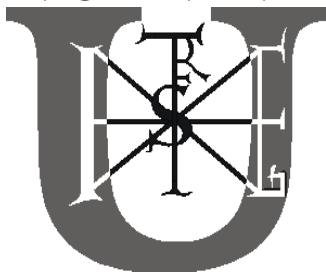


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SZENT ISTVÁN UNIVERSITY**

**DOCTORAL SCHOOL OF MANAGEMENT AND BUSINESS ADMINISTRATION**



**THESIS OF THE DOCTORAL (PhD) DISSERTATION**

**THE CORRELATION ANALYSIS OF GENERATING MUNICIPAL SOLID WASTE AND  
THE EXAMINATION OF WASTE MANAGEMENT PUBLIC SERVICES ENSURED BY  
THE SELF GOVERNMENTS IN PEST COUNTY**

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# 1 INTRODUCTION

## 1.1. The significance and actuality of the topic

Due to the increasing consumption of the population the amount of waste is growing continuously. This process can trigger the depletion of the natural resources. Furthermore, it can also be the reason for the impairment of human health as its consequence. Healthy environment is one of the important factors of proper living conditions. Our most supreme law, the Constitution also acknowledges the need for healthy environment. This basic law assigns the protection of the natural environment to the state as one of its duties.

The waste management of Hungary was in a very underdeveloped state at the beginning of the 1990s. At that time the legislators as well as the professional and civilian organisations did not possess enough experience in connection with waste management. The national situation can be best described by disorganisation, the dangerous nature of treating and managing waste to the environment, the disproportionately huge amount of waste generation and the low proportion of waste utilisation. The approach of stressing the economisation on natural resources was also missing. The situation can be modelled by the general problems of landfills; at that time based on the theory of „one settlement-one landfill” there were more than three thousand old-fashioned landfills harmful to the environment all over the country.

Although the laws disposed of the activities concerning the single waste types and the types of waste themselves, but the thorough framework covering all activities and waste types was missing. The use of notions in the regulation at that time and the system of requirements were not unified and the regulation did not comply with the modern environmental requirements.

The defects of planning waste management were also striking. The Parliament approved the National Waste Management Plan in 2002 and after that regional projects were made. A significant lack of information characterised that era and those dealing with this topic did not possess proper guidelines, aids, instructions yet. Moreover, their number was also slight. The data provision on waste was also rather deficient. Waste Management Information System (HIR) was launched only in 2004.

Several international regulations and commitments urged to cease the situation described above as soon as possible. In 1996 Hungary became the member of the OECD and among others, one of the requirements of membership was to abolish the old-fashioned system of waste management.

Besides the commitments of the OECD membership the legal harmonisation of our EU accession is also of high importance. At the environmental round of talks about accession to the European Union it became obvious that compliance with lawmaking of waste management is one of the most basic commitments of legal harmonisation.

Act XLIII. (Hgt.) on Waste Management accepted in 2000 can be regarded as a milestone in the fulfilment of the requirements listed above. It is worth noting that a great part of the environmental regulations of the European Union is directive regarding legal harmonisation so when implementing them to the national legal system the member states have a discretionary power of a certain degree. Consequently, the basic liability for the member state is to comply with the objectives and liabilities stated in the directive without prescribing what special rules to apply by the legislator to execute them. Taking on this change, the accepted law created the basic legal framework for waste

management, in many cases by assigning a legal regulation of a lower level to work out the details of execution.

The cause of environmental protection became more emphasised after Hungary's accession to the EU. Considering that environmental pollution is not stopped by the borders of the countries, healthy environment can only be ensured by the mutual coordinated operations of the member countries so that is why the EU gives a priority to take over, implement and continuously monitor environmental achievements.

With respect to the planning of waste management on the basis of the Hgt. a National Waste Management Plan as part of the National Environmental Protection Programme should be worked out, then approved by the Parliament so that the strategic targets outlined by the law and stated objectives as well as the basic principles of waste management should prevail. Based on the national plan the executive bodies of environmental protection prepare regional waste management plans in compliance with the regional arrangement and development plans with the inclusion of the regional self governments, other bodies, social organisations of environmental protection and those safeguarding interests. Working out the National Waste Management Plan II is taking place during the preparation of the dissertation, which will determine the priorities and targets of waste management between 2009 and 2014. When preparing plans, it is essential to get to know the regional conditions both on a national and a regional level. The amount of waste generation can be determined by different demographic and social factors so it is an important question what impacts the factors above have on the amount of the generated waste-if any.

The question of treating municipal solid waste (MSW) is a highlighted segment of waste management. This type of waste is generated during the everyday activities of the population that is why the safe management of waste is one of the responsibilities delegated to self governments.

The Hgt. introduced the obligation of managing municipal solid waste in Hungary. According to this law the self governments of the settlements were to organise the public service to manage municipal solid waste till 1 January 2003, which should at least cover the collection and disposal of waste from the real estate owners. Besides ensuring the basic services the self governments could individually decide if the public service should cover the separate collection of the single components of waste and if so, which waste components and collection methods should be applied during the process. The law orders the real estate owners to make obligatory use of the organised public service. Furthermore, it also provides for the population to pay for the costs of the service based on the principle of „the polluter pays” in a proportionate way.

## **1.2. Objectives**

Basically I have set two targets in my research. On one hand, after reviewing the related literary works my aim was to examine if there was a relationship between the generation of municipal solid waste and different demographic/sociological/economic factors-if any. This segment of my research includes the examination of secondary data relations. The formulated objective of this part of the study is to provide assistance at planning different levels of waste management, with special regards to exploring the cause-reason factors of generating municipal solid waste.

In the second part of the dissertation I have analysed the public service of municipal solid waste organised by the self governments of the settlements. I have carried out primary research among the self governments of Pest County and after that the results gained were annexed by the data of the questionnaires filled in by the population. My objective was to draw attention to the defects of legislation as one of the responsibilities of the self governments as well as to highlight the actual

problems and anomalies in relation to the waste management public service fee incurred by the self governments. As far as this area is concerned I have also examined the misdemeanour procedures of the self government regarding waste management together with the important questions arising from the launch of regional waste management systems. The primary research was carried out with the participation of the self governments and the inhabitants of Pest County on both the levels of self government and the population, respectively. The objective of my analysis is to reveal problems as I did not have the opportunity to carry out representative research due to lack of resources. In my opinion, my results can serve as the basis of further research in the areas examined.

My hypotheses are the following:

H1: The municipal solid waste (MSW) per capita generated by the public shows the following correlations expressed by the sub-hypotheses below in the micro-regions of Pest County:

H1a: A more significant population density means bigger waste generation so the correlation is significant between the MSW per capita and the extent of urbanisation of the regional settlements as well as the population density.

H1b: Consumer habits change when influenced by higher income, which also has an impact on the fact that the population generates more waste so there is significant correlation between the MSW per capita and the personal income tax per capita of the regional inhabitants. Furthermore, the registered regional rate of unemployment and the amount of MSW per capita are inversely related.

H1c: The presence of retail outlets triggers a higher generation of waste especially with regards to packaging so the correlation between the amount of MSW per capita and the number of retail outlets is significant.

H2: The examined self governments comply with the law when drafting their environmental programmes, regulations and waste management plans with the specified content by meeting their legal obligations.

H3: The examined self governments apply the two-tier fee in their pricing technique concerning public services in waste management, which is always proportionate with the amount of the transported waste.

H4: The number of delinquencies and violation concerning waste related issues is significant.

H5: The examined self governments employ curbside collection in case of houses and containers applying selective waste collection in case of housing estates.

## 2 MATERIAL AND METHOD

The dissertation introduces the examined research topic by means of reviewing the specialist literature. During my research work I have used both national and international works. I have carried out the analysis of thorough scientific books and articles. The legal background of waste management is an emphasised part of the research so that is why it was essential to study the relevant laws of both Hungary and the European Union with special regards to the secondary regulations of the EU. I have taken part in several national and international conferences where I have tried to make use of the presentations for my research topic.

In the first analysing part of my research I present the liabilities of self governments to environmental protection and waste management. After that their tasks in connection with environmental protection are interpreted. I also present the special feature of public service by analysing its legal background. The analysis concludes with the exploration of the basic relations of waste management fees regarding different economic-legal considerations.

