CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE
Faculty of Economics and Management
Department of Economics

DIPLOMA THESIS

System of domestic waste recycling in CR and its effectiveness

Author: Anna Mládková

Diploma thesis supervisor: Doc. Ing. Mansoor Maitah, Ph.D. et Ph.D.

Diploma thesis consultant: Ing. Oldřich Výlupek, Msc. Ph.D.

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DIPLOMA THESIS ASSIGNMENT

Mládková Anna

Economics and Management

Thesis title

System of domestic waste recycling in CR and its effectiveness

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Objectives of thesis

To analyse the system of domestic waste recycling in the Czech Republic. Find out the advantages and disadvatages of it, compare the succesfullness and efectivness of the system, how is it influenced. How people behave in terms of recycling domestic waste and how they are or can be motivated to the right action by various means and predispositions.

Methodology

First part contains the review that describes the systems of sorting and recycling domestic (=municipal) waste. in the Czech Republic. The information is obtained from various internet sites, press, excursions and by own research. The most data are being collected by questionaire distributed to different types of people living in a different places to evaluate what influences their behaviour. The data are going to be processed in suitable programmes for data treatment to formulate the results and consequences and potential approval of the hypotheses.

Schedule for processing

May - September 2013: Collection information to describe and compare the functioning of the two systems

June - November 2013: Collecting statistical data and data treatment

December 2013 - February 2014: Observing results and formulating the final knowledge got by the research

March 2014: Finishing and publishing the master thesis

The proposed extent of the thesis

60-80 pages

Keywords

Domestic waste, recycling, Prague, Czech Republic, sorting waste, public policies, incentives, influencing people's behaviour, motivation

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Recommended information sources

Vivre mieux: Vers une société écologique : 2012 programme d'actions pour les temps qui viennent. Paris: Les petits matins, 2012

Beneš, Bohumil, Ing. et al. Odpadové hospodářství. Praha: Verlag Dashofer, 2012

PEARCE, D.W., TURNER, R.K.: Economics of natural resources and the environment. 1990.

The Diploma Thesis Supervisor

Maitah Mansoor, doc. Ing., Ph.D. et Ph.D.

Thesis Consultant

Ing. Oldřich Výlupek, MSc, Ph.D.

Last date for the submission

March 2014

ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE
Provozně ekonomická fakulta

prof. Ing. Miroslav Svatoš, CSc.
Head of the Department

Ing. Martin Pelikán, Ph.D.
Dean

Prague February 14. 2014

DECLARATION

I hereby declare that I have worked on my Diploma Thesis titled "System of domestic waste recycling in CR and its effectiveness" solely and I have used the literature and sources listed in bibliography.

In Prague, 28th March 2014

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Anna Mládková

ACKNOWLEDGEMENT

I would like to thank to my consultant Ing. Oldřich Výlupek. Msc. Ph.D. for his professional recommendations, suggestions, and help with my Diploma thesis. I want to thank to the thesis supervisor doc. Ing. Mansoor Maitah, Ph.D. et Ph.D. as well.

Next I would like to thank also to Lisette Ibanez for her professional support during my internship in Montpellier.

Thanks also belong to everybody who kindly participated in the social research and filled in my survey.

System of domestic waste recycling in CR and its effectiveness

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Systém recyklace komunálního odpadu v ČR a jeho efektivita

Summary

This thesis is about domestic waste recycling in the Czech Republic. The literature review explains how the recycling of the main components of domestic waste works in general and specifically in the CR. The organisation of the recycling and its facilities within the CR are analysed including the accessibility, utility, policies and rules of the system in general. The second part of the theoretical background speaks about the economic theories describing the consumers' behaviour concerning recycling.

The practical part is based on own research about peoples' recycling habits and opinions. The features of recycling behaviour such as willingness to recycle, reasons of recycling, the intensity and devotion are analysed, discussed and compared with the theory. The main aim is to get known what influences the behaviour of recycling within the Czech Republic, taking into an account the current situation, discuss and evaluate further opportunities and perhaps even formulate some recommendations to improve the situation.

It has been found out the people's awareness of recycling is very good but the scope of recycling among people is not always sufficient. The willingness is high enough but the facilities must be well available and accessible.

Key words

Recycling, domestic waste, paper, plastic, glass, tetra pak, EKO-KOM, motivation, recycling system, recycling nest, consumer behaviour

Shrnutí

Tato práce je o recyklování (třídění) domácího odpadu v České republice. Literární rešerše popisuje jak funguje systém recyklace hlavních složek domácího odpadu obecně i konkrétně v ČR. Organizace recyklování a zejména příslušné vybavení v rámci ČR, jsou analyzovány včetně přístupnosti, užitečnosti a pravidel obecně. Druhá část teoretického základu shrnuje vybrané ekonomické teorie, které popisují chování uživatelů týkajícího se recyklování.

Praktická část je založena na vlastním výzkumu o recyklačních návycích a názorech lidí. Rysy recyklačního chování jako třeba ochota třídit, důvod, proč třídí, v jaké intenzitě a odhodlání jsou rozebrány, diskutovány a porovnávány s teorií. Hlavní cíl je zjistit co

ovlivňuje chování ohledně recyklace v České Republice, vzít v úvahu současnou situaci a zhodnotit další možnosti a možná i formulovat nějaká doporučení ke zlepšení situace.

