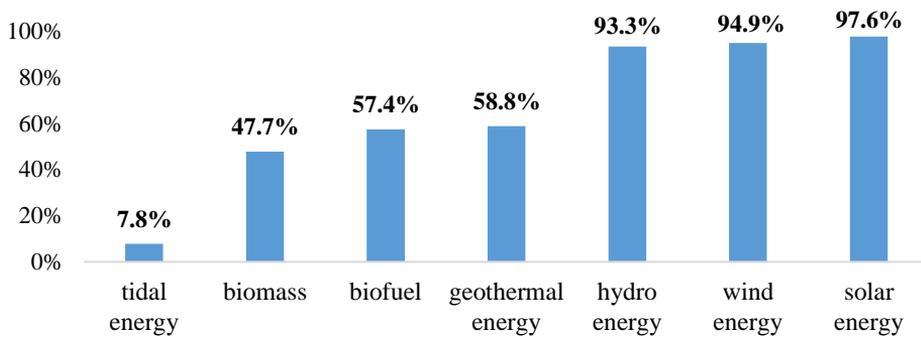
3.3. Residential survey results

The last part of my primary research is the residential survey in micro-region level. The main topic of the first part of this questionnaire is the renewable energy, the environmental awareness, the environmental protection and the related investments, as well as the possibility of average monthly savings through renewable energy sources. The second part of the questionnaire focuses on the use of smart tools, application skills, types of advertising in social media, as well as renewable energy applications, which allow to the residents to expand their

knowledge further. With a view to representativeness, I asked the population of the 25 municipalities in proportion to the total number of inhabitants living in the micro-region. My hypothesis in the matter of this survey was that the knowledge and use of renewable energy is low by the population living in settlements in the area under examination. I analyse the results of my residential research along this hypothesis.

In case of the results, I was curious to see which types of renewable energy are known in addition to the report content of renewable resources. In addition to the six responses I have given, I have also indicated the possibility of tidal energy (Figure 6), as 7.8% of respondents identified it in the 'other' category.

Figure 6: Distribution of the residents examined according to the renewable energies they know (%)



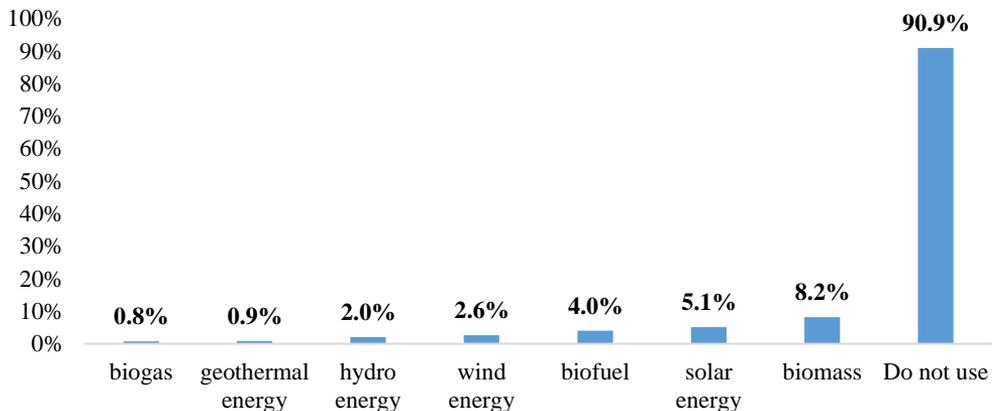
*Note: More than one answers could be marked!
Source: Own research and compilation, 2020*

The results show that the general knowledge of biomass (47.7%), biofuels (57.4%) and geothermal energy (58.8%) is significantly lower than for hydro (93.3%), wind (94.9%) and solar (97.6%). In the course of the survey the inhabitants of Abasár, Detk, Gyöngyös, Gyöngyössolymos, Nagyréde, Pálosvörösmart and Visonta were more familiar with renewable energy, while in other settlements they had much less general knowledge of this.

The next question in the residential questionnaire already covered the personal use of renewable energy (Figure 7). The results show that only a very small part of the resident uses some kind of renewable energy source. Only 5.1% of the most well-known solar energy source use it in some form (typically solar panels).

Wind energy consumption of 2.6% is less surprising, because as wind energy (e.g. wind turbines) is not generally used in Hungary due to less favourable weather conditions. Since the vast majority (90.9%) do not use any renewable energy sources, I will present answers to the following questions in connection to who use some form of renewable energy.