In the following part of the research correlation examinations are carried out between the amount of municipal solid waste per capita and different social/economic factors on a micro-regional level. Correlation calculation is applied between the amount of municipal solid waste per capita on a micro-regional level as well as the extent of urbanisation of the micro-regions, their population density, the personal income tax per capita, the registered rate of unemployment and the number of retail outlets in the area. The objective of this part of my examination was to prove the report of the World Bank published in 1992 and the practical implementations of the theory on the environmental Kuznets curve.

In this part of the paper exclusively secondary data were used for the different correlation analyses. The issues of the National Statistical Office on Pest County and the regional statistical books served as the basis for quantitative examinations. I have realised that using the data of the NSO can, in many ways be, restricted especially regarding relevance and accuracy. The secondary data may be inaccurate or not totally updated, reliable.

During the first phase of the second part of my research, the collection of primary data, i.e. primary research was carried out with regards to the self governments under the jurisdiction of Pest County. The questionnaire was used as a method to meet the set target. The objective of data recording was to examine the public services in waste management at the self governments with special regards to the fee structures applied by the self governments, selective waste collection and the delinquencies concerning waste related issues. Data were recorded between October 2009 and December 2009. During the survey my objective was to ask all the self governments of Pest County so to achieve this, all the self governments were sent an electronic questionnaire. In the first round 43 questionnaires were sent back from the total 187 so that is why those who did not return it were repeatedly sent this research aid. The efficiency in the second round of sample taking was better as altogether 114 questionnaires were obtained ready for assessment. Sample taking was not representative as it was not my objective during the research to come up with general data typical of the population, either. My basic objective is the thorough examination of the examined questions. As far as I know, such a survey on a national level carefully analysing the questions of waste management so deeply from such an aspect has not been carried out so far so that is why it is essential to go on with founding and exploring research. During the research a pretested standardised questionnaire was used, which can be found in Appendix 1. The content of the questionnaires sent to self governments was the following: after recording the basic data of the settlement general environmental problems were highlighted. After that the public service fee and the delinquencies concerning waste related issues were questioned together with the points of selective waste collection I regarded important. The widespread Likert method as a way of

measuring attitudes was used for such questions. The impact of the single factors was measured by a 5-grade Likert scale. On the basis of this, only the highest and the lowest values were defined so the strength if the given opinion could be measured by the mean number of points of answers to different factors.

This phase of my examination was also annexed by quantitative methods. To define the direction of the research more precisely and to make the questionnaires more perfect, detailed interviews were made with the environmental executives of different self governments. During the interviews partly the questions of my questionnaire were studied by the respondents and also the small talk was directed at different attitudes, causes and reasons. The interviews were intimate, personal ones lasting for almost one hour without a predefined structure.

After that the programmes and regulations of the self governments on the environment, if any, were analysed together with their plans on waste management. The papers above were obtained either via the internet or they were paper-based ones. The objective of this part of the research was to examine the compliance of the documents above with the regulations.

The objective of data recording was to highlight the single questions of public services in waste management from the part of the population. The question how proportionate the population feel the public service fee is with the amount of waste transported was highlighted. Furthermore, the correlations between the motivating and connected factors of selective waste collection were also regarded essential to be explored. Finally, the extent of the knowledge of waste management systems launched or to be launched nowadays from the part of the population was also examined. Data recording took place between October 2009 and December 2009 when the full-time and correspondent students of Szent István University served as the basis for sample taking during the survey.

Sample taking was not representative as it was not my objective during the research to come up with general data typical of the population, either. My basic objective was to carry out exploring research to found the professional interviews planned in the later phase of my research and to outline as well as to make my hypotheses more punctual. During the research a pretested standardised questionnaire was used, which can be found in Appendix 2.

Both in the case of the questionnaires for self governments and the population open and close questions alike were applied. Open questions were primarily used to survey the knowledge, professional preparedness, thoughts and opinions of the persons. However, a great part of the questionnaires was based on close questions to which the respondents could reply in a predetermined way. The answers gained this way were more obvious and the readiness to respond was also greater. The questions contained both yes/no or ranking ones, which give an opportunity to give more answers or to put the answers in an order. During the finalisation of the questionnaires my objective was to express the answers numerically in the most precise way possible to reach the exact target of measuring.

To support the study properly, the data recorded by the questionnaire were assessed by means of statistical analyses based on scientific methods. The feeding and statistical processing of data were realised with the help of SPSS 13.0 programme. The results are illustrated by several figures and tables to make understanding easier. Figures and diagrams were prepared by using Microsoft Excel and Microsoft Visio programmes. The questionnaires were first encoded then data clearing was applied. Several statistical methods were used for my analyses. The Pearson correlation coefficient ( $r$ ) was calculated to explore the presumed correlations. The definition of this is the most frequently used statistics which measures the strength of the connection between two metric variables, X and Y. It is an indicator to define whether there is a correlation between X and Y by denoting the extent



of the correlation of changes in one variable, X with the changes of another variable, Y. The Pearson correlation coefficient can only be applied to data which can be measured by an interval scale. If we would also like to carry out hypothesis examination, then we have to presume normality. Another measure, the so-called Spearman rank correlation coefficient must be calculated in case of data which are not normally spread or cannot be measured by an interval scale so the Spearman rank correlation coefficient was also used on case of further correlations. During the processing of the results of the quantitative research besides the descriptive statistics I also carried out bi-and multi-variable correlation examinations with the help of Chi-square trial, factor-and variance-analysis. In the case of every method several trials were made but among them only the results of the most statistically suitable segmentation that can be best explained professionally are detailed when presenting the research results. In case of the correlations examined by variance analysis the significance and F values were considered. In case of the Chi-square trials, the examination of the internal correlations of the single relations was carried out on the basis of the values of the corrected standardised residuals (AdjR) in all cases interpreted in the following way: Adj.R  $\geq$  2: 95% reliability of a positive deviation from the expected value; Adj.R  $\geq$  3: 99% reliability of a positive deviation from the expected value. In case of a negative sign the deviation is negative with the same value intervals.

### 3 RESULTS

#### 3.1 Correlation examinations

In this phase of my research I aimed at proving and extending the international research so the correlations between the amount of municipal solid waste per capita on a micro-regional level and the different economic and demographic factors. By using the regional statistical database of the Central Statistical Office I examined if there is a correlation between the amount of waste per inhabitant and the population density per micro-region in Pest County in 2008. By assuming that the volume of municipal solid waste per capita is relatively higher in the city I was searching a correlation between the amount and the extent of urbanisation of the micro-region, which was determined by proportioning the number of the city-dwellers to that of the micro-region. I also had a closer look at the relationship between the volume of municipal solid waste per capita and the personal income tax per capita by considering the thesis according to which consumer patterns change due to higher income and it results in more waste. I also analysed the relation between the amount of municipal solid waste per capita and the proportion of the registered unemployed by micro-region and finally I examined if there was a correlation between the number of the retail outlets in the region and the volume of municipal solid waste per capita by presuming that the higher density of retail outlets results in a greater amount of waste generated.

First I examined the question whether there was a correlation between the extent of the urbanisation of the settlement/micro-region and the amount of waste generated by the population of the settlement/micro-region supposing that in cities the amount of waste generated per capita is higher. However, it cannot be stated that in cities only the city-dwellers generate waste as cities can just be highlighted among the settlements because they play a central role in the given area; they have agglomerations from where part of the population commute to work or pursue other activities every day. Apart from this, the difference between the consuming habits of the city and country dwellers arouses some questions.

There are several methods to prove my theory above. At present the Spearman rank correlation coefficient ( $r_s$ ) was defined to prove how strong the correlation was.

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(n: number of elements in the sample,  $d_i$  the difference between rank values )

The calculation of rank correlation between the amount of MSW per capita and urbanisation in Pest County resulted  $r_s = 0.444118$ ,  $P < 0.1$ , which means that the correlation is weaker than average and significant on a 10% level.

So the correlation is not too strong so based on these data urbanisation is not in a strong correlation with the waste generation habits of the inhabitants. The calculation proves the hypothesis according to which cities are just highlighted from their surroundings because their functions (agglomerations, supply areas) stretch beyond their borders so it can be seen that not only those living there generate waste.

The statement above is justified by the correlation analysis that was carried out between the amount of waste per capita in the micro-regions and their population density.  $r_s = 0,308824$ , which means that in this examined case the correlation between the population density and the amount of waste

generated is weaker than the correlation between the extent of the urbanisation of the micro-regions and the amount of waste generated.