Bylo zjištěno, že veřejné povědomí o recyklování je velmi dobré, ovšem rozsah třídění není vždy dostatečný. Ochota třídit je dost vysoká, ale je třeba, aby zařízení byla dobře k dispozici a přístupná.

Klíčová slova

Recyklace, domácí odpad, papír, plast, sklo, tetra pak, EKO-KOM, motivace, systém recyklace, recyklační hnízdo, chování spotřebitele

Table of content

1 Introduction

This thesis is about domestic waste recycling system effectiveness in the Czech Republic. The organisation of the domestic waste composition, collection and disposal, notably in the Czech Republic, is described in the first part of the literature review in order to provide an insight into the problematic. Some more specific examples of recycling installations and organisation forms are mentioned as well. More general economic theories considering especially the recycling behaviour of people are reviewed to be discussed later on with the collected data in the practical part.

The practical part is based on social research designed to get to know what influences people to recycle and if so, how much. The response and point of view of the population, the important users of the system, is crucial to evaluating the efficiency and appropriateness of the system regarding the policies, instalments, habits, incentives, etc.

The topic has been chosen because it is quite a topical issue related with the environment protection, which is generally an important task to be solved in today´s world. The field of recycling is an interestingly developing area that is permeating the economy and becoming an attractive subject of doing business. Speaking about today's recycling, the border between ecologic and economic is getting thinner which is necessary to create an environmentally friendly system and society. Recycling is a very current issue often discussed and sometimes undervalued.

The main aim of this thesis is to find out what might influence people to recycle and on what scale. The target is being developed especially by summarising the recycling opportunities in the Czech Republic mainly from the perspectives of the local population.

The social research has been used to collect data about the recycling possibilities, habits, and opinions of Czech citizens. The data evaluation is supposed to reveal some of the recycling patterns considering, among other things, the geographic and demographic indicators.

Some of the assumptions and discussions are based on economic theories connected to consumers' behaviour relative to recycling (i.e. the sorting out the recyclable waste). The investigated data are treated and assessed appropriately in order to prove or disprove the general theory of economic behaviour for the Czech environment as well as to find out some new relevant conclusions. The emerging trends and tendencies are explained at the end of the thesis. The results are discussed and compared to the existing theories.

Potential application of the findings of this research might be used as a basis of policy making concerning recycling facilities and rules.

2 Objectives and methodology

2.1 Objectives

The aim of this thesis is to summarise the system and infrastructure of the domestic waste recycling system in the Czech Republic. The most emphasized are the packaging materials as a crucial fraction of domestic waste. By recycling we mean rather sorting the waste by households. There is described the establishment including the recycling possibilities and facilities of Czech citizens as well as its corporate background. The practical part is rather focused on willingness of people to perform the recycling activities and their opinion on this phenomenon. The important part of the work is social research that is supposed to assess some of the factors influencing people, whether to recycle or not and in what intensity. The policy making suggestions emerge from the results, particularly it is discussed how the found information can be used in amelioration of the recycling domestic waste results.

2.2 Methodology

The professional books, webpages, reports and papers are used to make the literature overview. It is to make a summary of the opportunities of local people in the Czech Republic to dispose their waste correctly. The politics of EKO-KOM is highlighted. The company that represents the international green dot system in the CR is responsible for the disposing and recycling package waste of businesses but in municipalities as well. The system of recycling facilities and its organisation in the country is described. Some legislative and policies are mentioned too.

The practical part is based on social research among people living in the Czech Republic. The respondents from various demographical and geographical groups were asked to fill short questionnaire considering the questions about their recycling habits, opportunities and point of view. The obtained data were processed mainly in Excel and sorted according to many different aspects. Based on the results observed by charts, ratios and other relevant indicators emerging from the data set, the strengths and weaknesses of the Czech domestic waste recycling systems are discussed. The facts about peoples' recycling behaviour patterns resulting from the research are compared with the researches already made elsewhere about this issues.

2.2.1 The research methodology

The aim of this work is to collect information about people who recycle or not, treat and evaluate them and ideally to find out some relations and get know what might be an influencing factor to be better at recycling.

It is not enough to ask only if they recycle or not because the level of recycling varies. In the Czech Republic the recycling system is well developed and people have quite a lot and good opportunities to dispose their domestic waste sustainably. However the circumstances differ place by place, region by region. The questionnaire is supposed to help to find out various factors influencing people's performance and willingness to recycle.

To evaluate the data collected within the questionnaire I used mainly the functions available in Excel. All the gained data were recorded into the spreadsheet and then the comparisons were performed by creating graphs, filtering the values and so forth.

2.2.2 Investigating the information

The own practical results are based on the questionnaire distributed among people. The target group of the research were any adult citizens of the Czech Republic.

At the beginning of the form there is part to get known the social and demographic data. The gender, age, housing type, size of the municipality, education, income and number of household members are required.

After that the crucial question is asked; do you recycle or not? In the case of positive answer the respondents are further asked about what materials do they recycle in general.

Next part inquires whether they know how far is their nearest recycling nest. If they know it they are supposed to choose approximate time distance out of three categories. Following question asks to tick what materials are possible to sort out at the nearest nest and right next to it they are asked to confirm whether they really perform out there.

Finally the respondents are required if they know whether their neighbours recycle or not. The last question asks to explain (by multiple choice question or write their own opinion) why do they recycle or not.

Any other comments and opinions were welcome. The original questionnaire and its English translation are available as the supplements.