Figure 7: Distribution of the examined residents based on renewable energy use (%)



Note: More than one answers could be marked!

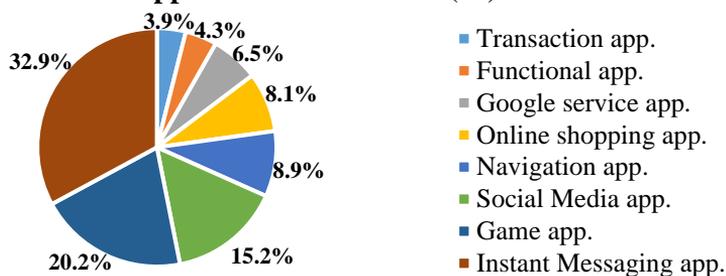
Source: Own research and compilation, 2020

In the case of residents using renewable energy sources, I examined the sources of investment with an open question. On the basis of the replies received, I have identified four different funding sources, distributed into a total of 100%, since each of the residents concerned typically participated in only one tender or made an investment in renewable energy until the time the research was carried out. Most of them – about 58.5% – invested in renewable energy from their own funding sources. In addition, 17.1% of the respondents successfully applied then won a national tender (TÁMOP, KEHOP), and 14.6% accomplished an EU tender. In terms of the results, it was 9.8%, who applied for an investment in renewable energy but could not implement the tender because of rejection or the failure to meet the necessary conditions described in the tender. The results are also influenced by factors such as the energy source, the achieved amount of energy and the technology it was made by, but I was not able to go into details in the framework of this research but it definitely will be a part of my further research objectives.

I also examined where the necessary information for the execution of the investment is to be obtained from. The important questions for my thesis is – which I have already mentioned several times during the examination of students and municipalities – what social portals or other communication channels are used to inform the residents of current tenders and investments. One interesting result is that the internet is not the primary source of information for the respondents, but the most relevant for them is the information from professionals (91.3%). The internet is only the second source for them (77.7%), which has led to several people pointing out that they are incompetent on the subject, so in many cases they do not know on what side they should approach the search in case of tenders for energy investments. Another important area of information acquisition is the connection network, which includes relatives, acquaintances and friends, therefore many people – 31.1% – turn to them for this purpose. Renewable energy and related textbooks (14.6%), newspapers and magazines (12.6%) are used much less for information, and the main reason for this is that they are available in limited places and quantities making them difficult to obtain. Although my research revealed that several of the local municipalities participating in my research provide opportunities for information in local municipality institutions, in the form of a book or a magazine but very few people use these opportunities and as a result they are informed too late or not informed at all about investments and tenders.

In terms of online communication aspects, in order to determine which topic people are most interested in, I considered it necessary to ask the residents which applications were last installed on their smartphones (I chose this device because most of the people use these phones, so compared to other devices). Based on the obtained results, I have defined eight different categories of applications (Figure 8), from which the most used category is the Instant Messaging applications (32.9%) – e.g. Viber, Skype, Facebook Messenger. Second most downloaded category is the Game app. (20.2%) and third category is Social Media app. (15.2%). The Functional app. (4.3%) – which I defined myself – include all applications that are designed to read the news. Based on the results my future application which I wish to develop in the future falls into this category, and although at first not seem like a lot of the distribution indicators, but later it can be upgraded for additional features (e.g. Chat functions etc.).

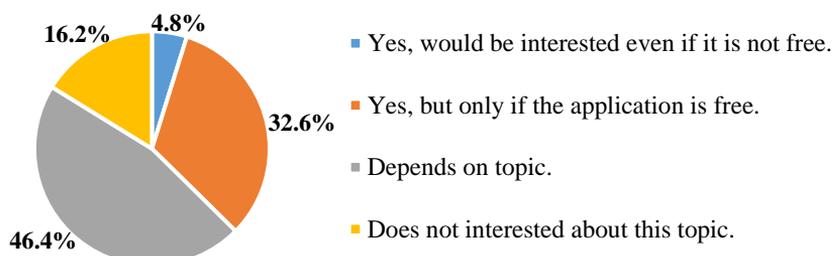
Figure 8: Distribution of the examined residents according to the last application downloaded (%)



Source: Own research and compilation, 2020

I have also examined whether the surveyed inhabitants meet with environmental protection news, renewable energy, environmental sustainability on the social media portals they use, and if so, whether they read them. According to the results, 48.6% of them have already seen and read news regarding these topics. In case of the above-mentioned Instant Messaging applications I was also interested to know whether if an application would be created in connection with renewable energy and environmental awareness, would it be downloaded or used. In this regard, I have set out four different options for responding (Figure 9).