The value between the personal income tax per capita and the MSW per capita is  $r_s=0,420588$ , while regarding the number of retail outlets it is  $r_s= 0,347059$ . In my examination on Pest County the proportion of the registered unemployed showed the weakest correlation with the amount of generated municipal solid waste  $r_s=0,291912$ .

The correlations of the other indicators drawn in the examination are presented by Table 2.

**Table 2: The result of correlations among MSW per capita, personal income tax and density**

	Spearman's rho	Municipal solid waste, kg/person	Personal income tax per tax payer, HUF	Population density, person/ km <sup>2</sup>
<b>Municipal solid waste, kg/person</b>	Correlation Coefficient	1.000	.421	.309
	Sig. (2-tailed)	.	.105	.244
<b>Personal income tax per tax payer, HUF</b>	Correlation Coefficient	.421	1.000	.862(**)
	Sig. (2-tailed)	.105	.	.000
<b>Population density, person/ km<sup>2</sup></b>	Correlation Coefficient	.309	.862(**)	1.000
	Sig. (2-tailed)	.244	.000	.

Source: own calculation

\*\*The correlation is significant on a 1% level

As we can see from the results, there is a significant correlation between the population density per micro-region and the personal income tax per taxpayer ( $r_s= 0,862$ ,  $P<0, 01$ ). The correlations between the amount of municipal solid waste per capita and the other factors of the table cannot be regarded significant, however, as Sig. (2-tailed) exceeds 10% everywhere.

To carry out further examinations I also included the micro-regions of two counties of the Northern Great Plains, namely Hajdú-Bihar and Szabolcs-Szatmár-Bereg. I chose these two counties because regarding their size, they are similar to Pest County, their population density is half that amount and, at the same time, the average ratio of the registered unemployed is three and five times higher than the values of Pest County, respectively.

Table 3 presents the descriptive statistics of the indicators of the three counties.

**Table 3: Calculations regarding the selected counties**

Micro-regions		N	SUM	Mean	Std.Deviation	CV %
<b>Pest county</b>	Municipal solid waste, kg/person	16	5576	348,50	67,99	19,51
	Number of commercial outlets	16	16171	1010,69	506,51	50,12
	Personal income tax per taxpayer, HUF	16	6927039	432939,94	140036,09	32,35
	Number of taxpayers per 1000 persons	16	6984	436,50	18,37	4,21
	Population density, person/km <sup>2</sup>	16	4135,3	258,46	208,29	80,59
	Area,km <sup>2</sup>	16	6391	399,44	279,75	70,04
<b>Hajdú-Bihar county</b>	Municipal solid waste, kg/person	9	2385	265,00	61,52	23,22
	Number of commercial outlets	9	8265	918,33	1107,27	120,57
	Personal income tax per taxpayer, HUF	9	2096208	232912,00	71489,87	30,69
	Number of taxpayers per 1000 persons	9	3627	403,00	41,22	10,23
	Population density, person/km <sup>2</sup>	9	898,9	99,88	122,40	122,55
	Area,km <sup>2</sup>	9	6212	690,22	261,97	37,95
<b>Szabolcs-Szatmar-Bereg county</b>	Municipal solid waste, kg/person	12	3755	312,92	94,06	30,06
	Number of commercial outlets	12	9352	779,33	827,46	106,18
	Personal income tax per taxpayer, HUF	12	2641797	220149,75	54609,36	24,81
	Number of taxpayers per 1000 persons	12	4314	359,50	33,00	9,18
	Population density, person/km <sup>2</sup>	12	1170,4	97,53	59,15	60,65
	Area,km <sup>2</sup>	12	5938	494,83	164,33	33,21

Source: own calculation

From the last column of the table we can see that except the number of taxpayers per 1000 persons in case of all the indicators there is a very high changeability between the micro-regions of all the three counties. The reason for this, in many cases, can be the fact that in the case of certain indicators in a micro-region neighbouring a city are 7-10 times bigger than the other similar indicators of the other micro-regions in the county. The most striking one in the case of both counties of the Northern Great Plains is the number of commercial outlets, where the value of the CV% is above 100%. Another striking indicator is the CV% value of the population density where explanation also lies in the great differences between the data of the Debrecen micro-region with 422 person/m<sup>2</sup>, Polgár with 36.6 person/m<sup>2</sup>, Nyíregyháza with 266.2 person/m<sup>2</sup> or Záhony with 134.6 person/m<sup>2</sup> and Vásárosnamény, the most densely populated one with 53 person/m<sup>2</sup>. In the other part of the examination I also examined whether the mean data of the micro-regions typical of the counties in case of the variables in the table above differ. Variance analysis (ANOVA) was carried out for each variable separately. Due to the constraints of space, not all the six variance analysis tables and the attached Multiple Comparisons tables can be published now so that is why

we have to concentrate only on the important information necessary for drawing conclusions as presented by Table 4.

**Table 4: Comparisons of the micro-regional means**

LSD					
Dependent Variable	(I) County code of micro-regions	(J) County code of micro-regions	Mean Difference (I-J)	Std. Error	Sig.
Municipal solid waste, kg/person ANOVA result (F=3,49; P<0,05)	1	2	83,50(*)	31,71202	0,013
		3	35,58	29,06455	0,229
	2	1	-83,50(*)	31,71202	0,013
		3	-47,92	33,56085	0,162
Number of commercial outlets, ANOVA result (F=0,295; P=0,747)	1	2	92,35	328,9247	0,781
		3	231,35	301,4645	0,448
	2	1	-92,35	328,9247	0,781
		3	139	348,1012	0,692
Number of personal income tax per taxpayer, HUF ANOVA result (F=18,78; P<0,01)	1	2	200027,93(*)	43339,11	0
		3	212790,19(*)	39720,95	0
	2	1	-200027,94(*)	43339,11	0
		3	12762,25	45865,80	0,783
Number of taxpayers per 1000 persons ANOVA result (F=22,56; P<0,01)	1	2	33,50(*)	12,51	0,011
		3	77,00(*)	11,46	0
	2	1	-33,50(*)	12,51	0,011
		3	43,50(*)	13,24	0,002
Population density, person/ km2 ANOVA result (F=4,88; P<0,05)	1	2	158,58(*)	64,28	0,019
		3	160,92(*)	58,91	0,010
	2	1	-158,58(*)	64,28	0,019
		3	2,34	68,03	0,973
Area, km2 ANOVA result (F=4,101; P<0,05)	1	2	-290,78(*)	101,56	0,007
		3	-95,40	93,08	0,313
	2	1	290,78(*)	101,56	0,007
		3	195,39	107,48	0,078

Source: own calculation

\*The mean difference is significant at the .05 level.

From the first column of the table we can calculate the F quotient of the ANOVA calculation, which is the proportion of between groups and the mean square of within groups and the significance level of the probability of the F-trial. In case of all variables when the value of P is lower than 0.05, the result of the ANOVA examination is significant, which suggests that there is a deviation between the average values of the counties. To decide the concrete mean values, we have chosen the LSD (Least Significant Difference) test among the post-hoc ones.

Table 4 compares the mean values of the certain pairs under the headings of the county codes of I and J micro-regions. The most important information is hidden in the last column marked as (Sig.) which shown the significance level of the t-test done in pairs. Where this value is lower than 0.05, there is a significant difference between the examined two mean values. Micro-regions were coded by counties: 1= Pest, 2= Hajdú-Bihar, 3= Szabolcs-Szatmár county.

The evaluation of the table is easy when knowing the codes. What is obvious is that based on the average number of commercial outlets in the ANOVA examination there is no significant difference between the certain counties so this variable is not so necessary to be dealt with. In the case of the other variables we can see that the mean values of the micro regions in Pest County are significantly different from the averages of both counties except the municipal solid waste and the area. There is no statistically proven deviation in case of the two indicators mentioned above from the micro

region averages of Szabolcs-Szatmár County. A significant difference could only be shown regarding the number of taxpayers per 1000 persons between the mean values of the micro regions of Hajdú-Bihar and Szabolcs-Szatmár Counties.

Among the variables examined so far further calculations were carried out with the municipal solid waste kg/person, personal income tax per taxpayer HUF and population density person/m<sup>2</sup>. By counting with their absolute value, a correlation was shown among the variables. The Pearson Correlation was used in the calculations.