Most surveys were printed and distributed personally to the respondents. People seem to take it more seriously when the survey is on a paper than online form. However some of the forms were also sent by email.

3 Literature review

3.1 Definition of waste

Very general definition of waste may represent for example; “Any substance or object the holder discards, intends to discard or is required to discard”. However “Once a substance or object has become waste, it will remain waste until it has been fully recovered and no longer poses a potential threat to environment or to human health”. [1]

3.1.1 Domestic vs. Municipal/Communal waste

Domestic waste is often mixed up with the term of communal waste. Communal or also municipal waste includes any waste emerging from activity of physical persons in a municipality. Therefore the domestic waste, which is refusal from households, is just one fraction. The communal waste is created also by the waste generated from other institutions such as offices, hospitals, schools and even small businesses run by physical persons (i.e. lawyer’s office etc. which is generally similar to domestic waste), but also the rubbish emerging from the public space maintenance; parks and streets. However the domestic and communal waste is used equally. [2,3]

Important fractions of the municipal waste are; solid communal waste, domestic waste, commercial waste, recyclables (secondary matter, package and reversible package), biodegradable waste, volume waste (including old furniture, fridge, mattresses and so forth). The residual communal waste is the inseparable waste after taking any matters that can be further valorised. [3]

On the other hand there is a waste emerging from industries. It is any substance (sometimes dangerous or toxic) coming from the manufacturing and production.

There are many kinds of waste according to its origin and composition, way of treating, disposing and so forth. This thesis is focused on domestic waste. The garbage/waste/trash emerging in households. Domestic waste is significant fraction of total waste.

Considering the waste in general there are various groups; solid waste, liquid waste, e-waste, medical waste, hazardous waste, radioactive waste, organic waste…

The common solid waste consists of these basic categories;

construction waste (one of the highest volume ever), waste generated from other industries and businesses and institutions such as offices or schools; (usually similar to domestic waste), hazardous is any waste material that is dangerous either for the environment but also for the health of people. It is the waste that includes for example; medical waste (the material used during medical care such as injections and needles, bandages, plasters connected with biohazard risk) or radioactive waste (which actually does not belong to common solid waste but represents the important issue within this problematic).

3.1.2 Domestic waste at a glance

Approximately half of the domestic waste and corporate waste similar to domestic waste consists of the package materials. [44]

Most types of packages are recyclables. Those recyclable materials are the base of the recycling system. The packages are composed out of the few basic material such as paper and cartons, tetra pak beverage boxes, different types of plastics, metal cans and last but not least the biodegradable waste.

The citizens of the Czech Republic have quite good recycling system available. Because almost all cities, towns and municipalities are part of the unite system of domestic waste recycling organised by EKO-KOM that is responsible for the waste separation and valorisation. The mechanism of this corporation will be explained later on in the thesis. One of the main features of the EKO-KOM is they provide so called recycling nest on public places everywhere in the country in order to let people separate their garbage as easily and as low cost as possible to encourage the maximum performance and secondary matter gain. The EKO-KOM basically assures paper, plastics, glass, tetra-pack, maybe the metal back collection, sometimes even something more. The widespread public opportunity accessible to anybody to separate the bio-waste is still missing. Let us summarize what are the main components of the waste emerging from people living in their households.

3.1.2.1 Paper

Paper is one of the most present fractions of Czech domestic waste. It comes out of the packages of food and many other consumers' products that are being thrown away at

daily basis as well as the old press, notebooks etc. The paper recycling is very traditional in the Czech Republic. This material has been understood as valuable commodity since long time ago. Even before development and boom of the separating waste tendencies people were used to sell the paper to the collecting yard and primary schools organised the collection competition. However those days people preferred to collect rather the masses of old newspapers or giant box cartoons, not the every piece of paper as we are used to do nowadays. The paper container is available at any recycling nest. [4]

3.1.2.2 Plastics

Other leading packaging material that creates significant part of our garbage is plastics. We find the plastic containers in any recycling nest as well however there might be differences of what is exactly accepted there, according to local opportunities considering logistic and profitability of the collection. Sometimes the nearest recycling factory is too far so it would not be worthy to transport. Many different types of these synthetic materials are frequently used to pack food, beverages, cosmetics and many more for its practical characteristics.

On the other hand the plastic is very harmful for the environment because its decomposition lasts so long. (Plastic bag needs 20-30 years, PET bottle or yogurt cup decomposes in 50-80 years and for example polystyrene never disintegrates). That is why it is very important at least to recycle the plastics already produced and used. [5]

Picture 1: **Different types of plastics are signed by various symbols. The packages are labelled by these signs so are the recycling bins for plastics to make clear what belongs there. Source: EKO-KOM**

Even though there are many different types of plastics with different chemical content and characteristics, there is one unite "yellow" container. We put there any type of plastic materials as foils, PET bottles, plastic bags, cups, boxes… Even though there are slightly different materials all together that are to be further sorted out it is necessary to follow the rules and throw there only the demanded materials (no PVC and other harmful plastics, packages do not need to be washed except the greasy ones etc.) If we want to be even more precise in sorting there exists many opportunities to collect for example covers

of the plastic bottles. This saves lot of work on sorting line and creates cleaner secondary material. [5]