Figure 9: Distribution of the examined residents according to whether they would like to use an application in connection with renewable energy (%)



Source: Own research and compilation, 2020

The first option was marked by very few respondents (4.8%) which shows that only a few people are interested in using such applications. One solution would be a full-fledged, free application up to the second phase, when additional services can be used to integrate pay-per-view parts which already contributes to covering later development costs. 32.6% of respondents would like to use this kind of application but only if it is available for free. Another 46.4% of them downloading applications which depend on the topic of applications and the last group (16.2%) who does not care about this kind of applications at all.

4. NEW SCIENTIFIC RESULTS

- 1.** With the help of primary research, I proved that the knowledge of the students of the studied area related to environmental awareness, environmental protection and renewable energy is extensive but their approach to the subjects under consideration is typically passive. At the same time I concluded that the skills, knowledge and attitudes of students enable them to make intensive use of the communication activities carried out on the web interfaces in the online space, and that through appropriate advertising tools and incentives the means of online communication can influence the behaviour of young people in relation to the environment.
- 2.** I proved with correlation studies that there are basically no significant differences among the target groups of students (primary, secondary and higher education) in the examined district in terms of their knowledge of environmental protection, environmental awareness and renewable energy. Students participating in higher education do not typically have a higher environmental awareness attitude or, in some cases, the attitude of secondary school students is more active. The main reason for this was the practical role of education. Overall, environmental awareness does not increase in the context of education.
- 3.** Based on primary research, I concluded that the investigated local municipalities strongly seek to invest in renewable energy sources to develop a public approach in these regards, to characterise them as environmentally conscious behaviour and they have future-proof plans related to renewable energy sources. On the basis of the examined area, I pointed out that municipalities have an important role to play in the development of environmental awareness at local level and in the dissemination of environmentally friendly solutions in particular by using online communication.

4. I have proved by primary research that the environmental knowledge of the population of the examined area is limited and their use of renewable energy sources is low.
5. On the basis of the results of the research, I have demonstrated that regional and rural development programmes can contribute overall to the achievement of EU and national environmental objectives through the assistance of municipalities at local and regional level. At the same time, the opportunities offered by the programs – especially for small settlements – are typically limited and play a smaller role directly for the inhabitants.

5. CONCLUSIONS AND RECOMMENDATIONS

Renewable energy sources, environmental awareness and environmental protection have undoubtedly become more important actors in our daily lives in the recent years. This is why it is important to examine the main aspects of global environmental trends in relation to the environment with the help of national and international literature and secondary information. Then I defined the role of environmental sustainability by means of definitions and how to provide sufficient environmental resources for the current generation to meet our needs. Environmental awareness and environmental protection are covered on almost all issues, in which all the efforts in invest and develop would be in vain.

The reason for writing the dissertation was in any event the current topic, and the aim was to explore the situation of the environmental behaviour and investments in renewable energy in the three target groups I examined, as well as the possibilities for improving it through online communication and related online tools. The topic affects all ages, but especially the young age group, because in the upcoming decades, the lack of fossil energy, extreme climate conditions and disasters will affect them the most. For all three target groups under consideration, I have put great emphasis on getting comprehensive and detailed information. In case of students, environmental protection, environmental awareness raising, technological tools they use, methods of using social media, media role in environmental issues, and the importance of applications focusing on renewable energy were highlighted. In the case of municipalities, even in spite of the difficulties encountered in the research, representative results were obtained, many of which were a forward-looking result, which serve as a practical guide for rural areas. I also tried to demonstrate representative results for the population, especially general knowledge of renewable energies, in connection with their use in the general public. I have examined in particular the amount, payback period and purpose of investments in renewable energy, the methods of reducing environmental pressures and the methods of using smart tools and applications on renewable energy.

- **Hypothesis 1:** Environmental awareness increases in the context of Higher Education. The knowledge, the level of environmental awareness and the online communication tools used by the students in primary and secondary schools under examination are at a lower level of environmental awareness, while the university students in the study have a stronger knowledge and attitudes about environmental awareness, environmental protection and renewable energy.