The results of the calculations are presented by Table 5.

**Table 5: Calculation of correlations in the selected counties**

			<b>Municipal solid waste, kg/person</b>	<b>Personal income tax per taxpayer, HUF</b>	<b>Personal income tax per taxpayer, HUF</b>
<b>Pest county</b>	Municipal solid waste, kg/person	Pearson Correlation	1	0,485	0,287
		Sig. (2-tailed)		0,057	0,281
		N	16	16	16
	Personal income tax per taxpayer, HUF	Pearson Correlation	0,485	1	,593(*)
		Sig. (2-tailed)	0,057		0,015
		N	16	16	16
	Population density, person/km <sup>2</sup>	Pearson Correlation	0,287	0,593(*)	1
		Sig. (2-tailed)	0,281	0,015	
		N	16	16	16
<b>Hajdú-Bihar county</b>	Municipal solid waste, kg/person	Pearson Correlation	1	0,676(*)	0,44
		Sig. (2-tailed)		0,046	0,236
		N	9	9	9
	Personal income tax per taxpayer, HUF	Pearson Correlation	0,676(*)	1	,881(**)
		Sig. (2-tailed)	0,046		0,002
		N	9	9	9
	Population density, person/km <sup>2</sup>	Pearson Correlation	0,44	0,881(**)	1
		Sig. (2-tailed)	0,236	0,002	
		N	9	9	9
<b>Szabolcs-Szatmár-Bereg county</b>	Municipal solid waste, kg/person	Pearson Correlation	1	0,465	0,279
		Sig. (2-tailed)		0,128	0,379
		N	12	12	12
	Personal income tax per taxpayer, HUF	Pearson Correlation	0,465	1	,854(**)
		Sig. (2-tailed)	0,128		0
		N	12	12	12
	Population density, person/km <sup>2</sup>	Pearson Correlation	0,279	0,854(**)	1
		Sig. (2-tailed)	0,379	0	
		N	12	12	12

Source: own calculation

\* Correlation is significant at the 5% level

\*\* Correlation is significant at the 1% level

Based on the data of the table there is a strong correlation in the two counties of the Northern Great Plains between personal income tax per taxpayer HUF and population density person/m<sup>2</sup>. ( $r= 0.854$ ,  $P<0.01$ ), ( $r= 0.881$ ,  $P<0.01$ ) In Pest county this correlation is of medium strength ( $r= 0.59$ ,  $P<0.05$ ) and significant. We have found another very strong, significant correlation in the table, which is between municipal solid waste kg/person and personal income tax per taxpayer HUF in Hajdú-Bihar County. ( $r= 0.676$ ,  $P<0.05$ )

### **3.2 The survey of the self-governments**

In the second phase of my quantitative research I have surveyed the self-governments situated in Pest County in order to explore the local problems of waste management. The basic characteristics of the sample were the following: the average population of the examined settlements: 9565.39 persons. The smallest population was 387 persons and the largest 70 000. The average number of populated dwellings was 3236.16 and the average built- in area of the settlements was 61.97%. Examining the real estate types it can be stated that houses overrepresented the pattern (93.13%), the proportion of the block of flats were 2.98%.

75.7% of the examined settlements have an environmental programme and 92.1% own a waste management plan. 73% of the surveyed settlements possess an accepted environmental decree.

Based on the stipulations of our environmental protection act (Ktv.) in effect the execution of the regulations serving the protection of the environment must be ensured by the local self governments. Moreover, they also have to perform duties delegated to them. The Ktv. obviously orders the self governments to work out a separate environmental protection programme for the settlement. This programme must be approved by the body of the representatives (at the general meeting). The single points in the content of the programme are stipulated by law. Besides, the programmes can contain other regulations taking the local conditions into consideration.

In this phase of my research I examined to what extent the self governments comply with the law in this area. Based on the questionnaires returned, after the assessment I could draw the conclusion according to which a significant part of the examined self governments, i.e. 24.3% do not possess an own environmental protection programme as they declared it. When examining the decree on environmental protection, the results are even more disappointing. Approximately 27% of the examined settlements stated to have no decrees on environmental protection. In my opinion the results above highlight a great lag in the legislative liabilities of the self governments.

The picture is more favourable regarding the legislative liabilities of the self governments that took part in the survey concerning waste management. "Only" 7.9% of the self governments did not possess a waste management plan on the basis of the questionnaires. As making plans is also a duty stipulated by law, in my opinion part of the self governments have to make up for the loss in this area, as well.

In connection with the examined waste management plans it can be stated that regarding their content they comply with the requirements outlined by law but at the same time, part of the examined projects there is a serious deficiency. It is necessary to present the types, amount and origin of the generated, utilised waste on the area by waste streams in the project. Furthermore, information must be supplied about the types of the generated waste and its annual amount, the types and the amount of the accumulated waste as well as the types and the annual amount of the waste transported in and out of the area. A part of the plans examined provided extremely little information on these questions. Instead of the concrete data in the tables we can meet the sign n. a. (not applicable) so although the plans are adequate regarding their form, they do not provide a

guideline to waste management questions in their content so they cannot fulfil their original functions.

In the following phase of my research I analysed the practice of setting the public service fee of waste management in the areas of the sample. In the first phase of the research on the fee I tried to find out who pays the public service fee for waste management at all. The findings are not surprising as based on the theory of “the polluter pays”, most of the fee is paid directly by the population to the self governments (public service provider). We can also find an example when the self government “takes over” the fee from the public. In this case the population does not directly pay for the service in real but at the same time, the self government charges the service fee as a form of communal tax on the inhabitants. The proportion of the settlements is very low (7.9%) where the self government totally takes over the costs of transporting waste. Generally, this “gesture” is not possible due to the restricted financial means of the self governments.

In case of the self governments where the fee of transporting waste is financed by the population we can state that the greatest part (75.7%) is paid for emptying the bins. There was not a single settlement where the fee could have been decided on the basis of the number of dwelling rooms. The fee for waste transportation levied on the basis of the number of persons in the household was not typical, either. There were cases, however, when the basis of the fee was the real estate or the plot itself.

My survey concludes that the self government apply the two-tier fee in a very few cases. Regarding the type of the public service fee for MSW applied at the settlements it was a one-tier fee in 93.8%, only 6.2% of the settlements included in the examination apply the two-tier type of public service fee for MSW. According to the respondents the most important reason for quitting the two-tier fee is that the maximum 40% flat-rate type basic fee (for utilisation) stipulated by the decree is not realistic in practice with regards to the fixed costs of public services. The basic fee is 35% of the public service fee on the average in the case of the self governments that apply the two-tier fee.

Very extreme answers were given to my question, i.e. how much the self governments estimate the MSW generation of an average household on their areas was. There was such a self government that indicated the amount in 20 litres per week while others declared 200 litres per week. The answers are more interesting if we compare them with the ones to the following question where I enquired how much the minimal amount of waste per week was in the contract. The smallest amount in this case was 40 litres/week, the biggest 240 litres/week. In many cases I found such a questionnaire where the amount of MSW per household estimated by the self government was much lower than the minimal amount per week stipulated in the local service contracts. The self governments themselves also acknowledge that the amount of waste generated by the households does not reach the volume of the minimal bin on which a contract can be made. Despite of this fact, it is not possible to make a contract on a smaller volume. According to my calculations the average minimal amount of waste per week at the examined settlements is 77.09 litres. At the same time, it is favourable that the population has the possibility to choose the type of the bin at 86.5% of the responding settlements. Most settlements use the 110- or 120 litre-bins. Where it is smaller, the alternative is the 60-litre bin. In line with the above-mentioned facts, the public service contract is usually made on at least the 120-litre bins in the settlements of the sample. The second most popular size of bins was the 240 litre-bin followed by the 110- and 60-litre ones. All settlements drawn in the examination define the amount of waste generated by volume. In my survey there was no settlement that could define the amount of municipal waste by weight.

More than half (56.8%) of the settlements examined in the sample do not label bins with a unique identification. 43.2% of the self governments in the sample that have an individual ID use the bar code in 100%. None of the self governments have introduced the RFID chip system. 94.7% of the



responding self governments provide the opportunity to transport the extra waste generated, which is possible with the help of sacks purchased from the service provider.