3.1.2.3 Glass

The glass bottles and jars are being replaced in some cases by the more practical and lighter plastic containers however glass still creates significant share of the domestic waste and therefore the glass container is present in all recycling nests. Somewhere they even distinguish the transparent and coloured glass. Considering this in the Czech Republic there still exists efficient deposit system of glass bottles against deposit so that the recycling bins are dedicated to those beverage bottles that cannot be returned, jars, but also the old dishes made of glass or the window glass and any other glass components coming out of households. It is forbidden to spoil the lot by the porcelain or mirror glass. If there are two types of glass bins, it must be sorted according to colours (transparent/coloured). If there is only one container the glass is mixed. The rules might be also adjusted in different regions. It is always necessary check the labels on the recycling nests rubbish bins. [6]

3.1.2.4 Tetra pak

The “magic” box originates form the Swedish company, so does its name. Nowadays more producers make this kind of package that protects perfectly its content, but we use the name in general because it is shorter than the “beverage package”. In the Czech recycling nests the orange container dedicated to its separation is not the matter of fact. As the structure of the box as well as its recycling process is very complicated and the presence of the container is limited by the availability of processing facilities (the procedure will be explained). Sometimes according to labels the people are requested to put the tetra-packs either to plastic or paper bins. They are preferred to use to pack many beverages and liquid food. [7]

3.1.2.5 Metal packages

Speaking about packages as originators of the most significant amount of domestic waste the metal cans and tins are also important. There are plenty of beverages being produced packed in the tins and many kind of conserved food in cans so the amount of metal domestic waste is not at all negligible. However the containers are hardly to find in

the majority of recycling nests. The truth is we can dispose and even sell this waste to the collecting yard, but not everybody would do that and it might be worthy to install these containers right next to the paper and plastic ones to encourage people to do even little bit more effort.

3.1.2.6 Biodegradable waste

Bio waste does not belong among the common group of recycling waste containers included in public recycling nests. But it creates high share of the domestic waste. In general it is not recyclable in an organized manner in the same extent as paper or plastics. People living in the family houses with gardens have better chances to recycle it by managing their own compost which is the best way of valorising the domestic bio waste that normally includes especially rests and skins of the fruit and vegetables, old flowers, and even the most significant part-the greenery emerging from garden maintenance. There are other possibilities of disposing ecologically the bio garbage even when living in flats, but it is rarely seen (e.g. vermicomposter), because it is quite time, space and skills demanding.

There are some possibilities to dispose domestic bio-waste to occasional collections organised by municipality, collecting yards etc. The brown rubbish bin is dedicated to bio-waste but it is still very rare and these possibilities differ town by town. There is still lot of space to improve the collecting performance both on the side of public as well as the municipalities who should be interested in it in order to reduce the bio waste ending on a landfill. It is very harmful for the environment. The decomposition of the compost produced methane which is also responsible for the greenhouse effect. [8]

3.1.2.7 Other types of domestic waste collection

The five components mentioned above are the significant part of domestic waste, however not the only ones. Thinking about domestic waste first comes up to one's mind those five parts because they are being disposed very often, even daily, that is why they create such an important part.

However there might be found many more things in people's garbage. Almost everything we don't want any more can be reused or recycled such as old clothing, electronics, batteries, medicine etc. For those cases there are different companies than

EKO-KOM (but similarly organised) to assure the take back collection of the batteries, textile (usually to reuse it for charity purposes), light bulbs or small electronic devices. Some of these instalments are less frequently right next to the recycling nests (textile, electronics…), some are preferably at shops, school, and some other public places (batteries, light bulbs, medicines…) and actually any kind of trash can be given to the local collecting yard. The yards are first of all dedicated to disposing bulky or dangerous waste that is difficult to get rid of.

Of course we cannot recycle everything and there still rests the residual element of domestic waste comprising of the used napkins, contaminated paper, rests of food and many more. Concluding the domestic waste composition summary we can surely declare that by the recycling we can reduce the amount of our waste very considerably.

3.1.2.8 Domestic waste composition

It is difficult to find out how are all the materials represented in our domestic rubbish bins however such estimations exist. It is different to consider the weight and volume. When regarding the domestic waste content it is more relevant to regard the volume because the material saved by recycling reduces the volume of undesirable landfill. On average the 29.7% of the domestic waste is supposed to be paper, 49.3% plastics, 1.4% glass, 2.3% hazardous waste, 5% bio waste and 12.3% metal. Speaking about the weight the paper creates the 23%, plastics 14%, glass 9%, bio waste 18% etc. [9]

3.2 Definition of recycling

There are many definitions of the term “recycling”. In general it might be explained for example as a process of collection of any material (which would be normally meant to be disposed) and reusing it in various ways in order to reduce consumption energy or any other kind of (mainly natural) resources.

In general there are two main reasons why to recycle; firstly to reduce the usage of raw renewable and non-renewable materials (either to protect the environment or to reduce costs). And secondly to re-use the waste in order to reduce its disposal on a landfill or by incinerating that are the less desirable ways of discarding the solid waste. Indeed the incineration is not necessarily bad because the heat gained can be transformed into energy therefore even reused. However it creates bad elements when burnt and there is still some

ash remaining that represents harmful waste. Legally the valorisation of waste by incineration is economically bearable. [44]

People are not at all united about what might be included into recycling and what not already. Incineration can be sometimes understood as a lower level of recycling because even though the material is reused and valorised to create some more goods that is usable the energy lost is high and the heat is no further recyclable when utilised so the cycle of recycling is closed.