I consider it rejected

On the basis of the results of the analyses carried out and of the related statistical correlations, this hypothesis has been rejected. Students clearly associate environmental, recycling, renewable energy, environment and healthy lifestyles with the concept of environmentally conscious lifestyle.

I examined along scaling method which of some product features is how important it is for students. On the basis of the results presented, it would seem more likely that a large number of students are environmentally aware and would like to contribute to environmental protection in some way, but still when it comes to their own financial factors, it is no longer important for them at all to have as little burden on the environment as possible. In particular, this is the case with regard to the price and environmental characteristics established on the basis of the cross-table analysis, which shows that university students choose on the basis of price rather than on the basis of the environmental burden of a product. Primary school students pay much more attention to this.

On the basis of this view, I believe that environment friendly products could be moved into a direction that, taking into account the possibilities for price differentiation, it would not only be possible to produce more quality products, but it would be better to buy less environmentally harmful items. So, although students have generally heard about environmental protection and are basically aware of the importance of environmental awareness aspects, it does not necessarily occur in their daily lives or while shopping.

My most important recommendation with regard to the results is that environmental awareness should, as far as possible, be even more integrated into education, which is based on the results, should start as early as possible in the nursery education. It should be emphasized that environmental awareness is

important in relation to consumer behaviour and that we can make an even more active contribution to achieve environmental objectives through our purchases. I consider the awareness of this as young as possible to be essential for sustainability.

- **Hypothesis 2:** Local municipalities play a decisive role in influencing the environmental awareness and environmental attitudes of the residents in the examined area.

I consider it accepted

On the basis of the questionnaire used for my primary research and the results obtained in parallel oral additions, it is worth pointing out that smaller villages have much more difficulties to apply for tenders and improvements for renewable energy, as there are a number of requirements that they cannot meet (e.g. the state of municipal buildings, problems of installation due to inadequate structure, lack of own funding etc.). This is also illustrated by the fact that the five smallest of the 25 municipalities in the district were not able to participate in any related applications during the time of my research.

In terms of future developments, all 25 municipalities plan to invest in renewable energy, ranging from 500,000 HUF to 75 million HUF depending on the category. On this basis, it can be said that the investigated municipalities are clearly committed to environmental awareness and the use of renewable energies (mainly solar and biomass). Their activities make a strong contribution to the strengthening of local environmental awareness, the promotion and spread of environmental conscious solutions, renewable energies.

Compared the results of the municipal and residential survey, it was found to be questionable and unclear in the opinion of the municipalities on the approach of the population to the environment and the use of renewable energy sources. On the basis of the research, the attitude, activity, supportive and exemplary behaviour of the municipality can greatly improve this.

The problem is that municipalities in smaller settlements cannot finance these costs on their own, which also affects the local population. My emphasised recommendation is that the dissemination of environmentally friendly solutions should also be made more accessible to smaller and poorer municipalities by developing appropriate schemes. Adequate funding could not only contribute to

alleviating environmental problems but could also generate costs which could be channelled to other areas by the municipalities concerned, and in many cases, which are already facing economic and social problems. On the basis of my research results the implementation of multi-stage projects should be considered as a priority in the application systems as the blocking of these processes has been highlighted by the investigated municipalities in relation to the application sources of a next project element.

On the basis of the results, I would consider it appropriate to enhance cooperation, exchanges of information and experience, joint investments, the dissemination of good practices and policies.

- **Hypothesis 3:** The knowledge of the population living in municipalities on renewable energy and the use of renewable energy sources are low in the examined area.

I consider it accepted

My primary research has shown that the people living in the area under investigation have a general knowledge that includes knowledge of the basic meaning of water, wind and solar energy, but can be characterised by knowledge gaps in further renewable energy sources.

The results are also influenced by factors such as the energy source, the amount of energy that was achieved, and the technology that was made with, but I was not able to go into details in the framework of this research and it definitely will be part of my further research objectives.

The results of everyday environmentally friendly behaviour show that, apart from certain cases (e.g. avoiding waste of electricity and water), the attitude of the population is still needs to be improved. A typical result, for example, is that only a quarter of the respondents do not use plastic bags or plastic straw. The main motivation for using environmentally friendly solutions is to save at the household level, not to take into account social interests.