One of the objectives of the research was to survey the amount of the fee of treating MSW borne by the population at the time of the questionnaires (November 2009) on the area of the sample. The fees were divided into two groups by the method of paying the fee and the averages typical of the groups were calculated. As a result we can see that the basis of payment is the real estate, the average fee is 27600.37 HUF+VAT /year. Regarding the managing fee of one litre waste the smallest amount mentioned was 1.97 Ft, the highest 15.45 Ft.

As expressed in several decisions by the Court of Constitution, the principle of proportion must prevail in contracts on public services. Obviously, in case of the temporarily used real estates the amount of waste generated is smaller than in case of those permanently used. If the self government does not apply a kind of differentiated fee structure on the previous ones, in my opinion it violates the principle of proportion. That is why I was interested if the self governments apply such a structure on the temporarily used real estates that takes the temporal nature of use into consideration. As a result of my survey in case of the temporarily used real estates 54.5% of the respondents have a different fee calculation method. Where the regulation takes the nature of a holiday home into consideration, fee-paying liability covers certain months (usually 6 or 9 months) stipulated by local decrees but I also met such a solution when the self government built the fee in the tax on houses.

In case of the obviously uninhabited real estates the basic question is if there is a possibility to be exempt from the use of the compulsory public service while it is uninhabited. The regulations do not give guidance on the suspension of the fee and its application is at the discretion of the self governments. In case of the examined settlements 79.3% of the self governments provide the opportunity to disregard the charge of the fee.

Altogether 31.2% of the self governments provide the population living there with the opportunity to make use of the exemption from the fee while the majority (68.8%) do not have such an option for the inhabitants. The exemption is allotted for social reasons by the self governments. In case of the settlements examined the condition of using it was to be over 70 years.

A lot more (71%) settlements provide the opportunity of using allowances on paying the fee and 29% of the self governments of the sample do not make it possible for those living there. Here again social factors are considered by the self governments. In some cases I found references to local social decrees about the possibility and extent of using allowances. The most important social factors are age and social situation. If the self governments provide for allowances, they require from the inhabitants to be 65 or 70 or they stipulate the number of persons in the household, where, besides age, to be single is another condition or the number of persons in the household cannot exceed two. The average extent of allowances was 55.27%.

I also examined how differentiate the professionals of the self governments thought the applied fee was. Those questioned think this fee relatively differentiated (average=3.21, where 1= totally undifferentiated, 5= totally differentiated). After that I analysed which fee charging method the specialists thought was the most fair. According to the respondents, the best method was the weight-based charge of fee followed by volume and the sack method when applying the differentiated fee.

Some respondents remarked that the weight-based charge is a theoretically fair model but its implementation in practice induces several problems. The present state of the national machinery was mentioned first, which is not suitable for the weight-based measurement. According to some,

the introduction of the weight-based charge would incur 2-3 times higher fees, that could not be tolerated by the population. Moreover, the introduction of such system always increases the amount of illegal waste disposals-according to the surveys. Another barrier to introducing the differentiated fee is that even when they would, they could not introduce the fee as they are tied by the contract made with the service providers—stated the respondents. These contracts embrace a longer period (10 years) between the parties and 20% of the respondents said that a more differentiated charge of fee was not in the interest of the public service provider.

Regarding the form of paying the fee 86.1% of the settlements charge a service fee and 11.1% of the examined self governments apply the communal tax. Charging the communal tax does not encourage either the decrease of the mixed waste nor the willingness to select. The only advantage that can be mentioned is that if all the waste is transported, the population is not interested in disposing waste illegally.

I also examined that what changes the fee applied at the time of my survey showed when compared to the extent of the fee applied previously. The introduction of the fee in effect has resulted in the following consequences at the settlements: in most cases (39.3%) the introduction of the new fee incurred an increase below 10%. At many places (25%) the extent of the increase did not exceed 5% but the proportion of the settlements where the increase in the fee was between 60-70% is also significant (14.3%). The introduction of the fee in effect resulted in a decrease at only 3.6% of the self governments.

After 17 July 2009 it was prohibited to transport waste into old-fashioned, uninsulated landfills that do not conform to the EU. The theory of “one settlement, one landfill” must finally be taken over by the modern disposing system operating on a regional level. The regional waste management plan of 2003 designated the most important modern landfills by analysing the amounts of the single waste streams. During the construction, the principle that the regional landfills must serve minimum 100 thousand people was heeded. The new landfills are operated as part of the regional waste management system funded by the EU. Three regional systems affects Pest County but the area of the whole county is not totally covered. The extent how the closure of the old landfills affect the settlements concerned was also examined together with the fact if the introduction of the system caused an increase in the distances of transportation. It was also necessary to examine if the higher costs of transportation to modern landfills appeared in the fee and if so, to what extent at the settlements concerned.

Most self governments (68.8%) of the sample did not have to change the place of disposing the waste of the settlement as a consequence of the closure of non-EU conform landfills.

It turns out from the replies that the distances of transportation did not significantly increase. MSW has to be transported to an average of 22.11 km in case of the self governments asked, which depicts a very favourable picture of the region as in case of the newly established systems the objective is not to transport waste farther than 40-50 km in case of any settlements and if it is not feasible, then a transfer station must be established.

73.1% of the responding self governments joined a regional waste management programme. Not every settlement is part of the system to be launched so there are “blank points” in the county.

The most important factor in the increase of the fee was the disposal costs of the landfill followed by inflation and the changes in petrol prices as experts say. It is interesting to note that the specialists did not think the increased distance of transportation a significant factor that increased the fee. The repairing costs of the vehicles appear to play the slightest role in the increase.

I wished to examine the consequences of the settlement's accession to the regional waste management programme on the increase of the fee. That is why a filter condition was built in so only the settlements of the total sample were drawn in the examination that aimed a regional waste management programme. I could conclude that in case of most of these settlements (56.3%) accession to the programme did not result a rise in the public service fee.

Besides leaving the same filter condition I also analysed the extent of the increase of the fee at the settlements that joined a regional programme. (Naturally, the examination covered only the settlements that had joined a regional programme where there was an increase in the fee as a consequence of the accession to the programme).

In the final part of the research on fees I examined how the self governments saw the future trend of the formation of fees if the regional system was to be launched in real on their area as we cannot talk about the operation of the whole system at the time of preparing the dissertation. Most of the self governments (72.4%) count on a further increase due to the future launch of the programme. The self governments predominantly expect a 20% rise but the 45-50% increase was also frequently assumed.

The high number of those not paying the fee causes a significant problem. According to my survey the extent of liabilities is 10.63% of the fee on the average in case of the self governments that have to cope with this problem.

In one part of my research I examined the delinquencies concerning waste related issues in the practice of the self governments. I think it is important to survey as there is a few statistical data on misdemeanour at our disposal both on the levels of counties and nationwide. Misdemeanour procedures in connection with the violation of the local MSW regulations were launched by less than half (43.8%) of the responding self governments.

The number of misdemeanour procedures was lower than 5 in most cases (42.9%) but the proportion of the self governments was more than 20% where the number of delinquencies was between 5-10 and 10-15.

During my research I also wanted to find out the picture that the frequency of misdemeanour procedures shows. It was concluded from the answers that the most frequent reason for launching a misdemeanour procedure was the disposal of not the proper type of waste at a place for selective litter collection. One of the most frequent reasons was piling up household waste, its disposal on a public area or the area of a real estate possessed by someone else together with the fact that illegal municipal solid waste was transported in the public administration area of the settlement. The relatively high values of spread show that the frequency of the occurrence of the single misdemeanour procedures shows a fairly heterogeneous picture among the respondents.

Regarding the extent of the fine levied by the public notary I concluded that mostly fines between 25-30 thousand HUF and 5-10 thousand HUF were levied by the responding self governments. There was no fine levied between 15-20 thousand HUF. The same number of the responding self governments levied fines below 5 thousand HUF and between 10-15 thousand HUF.

The number of delinquencies was below 5 at all settlements where misdemeanour procedures were launched in connection with the violation of the MSW decree.

The experts of most of the responding settlements (60%) estimate the number of illegal landfills below 5 while in case of 17% of the responding settlements this number is between 10-15. In case

of 11%, it is between 5-10. None of the responding settlements was estimated to have more than 30 illegal landfills.

In the final part of my research on self governments I inquired about the present situation of selective waste collection, the possibilities of composting and the solutions to the problems concerning the single waste management problems in the settlement.