However there exist many definitions. Some explanations consider recycling as the direct re-use of any objects, some of them claim recycling is just re-creation of the used matter. Other descriptions are wider and describe recycling as a repetition of a cycle of anything no matter if it is just re-filling the bottle or production of a new paper out of old newspaper. Many specific definitions automatically connect the word with the recycling of the material collected as waste. When hearing the term "recycling", people imagine automatically the items that are the most typically recycled such as paper, glass or plastics. The word in its metaphorical meaning of the re-processing the disposed waste matter has penetrated (at least in an adjusted form) into many foreign languages; such as Czech "recyklace", French "recyclage" or for example Croatian "Recikliranje".

Usually the word recycling is automatically connected with reusing garbage and often it is supposed to express even the process of sorting and throwing the waste into the specialised recycling containers. This specific meaning of this term should be understood according to the context.

3.2.1 Consuming – using hierarchy

If we describe recycling more specifically as an environmental friendly process of saving resources by re-creating garbage to avoid landfill and incineration, there exist disagreements about what might still be considered as recycling or eventually environmentally positive recycling. Some people believe recycling is just the classical way or reusing the material again and again to reduce the resources; such as the process of glass recycling which is a good example of saving the glass sand which is used for its production. But in this case more significant savings are in term of energy.

Picture 2: **Waste Management Hierarchy according to European Commision's Waste Framework Directive, source: http://ec.europa.eu/environment/waste/framework/**

3.2.1.1 3R concept

3R concept of reuse, reduce, recycle is originally supposed to range the three ways of treating the waste in order that reuse is the most sparing, reduce in the middle and the recycling is the last (still) relevant way of ecological disposal of rubbish. However there are many discussions and doubts based on professional comparing studies that such a hierarchy does not have to be necessarily like this.

For example there was a controversy in the CR whether the returnable glass bottles are more environmentally friendly concept than disposable plastic bottles. In certain assessment made by EU or Austrian Ministry of Environment the returning deposit system of glass bottles harms the nature more than recycling the plastic bottles for the single use. Because the cleaning disinfecting and transporting of heavy, voluminous bottles made of glass costs more energy than transporting and processing the light compressible plastic bottles. Some German studies has proven that some types of plastics are more or equally harmful comparing the reversible bottles system, however such assessments are very complicated and often ambiguous because many different aspects are examined such as consumption of materials, usage of natural space, greenhouse effect, hyperacidity, damages and jeopardise of human health etc.[44, 45]

As we have already suggested the 3R system might be even extended by developing the last level of recycling. There is not recycling like recycling. We can distinguish the recycling where the used material is transformed into the same form, typically the glass. Some materials may be re-created into the slightly different form (every cycle of recycling worsen the quality) such as paper or plastics in some cases. Then we have the tetra-pack

for example that is the one-off packages that means they cannot be re-created in the tetra-pack boxes again. However they are collected to recycling, normally to be chopped and attached into insulation boards. The least desirable way of recycling is the incineration that re-creates any garbage into a very different type of product that is even in different state of aggregation i.e. burning unsorted waste and use the emerging heat to make energy. This final stage might be preceded by one more environmental process of methanization that uses the bio-waste decay to produce energy in form of the bio gas.

The recycling is not at all only about saving the environment, but about saving or even earning money as well. Especially some recyclables are becoming very profitable business nevertheless some other material's recycling is not financially that worthy.

3.2.2 Recycle/recycling definitions

Czech law defines clearly the difference between the valorisation and recycling. Valorisation is more complex term that includes various ways of re-using the waste in order to get some more utility out of it. Valorisation consists of the reuse, recycling, energetic re-use and organic recycling as well. Recycling is material re-use. The produced material can be re-used to its original or different purpose. [10]

The environmentally oriented authors tend to consider the issue of recycling already such as the process of recreating the material that is typically the substance of the waste (e.g. plastic, paper, metal…) This is obvious especially considering the three official stages of green procurement already mentioned as 3R system of reduce, reuse, recycle. If we are interested in this problematic more deeply naturally we perceive that reusing and recycling are different activities so the meaning of recycling term is more specified on the environmentally oriented sources:

"At its very core, recycling is the process of using a material again rather than throwing it away. Through the process of recycling, valuable materials such as plastics, cardboard, paper, and metal are processed into new products in order to keep them out of landfills, reduce energy and water consumption, minimize pollution, and save raw natural resources." [11]

For this thesis the important definition is the one stated by the EU directive about waste that describes recycling as; "any way of usage, which allows the waste become another product, material or substance serving for the original or different purposes. It

includes the reprocessing of organic materials but it does not include the energetic usage and reprocessing for the materials there are to be used as a fuel or backfill material." [11]

In the professional literature that researches the issue of recycling, the term is clearly defined but it varies and depends on the view and background of each author. For example Rik G.M. Pieters describes recycling as: "Recycling basically consists of finding a new function for something that has lost its original function for its first user or of finding a new user. The goal of special treatment is to cause less pollution by treating hazardous waste separately, and differently, from non-hazardous waste." Pieters continues by explaining "The goal of recycling is to use less scarce resources (raw materials) by keeping them in the production and consumption cycle longer." [46]

Further the different types of special treatments considered as recycled are described. Those explanations include second-hand use as well as the resource recovery and even the last possibility of special treatment involving also incineration. We should keep in mind the article was written more than 20 years ago and since the definition, even though it is very descriptive, it might be found obsolete as the technology, understanding and opinions of recycling are changing and developing very dynamically.