One solution for improving the population's knowledge about renewable energy can be, for example, to provide local education or further training opportunities, which do not only discuss the importance of renewable energy sources or environmental awareness at a theoretical level, but also to present the reasons for taking action in this direction through practical concrete examples.

This can be done by co-operation at work or by individual contribution but it is about supporting the local community and the population in this way of shaping the approach. Therefore my main recommendation for the general public is the transfer of knowledge and the promotion of knowledge. This can be done directly and indirectly. In direct methods by online communication – on which I have formulated the following hypothesis – will also play a role. However, it is possible to influence the population through the activities of the municipalities, which are clearly drawn on the basis of the investigation.

Among the solutions, I would also recommend the extension of resources and support opportunities for direct investment in the use of renewable energy sources for the general public, and the provision of access to the necessary information.

- **Hypothesis 4:** The means of online communication can provide a good basis for encouraging the environmental behaviour of the target groups examined.

I consider it accepted

With regard to online communication and social media outcomes, I first consider it important to highlight the daily use of students on social media platforms and, in this context, whether students believe that the media adequately addresses the issue of environmental protection. In terms of results, 74.2% think that the media should pay much more attention to the emphasis on environmental news, which clearly shows that all groups of students are interested in this topic and would like to know more about it. Still, despite the fact that they think we should pay more attention to this, Social Media and internet searches do not address these issues. This shows to me that they tend most passively to receive information in the form of environmental awareness and renewable energy news, rather than in the form of actively seeking information.

On the basis of my recommendation, one of the most effective solutions would be to stabilise the online education system which I did not mention separately in the paper or in the questionnaire, but it is important to mention as it concerns not only higher education institutions but also all educational institutions in the world at once.

If we recognise the importance of this – the importance of online education in the development of environmental awareness – and can start developing young people's attitudes as soon as possible, then alternatives to tackling environmental problems can be effectively taught to the next generation. My recommendation is to integrate new environmental green-course line into the curriculum framework that can be mastered taking into account the specificities of online education. The current modern online environment allows for the creation and public use of their own instructional videos, which can be used free of charge in the initial phase and subsequently as a (paid) course, as part of another curriculum or other method. There are already several platforms for this implementation (eg. Udemy, Coursera, edX etc.), so that the results of my research can be used in the future by defining appropriate schemes.

Online communication is also important for municipalities. Based on the results, a positive approach can be established for the municipalities as each of the 25 examined municipalities has their own functioning website, 84% of them have Facebook contact information (48% even use the form of offline local written press). It is worth mentioning that in most cases a separate application monitoring system is also available on websites. My related recommendation – which I recommended to most municipalities in practice while conducting research – is the integration of a private communication platform on the websites (e.g. bot-chat, which can respond to questions concerning the given municipality by providing different algorithms and has a great advantage of being available in 0-24 hours) with the assistance of which local residents are more easily assisted. Although Facebook profiles were created as part of this process by municipalities, some functions are limited or not allowed (linked to subscription, e.g. advertising, portfolio analysis, News highlighting etc.) related to the communication.

The relationship of online communication with this topic was also explored in case of the population. With regard to the conclusions on the results of online communication tools and applications, I have defined eight different categories of applications which have helped me determine which types of applications the examined population uses most and most often. I hope that by using the research results I have obtained, I will be able to create a specific application focusing

mainly on renewable energy, environmental protection, environmental awareness. The aim of this is to create a high-quality software with active information network that can be updated continuously by means of a database, and can be integrated into the topic of online or even personal education. In order to optimise the operation of this, it is necessary to update the data regularly and to extend my research to a county or even national level depending on the form in which it can be incorporated into the curriculum.

- **Hypothesis 5:** The achievement of the European Union's environmental objectives is facilitated by area and rural development programmes/proposals at the level of the examined area.

I consider it partially accepted

On the basis of my research, it can be clearly stated that area/rural development tenders do not contribute substantially to investments in renewable energy and environmentally friendly solutions at residential level. Nearly two-thirds of the households represented by the surveyed inhabitants made the investment in renewable energy from their own resources, while less than one-third of them used a tender source. Many public tenders were unsuccessful or canceled due to unfulfilled conditions.

My previous proposals are closely linked to this hypothesis, as the lack of practical training leads to the failure of many unsuccessful applications. The local government's own strategy would form an integral part of the development of a local education culture to support the public in strengthening renewable energy sources and environmental awareness aspects. If not only theoretical, superficial information is provided to the residents (e.g. on applications) but also practical training in this respect, their attitude will change in a positive direction and they will be able to implement more efficient application processes.