The result of this survey shows a favourable picture as 96.4% of the responding settlements have already started selective waste collection. In case of the other self governments it is also working but only on an experimental level. There were no settlements among the respondents without the possibility of selective waste collection.

The most general among the forms of selective waste collection was containers. Part of the settlements combined the containers as a means of selective waste collection with curbside collection while the solution of a waste yard was only rarely used at present.

An important aspect of my survey was to examine how important the experts regard the selective collection of the single waste types. The answers reflect that the collection of PET bottles was the most important, which was marked by all the respondents. Based on the frequency of marking, it is followed by paper (94.4%) and glass bottles (30.6%).

At more than half (64.7%) of the settlements filling in the survey the population have the possibility of composting. Only 11.1% of the settlements, where the inhabitants have the possibility for both composting and selective waste collection, stated that the inhabitants proportionately pay less for the mixed waste. Unfortunately, these numbers show that the decisive part of the self governments do not reward the troubles of selective waste collection.

### **3.2 The survey of the population**

The practice of the self governments in connection with municipal solid waste was in the centre of my research. At the same time, I wanted to examine a few questions from the point of view of the population. That is why a questionnaire was conducted with the participation of the full-time and correspondent students of Szent István University as part of the public. The residence of the persons in the sample (n=500) was in Pest County without exceptions. The survey is not a representative one.

First the subject of my examination was the general satisfaction and opinion of the population concerning waste transportation. In general we can conclude that the respondents of Pest County were relatively satisfied with the entrepreneur or company performing waste transportation (mean=3.65, where 1= not satisfied at all and 5= totally satisfied). The number of respondents totally satisfied was as few (1%) as those totally dissatisfied (9.3%). The most significant problems in connection with the waste transporting entrepreneur or company was that "they do not take away all waste". More than half of the respondents mentioned this quality gap or defect in the service. Impreciseness was also among the most frequent objections together with the lack of modernity. The least significant problem was that the waste collectors transport at bad, disturbing times-according to the respondents.

Most respondents (63.4%) regard the fee for waste transportation too high. The proportion of those who think the fee is appropriate was much smaller (35.5%) while the proportion of those who think the fee they presently pay to their service provider is too low was very minimal (1.1%).

The survey concluded that the most significant part of the respondents (32%) thought that the self government operating in the settlement concerned did not apply a waste transportation fee in line with the amount of generated waste. The proportion of the respondents who feel this proportionate

fee is charged at their settlement does not even reach one quarter (16.5%) of the sample. At the same time, we have to note that the greatest part of those participating in the survey (51.5%) could not tell how their self government set the fee for waste transportation.

On the whole, the respondents think the presently charged fee is rather disproportionate (mean=2.1, where 1= totally disproportionate, 5= totally proportionate) with the amount of generated waste. 61.7% of the respondents evaluated the proportion of waste transportation fee as disproportionate (on a scale ranging from 1 to 5, where 1= totally disproportionate, 5= totally proportionate). 13.8% thought that the fee was rather proportionate and 13% believed it was totally disproportionate. The ratio of those who thought the fee was totally proportionate was 11.5%. A significant part of the members of the sample (82.3%) would make a contract on a smaller bin that at present if they had the chance. In the household of the respondents 80.7 kg, or 105.18 litres of waste are generated per week. The majority (67.8%) feel that the amount of waste generated in their household can be regarded as average. 20% of the respondents of the questionnaire stated that the amount generated in their household was above the average while according to 12.2% of them the amount of waste generated by them was smaller than average.

The examination of the public opinion concerning illegal waste disposal was in the centre of my survey. First I was trying to find an answer if the respondents knew about the existence of an illegal landfill at their settlement. The majority (68.9%) was not aware of an illegal landfill or a heavily polluted area. One-third of the sample (31.1%) replied that there was such landfill at the settlement and they knew it.

It was also my research objective to examine what the population thought about the sanctions and regulations concerning illegal landfills. According to the respondents two points should be highlighted to cut back on illegal waste disposal: one of them is education and another is stricter regulation. These two statements were given the highest mean and, at the same time, the lowest spread values, which refers to the fact that the opinions in connection with these statements correlate. I think it is very important to stress that even according to the respondents basically a social change of opinions would be necessary, whose foundation can be education in general as well as education in nursery schools and at schools. The first and the most important milestone on the way to a social change and a change in the way of thinking and attitudes is education to an environmental-conscious form of behaviour on the long run. However, the answers positively prove the fact that the population would strongly support higher sanctions and the introduction of stricter measures. The third most important point was the increase of the funds of the self governments to abolish illegally disposed waste. The support of the statement, i.e. a more frequent junk clearance would be necessary, was weaker and another one, i.e. operating waste yards would solve the problem was even much weaker.

From the survey on selective waste collection it turned out that the majority of the respondents (92.2%) would take the strains of selective collection but with some conditions. As they stated, the majority would be willing to invest more energy and undertake more tasks to put selective waste collection into practice. 40% of them would switch to selective collection if it did not mean any additional strains. The number of those who would collect waste in this form if they had to pay less fee was small (20.9%) and those who would collect waste selectively in return for money or other reward was even smaller.

I also examined why the population would not take the strains of selective waste collection. The greatest proportion (60%) of the respondents said because "waste was transported so far without this". 20% of them indicated the answer "it would be too complicated" and the same proportion replied that they did not see any point in selective waste collection.

The answers to my question, i.e. how well-informed the population was in connection with the waste management system operating at their settlement, do not give a reason for optimism. Almost half (48.3%) of the respondents did not know if their settlement was a member of a regional system. Based on the replies, the settlements of 14.6% of the respondents belong to a regional waste management system.

### 3.3 Other correlation examinations

In order to perform selective waste collection successfully, we always have to conform to the given situation and choose a proper method. It depends on a lot of factors, e.g. the willingness, attitude, information level of the people, the type of the settlement etc. Collection containers are the most effective at housing estates and other busy downtown areas, in the neighbourhood of shops, public institutions, blocks of flats and roads. They can also be used in case of houses, greenbelts and holiday homes but with different conditions. In case of the curbside collection, the bins and sacks disposed are collected. They can be collected in bulk or by fractions, in which case selection takes place subsequently. Curbside collection is mostly typical of sparsely populated areas as the inhabitants have to go far to reach the bins of the containers. The condition of success is, again, taking the local peculiarities into consideration, to ensure information flow and to survey the exact needs. The two basic forms of selective waste collection, i.e. containers and curbside collection have both advantages and disadvantages. Containers need little room and it is an established method on densely populated areas, where the bins are placed at public places. It needs less time and labour as there is no or just less need for subsequent selection. Its disadvantage is that its positioning is not always satisfactory and sometimes it is far so the population needs to cover a certain distance to reach it and sometimes it is mixed with other types of waste. On the other hand, the curbside collection is better on sparsely populated areas where bins and sacks are placed in front of the houses so there are no distances. The need for room is great here, however, and, as the collection is mixed, subsequent selection requires more time and labour. These methods can be mixed as within one settlement we can find both blocks of flats and houses, as well.

Waste yard is one type of selective waste collection that takes over not only separately collected waste but also other types such as hazardous or special waste (electronic devices, medicine) or bulky waste. For the previous ones there is another special system, e.g. in case of medicine the bins of the pharmacies or the containers for batteries at big shopping centres or certain shops.

In this phase of my research I examined if there was a statistical correlation between the factors, namely, the proportion the houses represent from the total number of real estates at the settlement and the type of selective waste collection chosen by the given settlement.

According to the results of the variance analysis there is not a significant relation between the two examined dimensions (a sig> 0.05) (Table 6).

**Table 6: The correlation between the type of selective waste collection and the proportion of houses**  
(value= significance level)

type of selective waste collection/ proportion of houses at the settlement	waste yard	container	curbside collection
	sig=0.242	sig=0.054	sig=0.091

**From: own calculations, 2009. N=114.** (variance analysis, One-Way-ANOVA, measure levels: proportional and nominal)

I also examined if there was a statistical correlation between the factors, namely, the proportion the blocks of flats represent from the total number of real estates at the settlement and the type of selective waste collection chosen by the given settlement by the same methodology. The results of this examination came to a similar conclusion as the significance values exceeded the level of 0.05 in this case, too (Table 7).