definition:	source:
"The collection and often reprocessing of discarded materials for reuse."	scicence.yourdictionary.com
"To treat or process (used or waste materials) so as to make suitable for reuse: *recycling paper to save trees.*"	dictionary.reference.com
"Waste minimization strategy in which reusable materials are recovered from a waste stream, and put to the original or different use."	www.businessdictionary.com
"Convert (waste) into reusable material: car hulks were recycled into new steel"	oxforddictionaries.com
"To change waste materials such as newspapers and bottles so that they can be used again"	www.macmillandictionary.com

Table 1: **Brief definitions found online, author's own elaboration based on stated resources**

The chapter is going to be concluded by one more source. The English word "recycling" can be interpreted as re-evaluation and comes from Greek word "kyklos – cycle". This wide term includes back acquisition of solid, liquid or gaseous states of aggregates and utilisation the waste energy that generally occurs at form of waste heat. In more particular sense of the word recycling it is returning waste into the production

process. Other traditional definition describes recycling as re-use of waste its secondary products or (consumed) final products of consumables as a raw material used for production of new products. [44]

3.3 Principles of recycling

There are many more or less astonishing ways of recycling processes. Every material has different story behind its valorisation. Some types of waste are reproducible into the exactly same matter (glass), some package materials are to be recreated into different products or different materials (plastics used to make tissues, tetra-packs used to create insulation boards).

To be able to subtract the valuable materials out of the domestic waste, there are two options. One is to let people throw their garbage unsorted and perform the triage industrially by using the sorting line. The easier, cheaper and lately even more effective way is to ask people to do some of this work by themselves. In different places all around the world different methods are used.

The compromise between personal sorting each recyclable materials and mechanical triage is so called curb side system functioning in some regions in the USA, where people are asked to sort out just two fractions of the waste; the recyclables and non-recyclables. The boxes containing the bottles, paper, cans etc. are collected and sorted later on. In some regions of southern France there exists for example the yellow container where it is supposed to be collected any package material, so plastic bottles, tetra paks, paper and cartoon packages and tins. On the other hand the plastic foils or yogurt caps are often not collected at all.

The patterns of the material collected and the way of collection highly depend on the local management, presence of the establishment that are able to accept and process certain amount of the waste. This explains the different collecting facilities and infrastructure in different region even though they are in the same country.

Nowadays in the Czech Republic lot of responsibility is entrusted to the citizens. Based on the previous development of education, advertising and getting into consciousness of the locals, people are quite trustworthy to recycle paper, glass, plastics and most of the times even tetra paks into the rubbish bins that are practically everywhere. [12]

Let us briefly explain how the materials collected in recycling bins are processed. In the Czech Republic the main package materials are recycled properly as follows;

3.3.1 Paper processing

Average Czech household separates about 45 kg of paper per year. The newspaper, magazines, paper and cartoon boxes, books, envelopes and office paper are supposed to be put into the blue containers. Dirty or even greasy paper, or book covers do not belong to this section.

The paper collected from the blue paper bins is transported to the final sorting line to sort out different types of paper and remove the residues. The different types are pressed into the packages and passed to the specialised recycling factories or paper mills. Approximately 91% of separated paper is valorised. [13]

The paper is usually re-used as lower quality paper. In paper mills there is a giant tank with water where it is finely mixed. The paper tissues are got rid of paper clips and other non-desired content. The clean mixture is pressed and after drying (and getting rid of its 96% of water) the new sheet of paper is created. This way the paper can be recycled maximally 5-7 times because the paper tissues are getting shorter and shorter. Typical recycled paper products are toilet paper, newspaper etc. Less known products are e.g. building insulation or paper briquettes. Other opportunities are also compost or biogas production.

In the CR collection and separating is quiet well done but unfortunately only 69% of the paper is processed in the country. The rest (more than 240 000 tons) goes abroad mainly to Austria, Slovakia and Germany. There are about 15 paper mills performing the paper recycling in the CR. [14]

3.3.2 Plastics processing

The yellow containers are dedicated to collecting recyclable plastics. Average Czech household separates 24 kg of plastics per year. The content of yellow bins is equally transported to final sorting line to separate various types and remove the refuse. The basic groups of plastics to be separated are; PET, hollow plastic packages, polystyrene and mixed plastics. Each groups I processed separately. The most widespread and also the most

demanded are the PET bottles that are further separated even by colour. Wrongly separated or dirty plastics might serve as alternative fuel in factories later on.

The packets of even 200 kg of plastics are transported to the processing factories where are washed and crushed to be re-created into new plastic material. The regranulates are present in majority of new plastics. Recycled plastics have many possible usages. E.g. the mixed plastics are processed to building or garden elements such as fences, grassing tiles, anti-noise panels etc. The PET bottles are used to create technic textile tissues to produce, carpets, clothing, plastic bags and many more.

The further separation can be done by collecting the plastic covers for the variety of social collections. [15]

3.3.3 Glass recycling

Approximately 27.5 kg of glass emerges every year in normal Czech family. The glass is to be collected to the green container. If there is also the white glass bin it is necessary to separate the transparent and coloured glass.