On the basis of the above mentioned thoughts, I strongly recommend that the application systems and opportunities be synchronised to the results, increased support for municipalities and the involvement of online communication systems.

Overall, the development and support of all the conditions I have formulated in line with the previous hypotheses should – as my main proposal – benefit from greater and stronger support for EU and national territorial and rural development policies. In doing so, of course, not only should direct investment resources, but knowledge transfer, learning, exchange of experience, the flow of good practices, the promotion of cooperation, the dissemination of innovations, the involvement of online tools, and, of course, the development and support of an appropriate education system be involved. Through these areas, the policies concerned could contribute significantly to increase environmental awareness and to ensure sustainability over longer term.

6. LIST OF PUBLICATIONS RELATED TO THE DISSERTATION

In this chapter the most important publications from the point of view of the dissertation are presented. Other publications can be viewed in the MTMT repository.

Szeberényi A. (2018): Representative Primary Research About Renewable Energy Investments in Case of the Local Governments Located in the Micro-Region of Gyöngyös, *Visegrad Journal on Bioeconomy and Sustainable Development* 7(2), pp. 51-56.

Szeberényi A. (2018): Reprezentatív felmérés a gyöngyösi járásban található önkormányzatok megújuló energia pályázatainak vonatkozásában, *Studia Mundi - Economica* 5(4), pp. 77-89.

Szeberényi A. (2018): Összehasonlító elemzés a gyöngyösi diákok körében környezettudatossági aspektusból, In: Némediné Kollár K.; Péli L. (szerk.) SMART tényezők vizsgálata a hazai megyei jogú városokban a Modern Városok Program tükrében : konferenciakiadvány, Gödöllő, Magyarország, Szent István Egyetemi Kiadó, pp. 45-50.

Bakos I. M. – **Szeberényi A.** (2017): The Tourism and Environmentally Friendly Aspects of the Short Food Supply Chains, In: Vladimir, Trukhachev (szerk.) Sustainable development of tourism market: international practices and russian experience, Book of proceedings of V. International scientific-practical conference, Sztavropol, Oroszország : Sequoia, pp. 5-11.

Gerencsér I. – **Szeberényi A.** (2017): Social dimensions of energy development in rural area, *Journal of Agricultural, Food and Environmental Sciences* 72(1), pp. 170-178.

Szeberényi A. – Varga-Nagy A. (2017): Az ökoturizmus jövője - Összehasonlító elemzés a gyöngyösi diákok körében környezettudatossági aspektusból, *Studia Mundi - Economica* 4(5), pp. 73-82.

Szeberényi A. (2017): Environmentally Conscious Lifestyle Analysis Among High School and University Students in a Hungarian Rural Town of the Heves County, *Visegrad Journal on Bioeconomy and Sustainable Development* 6(2), pp. 74-78.

Szeberényi A. (2016): A zöld- és megújuló energia kihasználásának lehetőségei az online térben primer kutatás segítségével, *Studia Mundi – Economica* 3(1), pp. 131-143.

Szeberényi A. – Ritter K. (2016): Environmentally conscious life education by the help of renewable energy, In: Csata A. – Bíró E. B. – Fejér-Király G. – György O. – Kassay J. – Nagy B. – Tánczos L. J. (szerk.) Challenges in the Carpathian Basin. Integration and modernization opportunities on the edges of Europe : 13th Annual International Conference on Economics and Business Kolozsvár, Románia, Editura Risoprint, pp. 818-836.

Szeberényi A. (2016): A helyi önkormányzatok és a helyi vállalkozások kapcsolata, együttműködése, In: Szügyi Gy. – Ritter K. – Bakos I. M. – Gerencsér I. (szerk.) Kézikönyv a képzési rendszer megalósítása az önkormányzatok gazdaságfejlesztési feladatainak támogatására, Gödöllő, Magyarország, Szent István Egyetemi Kiadó, pp. 63-68.

Szeberényi A. (2016): The Importance of Become Environmentally Friendly and Use Good Practice to Life by the Help of Renewable Energy, In: Ritter K. (szerk.) Economic and local aspects of rural development , Gödöllő, Magyarország, Szent István Egyetemi Kiadó, pp. 4-12.