**Table 7: The correlation between the type of selective waste collection and the proportion of blocks of flats**  
(value= significance level)

type of selective waste collection/ proportion of blocks of flats at the settlement	waste yard	container	curbside collection
	sig=0.254	sig=0.012	sig=0.592

**From: own calculations, 2009. N=114.** (variance analysis, One-Way-ANOVA, measure levels: proportional and nominal)

Both results highlighted that during the selective waste collection the self governments of the examined settlements did not consider the type of the settlement whether it consisted of blocks of flats or houses. At settlements where the area predominantly consists of houses, typically the container method is applied.

During my research I also tried to find an answer if there was a statistical correlation between taking the strains of selective waste collection and any of the demographic features of the individuals. The correlation examinations were carried out with the help of the Chi-square trial, according to the results of which I could conclude that neither the qualification, nor the type of residence, age, or not even the financial situation correlated with the examined question. ( $\leq 0,054$  significance levels  $\leq 0,822$ ) All this suggests that the willingness of switching to selective waste collection is not determined by the demographic features of the population, rather the influencing factors are other different things like the way of thinking or environmental dimensions beyond the individual.

I also wanted to find an answer if the amount of the generated waste could correlate with the demographic features of the respondents. The results of the correlation examination made it necessary to draw similar conclusions as in the case of the previous question. ( $\leq 0.137$  significance levels  $\leq 0.946$ ) At the same time, the extent of satisfaction with the presently applied fee of waste transportation correlated with the financial situation of the respondents. According to this correlation those with a higher income (between 120 thousand-200 thousand HUF) were more satisfied with the fee while those living on lower salary (below 80 thousand HUF and between 80 thousand-120 thousand HUF) were less satisfied with the present fee of waste transportation than either the average or those with higher salary. However, other demographic factor did not show a statistical correlation with the extent of satisfaction with the present fee of waste transportation.

### 3.3 New scientific results

1. I statistically justified that there was no tight correlation between the amount of municipal solid waste per capita and the extent of urbanisation as well as population density of the examined areas. Furthermore, the correlation based on pure logics between the amount of waste per capita and the financial situation was not a statistically strong one, either. The same can be stated in connection with the number of retail outlets. Based on the facts above, we can say that H1 hypotheses were partly justified.
2. I pointed out that a significant part of the self governments did not work out an environmental programme applicable on their area and the same can be stated regarding the making of environmental decrees. In many cases the decrees do not comply with the supreme acts at a higher level in the hierarchy of legislation delegating authority to decrees. The biggest problem was the partial absence of the compulsory elements stipulated by law and the frequent appearance of too general regulations disregarding the unique nature of the settlements. Based on these, we can conclude that the hypothesis H2 was not obviously justified.
3. I pointed out that a significant part of the self governments did not allow or regulate the possibility of suspending the fee in waste management. Consequently, the principle of

proportion between service and counter-service is greatly violated regarding the uninhabited real estates.

4. I statistically highlighted that the willingness of switching to selective waste collection was not determined by the demographical features of the population.
5. I pointed out that the real launch of the regional waste management systems would result in a significant increase in fees for the population.

### **3.4 New scientific statements**

1. I concluded that the application of the two-tier fee was very rare in the practice of charging fees of the self governments. The most important reason for quitting the two-tier fee is that the maximum 40% flat-rate type basic fee (for utilisation) stipulated by the decree is not realistic in practice with regards to the fixed costs of public services. The self governments regarded the weight-based charge of fee the fairest practice. At the same time, however, they do not regard it viable as the introduction of the equipment suitable for measuring would incur a significant rise in costs, which would have to be paid by the population. Furthermore, the significant rise in the number of illegal landfills also deters the self governments from introducing such a system. Another reason that ties the self government to the structure applied so far is that they are bound by the contract with the service provider for a long period. We can say that the most frequently used method is the single-tier fee charged on the basis of volume or the number of emptying the bins. The generally applied volume is the 110-or 120-litre bin. Not all the self governments make it possible for the inhabitants to switch to a smaller bin. A significant part of the population think that the self government of their settlement does not charge a waste transportation fee that would be proportionate with the amount of waste. The proportion of the respondents who feel the settlement would apply this proportionate way of charging the fee does not reach one-quarter of the sample. At the same time, we have to see that the greatest part of those taking part in the survey could not say how the waste transportation fee was charged by the self government. Based on these findings, I concluded that the hypothesis H3 was only partly justified.
2. I found that the problems concerning selective collection were in the centre of delinquencies related to waste management settled by the self governments. Most self governments in the country make use of selective waste collection system.
3. Statistically I concluded that the number of delinquencies and malfeasance related to waste management was relatively low. The problems in practice would induce more cases so the hypothesis H4 is not justified.
4. Statistically I showed that there was no justifiable correlation between the type of the settlements and the forms of selective waste collection (container, curbside collection) applied by the self governments. During the selective collection the self governments do not take it into consideration whether the settlements consist of blocks of flats or houses. Typically containers are applied at settlements where houses can be found predominantly. Based on the facts above, the hypothesis H5 is not justified.
5. I also found out that the population was not quite well-informed about the launch and the operation of the new waste management systems.



## 4 CONCLUSIONS AND RECOMMENDATIONS

A statistically justifiable, significant correlation could only partly be detected between the different factors examined and the amount of municipal solid waste. The correlations of the three examined counties could only partly show the correlations expected based on pure logics. Based on my calculations urbanised life cannot be tightly correlated with the waste generation habits of the population. The calculations justify the hypothesis according to which cities are just highlighted from their surroundings because their functions (agglomerations, supply areas) stretch beyond their borders so it can be seen that not only those living there generate waste. The significance of commuting to work is also reflected in the fact that 36% of those employed in Pest County commute from other settlements. The non-significant correlation between the increase in income and the amount of generated waste can be explained by the fact that with the increase in income, the consumption of better quality products also rises. The life cycle of such products is longer so this reduces the amount of waste generated.

In my opinion my research results highlight the great defects regarding the legislative liabilities of self governments. The existence of the legislative defects mentioned above is even graver considering the fact that our environmental protection act, the Ktv. since it entered into effect (on 19 December 1995) –for almost 15 years– assigns the obligation to the self governments to make programmes and regulations.

In connection with the environmental decrees of the self governments examined, a general defect was the problem that the self governments do not take the statements about the unique features of the settlement into consideration when working out a regulation so they do not detail how the settlement would tackle the problem of environmental pollution arising from local conditions or how it would reduce the environmental load affecting its area. In several cases I met such programmes that did not comply with the legal obligations as they did not fully contain the tasks in connection with environmental problems stipulated by law.

Lack of regulation or too generally formulated programmes and decrees have an impact on the settlements in practice besides the fact that they do not comply with the law. The practical significance of these questions is that the inhabitants of the settlements concerned could not obtain enough information on the real problems concerning the environment of the settlement whereas the information on the environment is regarded as public data. If a programme detailing the environmental problems of the settlement is missing, the inhabitants there could not be informed about the problems and dangers affecting their environment due to lack of information. The absence and/or general nature of the decrees result in the situation when the citizens are not totally aware of their rights concerning this field and also the fulfilment of their obligations could not be expected, either.

The picture is more favourable regarding the legislative liabilities of the self governments that took part in the survey concerning waste management. “Only” 7.9% of the self governments did not possess a waste management plan on the basis of the questionnaires. As making plans is also a duty stipulated by law, in my opinion part of the self governments have to make up for the loss in this area, as well.

In connection with the examined waste management plans it can be stated that regarding their content they comply with the requirements outlined by law but at the same time, part of the examined projects there is a serious deficiency. It is (would be) necessary to present the types, amount and origin of the generated, utilised waste on the area by waste streams in the project. Furthermore, information must be supplied about the types of the generated waste and its annual amount, the types and the amount of the accumulated waste as well as the types and the annual

amount of the waste transported in and out of the area. A part of the plans examined provided extremely little information on these questions. Instead of the concrete data in the tables we can meet the sign n. a. (not applicable) so although the plans are adequate regarding their form, they do not provide a guideline to waste management questions in their content so they cannot fulfil their original functions.