The glass from the street containers is collected by lorries. However there are only a few final sorting lines in the CR because it is difficult process and for long distances the glass is transported by train or camions. Final sorting lines can be either separated or part of a glass factory. The most important is to carefully remove the solid items (ceramics, porcelain, metallic pieces etc.) These large impurities are removed by hands. After that the glass is crushed and adjusted by using removers and vibration sieves. The tiny contaminations are cleaned by photoelectric sensors to assure high quality of the mixtures.

Re-use of glass waste means huge savings of energy for the glass factories and also an equivalent compensation of the raw material. According to technology, one dose might consist of 60-85% of recycled glass. Shards are heated in the degree of 800-1400°C. The melted down matter is used to blow new glass products. Glass can be recycled unlimitedly without quality and volume decrease. Usually the recycled glass is used to make bottles and other packages but also the fiber glass wool etc. [16]

3.3.4 Tetra paks[1]

In general the tetra-packs are collected into the orange bins. However these are not matter of fact everywhere and it depends on each particular municipality whether the beverage packs are collected into its special container, together with plastics/paper or collected at all. The precise information is always available on the labels. The possibility of recycling depends on the local sorting and processing facilities. In the Czech Republic there are less orange containers than those for glass, paper and plastic. The separation has started later on, in 2004.

This package is composed out of many different materials; the box contains paper, aluminium and polyethylene foil glued together. The recycling can be performed in paper factories by subtracting the paper component to create recycled paper. About 75% of the box consists of high quality paper that is recycled in paper mills. There is also one more technology. The boxes are chopped and pressed together using heat. This product serves as construction insulation thanks to its good thermo-insulation properties and it is normally used for building the ecological houses. Small family house construction requests around 5 tons of these boards which might be gained out of 30,000 of tetra-pack boxes.

Picture 3: **Figure 1 Tetra Pak sustainability claimed by the original producer, source: http://www.packgrowsback.com/en**

In spite of such complicated recycling mode the producers are keeping manufacturing tetra paks. These packages are very practical and have good characteristics

[1] (*Tetra-Pak here is used as a general name for the drink cartons because Tetra-Pack is the name of the most important firm that initiated it, nevertheless there are more different firms nowadays producing this king of packaging.)

that help to save energy and money elsewhere. The package keeps aseptic environment until opened, therefore no bacteria can get there. It allows storing the food/beverage up to 12 month without need of using costly fridges etc. [17,18,19]

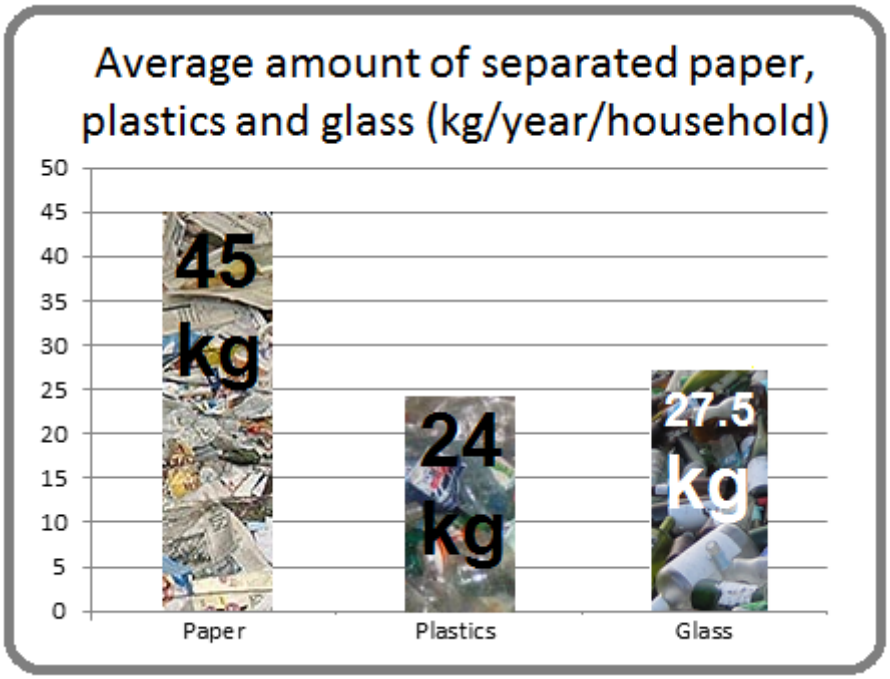


Chart 1: The average household yearly production of the main recyclable waste materials in the CR, author's own graph, data source: www.ekokom.cz

4 Recycling system in the CR description

4.1 Organisation of recycling facilities in the area of the Czech Republic

In the Czech Republic the recycling system is rather centralised by the EKO-KOM; authorised packaging company that represents the green point licence in the country and manages majority of the recycling facilities, while the collection of mixed communal waste is organised by each municipality itself. Nevertheless the system is similar in the whole country even though some issues (such as the one important for us considering the form of paying the service) are different.

Generally the regional waste management is organised by the municipalities and customised in different areas. Anyway all the local organisations of collecting communal waste must comply with the "Waste Management Plan of the Czech Republic" set for 2003-2013. [20]

Different municipalities have different system of waste collection. Still very common system of paying for the domestic garbage collection is the universal charge. It means no matter how much domestic waste a household/person produces the fee is the same for everybody. The amount is settled by the local management office but the Czech law specifies the maximal charge for the mixed waste is 750 CZK per person plus maximum 250 for the recycled waste therefore the garbage fee per capita cannot exceed 1000 CZK. The set charge should be derived from the local waste management costs. [21]

Somewhere the charge is progressive, it means the less mixed waste is produced by the household the less often the garbage bin has to be emptied and the smaller it has to be, so the payment is then naturally lower.