The Act on Waste Management has provided an opportunity to apply the two-tier waste management fee since 2008. The direct impact of the regulation is that the public service fee of waste management can also be charged as a sum of partial fees proportionate with the service and the amount of waste stipulated by a local decree of the self government. This way it can cover the operating costs of modern equipment and technologies, which also arise when waste is not treated. Maintenance fee can also be built in the public service fee together with the expenditures of the amortization of facilities and equipment as well as their renovation costs. During my research I experienced the fact that although the opportunity is given to self governments, they are not willing to introduce the two-tier fee. According to the specialists the main barrier to the introduction of the fee is legal regulation. According to the respondents the most important reason for quitting the two-tier fee is that the maximum 40% flat-rate type basic fee (for utilisation) stipulated by the decree is not realistic in practice with regards to the fixed costs of public services. Certain respondents stated that the extent of the basic fee necessary for a modern, updated public service can reach even 70-80% but the population would not tolerate such volume. If the only barrier to the introduction of the fee is law, it is recommended to think over the increase of the threshold level by 10-15%, which would encourage the self governments to introduce it. If several settlements introduced the two-tier fee, the costs of waste management would more likely be at disposal than now and the conditions of a more economical management could also be created. The introduction of the fee would decrease the number of conflicts between the service providers and the public. The acceptance of paying such a fee is higher by the public so it would also increase the willingness to pay.

The survey highlights that the principle of proportion is violated at several points in the fee setting structure of the self governments. Where the self government charges the service fee as a form of communal tax on the inhabitants, the proportionate nature of service-counter-service cannot be interpreted. This type of tax does not take the change in the amount of waste into consideration. During my research –if not too predominantly- I found such settlements where the population does not separately pay waste management fee as it is built in the local tax. This solution does not encourage the inhabitants to decrease the amount of waste generated as it generates the feeling that this service is “free of charge”.

It is also obvious from the research that the respondents regarded the weight-based charge of fee the fairest practice as the principle of proportion could prevail the best in there. At the same time, however, they also agree that at present there is no reality of charging this type of fee in Hungary. The equipment suitable for measuring is very underdeveloped and such great investments would be necessary that would incur a drastic rise in costs. Furthermore, the significant rise in the number of illegal landfills can also be foreseen in such a system. A great part of the self governments regard the fee charged by volume to be the closest to the principle of proportion. The main problem in connection with this is that the service provider does not always make it possible for the public to choose from different bins. During the research I concluded that several settlements faced the problem, namely, that the population had contracted for the smallest volume bin but in fact, they used greater volumes. The problem above could be eliminated by applying different types of electronic identifying systems (bar code, RFID) but, according to my survey, at present very few self governments apply electronic identification systems.

It also violates the principle of proportion when the population has to pay a fee even if they did not generate waste. It expresses the problem of the fee charged on temporarily used real estates and

holiday homes. The change in the situation came with a decision by the ombudsman whereas a modification of the Hgt. stipulates the principle of proportion in case of the temporarily used real estates, as well. During my research it was found out that several self governments did not have a separate system of charging fees for such real estates. Where they have, typically a fee for 6-9 months must be paid on these real estates. It also turned out from my survey that many self governments do not provide the opportunity to stop paying the fee as in general decrees do not regulate it and neither does a supreme source of law oblige them to do so. Another problem is the definition we mean by “temporarily used real estate”. When talking about holiday homes we do not face any problems because from legal point of view holiday home is the real estate which is registered under this name in the land office. But the present legal regulation does not give an adequate answer that would clarify the definition of the temporarily used real estate. The problem outlined above has been verified by my survey conducted in connection with the population of the examined county. The examination clearly has shown that a large segment of the population states that the self governments does not apply proportionate waste fee with the amount of generated waste. The proportion of the respondents who feel their settlement would apply this proportionate way of charging fee does not even reach one-quarter of the sample. At the same time, we also have to see that the greatest part of the participants in the survey could not say how the waste transportation fee applied by their self government was applied.

In my opinion by supplementing the act on waste management, the principle of proportion could be improved. If Hgt. obliged the self governments to dispose of the possibility of suspending the fee, the self governments (service providers) could not charge fees for the period of suspension. The control of this system would belong to the competency of the public notary so that only the inhabitants who obviously do not live in the real estate could make use of suspension.

Containers need little room and it is an established method on densely populated areas, where the bins are placed at public places. It needs less time and labour as there is no or just less need for subsequent selection. Its disadvantage is that its positioning is not always satisfactory and sometimes it is far so the population needs to cover a certain distance to reach it and sometimes it is mixed with other types of waste. On the other hand, the curbside collection is better on sparsely populated areas where bins and sacks are placed in front of the houses so there are no distances. The need for room is great here, however, and, as the collection is mixed, subsequent selection requires more time and labour. I could not show a statistical correlation between the type of the settlements of the self governments examined and the method of collection. The role of curbside collection on the area of the examined self governments is not significant. In the suburbs the self governments should put a greater emphasis on door-to-door collection besides the containers to be more effective.

Almost half of the respondents could not answer if the settlement where they lived was part of any waste management systems. Generally, it can be stated that the population was not well-informed about the new systems to be launched. It is essential for the population to be aware of the changes and developments on their area to create a proper attitude. Self governments should put a great emphasis on proper information spread and should strive that the information is sent to the broadest part of the population. Among others, it is very important to make people aware that the modern, proper management of waste incurs higher costs and this must be paid by the population based on the principle of “the polluter pays”. Self governments should also reach the inhabitants of their settlements via the most possible channels to present the programmes at different forums and events. Various leaflets and media performances can also form the attitude of the public. Moreover, it is also essential that the question be centred in different educational systems. One of the tasks of educational policy is that the topic of modern waste management should appear in the multi-level training systems of the future and disseminate the competencies in connection with this area in a broader stratum of the population.

#### **4.1 Recommendations for the utilisation of the dissertation and further researches**

The research includes such results that can be utilised in legislation with special respect to the suggested modifications of Hgt. The single correlation examinations of the dissertation can also assist the writers of projects in working out waste management plans of different levels. The results of the dissertation can also be recommended to self governments with special regards to the regulation of managing municipal solid waste on the level of the self governments. The results of the survey concerning the population can also serve for orientation in improving the service for the public service providers, non profit mixed businesses as well as entrepreneurs. The results can be built in the curricula of academic course books and courses dealing with the problems of municipal solid waste. The educational centres operating within the framework of regional waste management systems can also make use of the research results and thus a more precise picture can be depicted for the population regarding the topic.

With the inclusion of more significant resources the research can be extended to a regional or national level. Comparative studies can be prepared with the managing projects of municipal solid waste on the self governmental level of different EU member countries. The examination of the further correlations of factors decisive in the generation of municipal solid waste is also possible. The research can be extended to highlight the problems in managing municipal solid waste from the point of view of the public service providers. Moreover, it can also be supplemented by a representative survey of the satisfaction of the population in connection with the public service concerning municipal solid waste.

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## **CURRICULUM VITAE**

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dr. Zoltán Szira was born on 19 March 1975 in Budapest. He finished his secondary school studies at Mátyás Corvin Technical School in Budapest where he was also qualified as an electronic technician besides obtaining the General Certificate of Education.

In 1996 he started his teaching career as a teacher of English at the Department of Languages of Gödöllő Agricultural University. During the time spent there he took part in teaching both general, conversational and Business English courses. He played an active part in working out the professional language exam system of the institution. He also took part in organising language courses and up till now he has been participating in organising and conducting accredited language examinations.

In 2001 he obtained a degree of law at the Faculty of Law of Szeged University and starting from that year he became a colleague of Szent István University Institute of Business Law and Public Administration. At present he is the teacher of Szent István University Institute of Public Administration and Business Law as a senior assistant professor. He teaches the subjects entitled General and Business Law, Basics of Law, Company and corporate law and Labour law. He is responsible for the course entitled Business law in English for foreign students. He takes part in compiling the professional material of different legal subjects and the author or co-author of several university course books. He is a professional writer for the agricultural periodical entitled Agrárhaszon.

He has participated in different international study programmes and exchange programmes (USA, Slovakia, Finland).

He regularly takes part in national and international conferences with presentations or posters.

The following data signal his publication activity: 4 articles in foreign languages and 3 articles in Hungarian that were published in a scientific journal; 7 presentations in a foreign language at scientific conferences published in a conference resume volume; 7 presentations in Hungarian at scientific conferences published in a conference resume volume; 7 printed course books,; 14 articles published in a professional periodical; 4 articles on the Internet.

He has an advanced level language examination in English and in German, as well.