The decision whether implicit the progressive or flat charge is up to management of the town or village. Logically the progressive fee is supposed to motivate people to reduce their domestic waste production by recycling more properly, but often the flat fee is preferred as well. There might be various reasons. It does not necessarily mean the management is against the environmental friendly policies. It can be based on particular local experience. Somewhere they assume the progressive fees might motivate to recycle, elsewhere they prefer the universal fee to avoid illegal landfills.

For example Prague has sophisticated system of progressive waste removal fees.

Different local managements have different perspectives and different needs that even the mixed waste management is adjusted to. There is other different case of approximately 3% of Czech municipalities that do not require any fee for the mixed waste collection. For example the mayor of city of Teplice believes it is not relevant to demand the garbage fees from the citizens because the town directory is supposed to assure such service automatically as it is responsible to furnish public lighting or proper communications. [22]

Price of domestic waste collection in CZK according to volume and frequency							
Collection frequency	1x/2 weeks	1x/week	2x/week	3x/week	4x/week	5x/week	6x/week
Container volume/l							
70	86	153	287	421	555	689	823
80	87	154	283	422	555	689	823
110	103	186	349	513	675	831	1005
120	102	186	335	504	679	802	955
240	163	303	586	829	1101	1285	1593
360	234	427	792	1156	1536	1908	2281
660	425	768	1454	2140	2825	3511	4197
1100	592	1068	2001	2952	3892	4550	5737

Table 2: **Progressive fee for mixed waste removal in Prague, data source: praha.eu**

To summarize it; the Czech municipalities (who are responsible for the domestic waste management) have several choices to get paid for the domestic mixed waste collection.

1. Accept payments for collection, transport, sorting and disposal of the waste form the physical persons base of a contract
2. Communal waste fee, so called the fee for a bin
3. Local fee for the running and maintaining the system – the fee per capita.
4. Abolish the fees and maintain the service from the local budget as other public services. [22]

What for the municipalities charge actually? According to Czech legal system the municipalities are obliged to assure the places to where physical persons can put their communal waste that they produce (including the hazardous waste). They are authorised to demand the appropriate payment for this service. On the other hand the physical persons have to follow the system (including the sorting) of the waste collection. The owner of the real estate is responsible for paying the fee. [23]

4.1.1 EKO-KOM Czech version of Green Point system

The obligation of the proper infrastructure to dispose the different types of waste correctly the EKO-KOM is helpful on the majority of Czech areas.

EKO-KOM makes contracts with the producers, importers and retailers of the packaged goods and the communities and cities. Those subjects are obliged to take responsibility of the packages wastes. Also the municipalities have to assure take back collection of domestic waste, because they are actually its producers within the domestic waste. Because of the vast fraction of domestic waste consists of the packages the municipalities pass the part of their responsibility to EKO-KOM that organises complex national system of take back collection in order to assure appropriate valorisation. [24]

The municipalities pass only the part of their responsibility to EKO-KOM. They have to still organise the collection of the hazardous, bulky waste etc. While the package producers actually get rid of the obligation entirely. Therefore system of the collection works very indirectly. Producers "rely" on the consumers put their package into the proper bin and as the municipalities "rely" on their citizens to dispose the recyclable packages properly and not to put them into mixed waste bins. In spite of the unreliability of the human component of this system it works quite well. People are already aware of the rules and environmental reasons of doing it. But still, there is plenty of space to improve the results.

The awareness and responsibility of the public is researched in the practical part of this thesis.

4.1.1.1 The garbage law in the Czech Republic

In general the Czech law system says that any firm or trader who produces packages or packed goods or who introduces them on the market i.e. imports, fills or sells them is obliged to accept them back in order to re-usage, recycling or elimination. Actually it means the package providers they have to assure the possibility to be taken back. The subject might take care if this itself, transfer to some other subject or transfer the responsibility to EKO-KOM. The municipalities are officially the producers of the packaging waste as well, therefore it is obligatory for them to assure the proper disposing system. The municipality can manage it itself or transfer the obligation to any authorised subject. 6,025 municipalities containing

in total 98% of Czech population are currently subscribed at EKO-KOM. To complete the information the number of enterprises involved in the program is 20,241. [24]

The majority of the municipalities are then covered by this global system. However the EKO-KOM provides the containers for paper, glass and plastics for sure. The other materials such as those for tetra paks, metal cans or two kinds of glass are not the matter of fact and are not placed everywhere. Its presence depends on the effectiveness of the collection, whether there is good possibility to process the collected material or how the town hall is interested in it. The other waste that is possible to recycle or reuse such as bulky waste; electronics etc. are collected by different organisations. In general there are enough possibilities to dispose waste correctly on a sustainable way available for the vast majority of the population. Anyway almost everybody has the chance to separate waste accordingly. However there is always space to improve the accessibility of the collection nests of course. The average walk distance to the nearest recycling nest is 102 metres. However the mean value is always a bit misleading. We can imagine the shortest distances are represented by the high number of giant blocks of flats and on the other hand there are still many rural areas on countryside with the low density of inhabitation and therefore the containers are further in general. [24, 25, 26]

Usually the Czech Republic is mentioned as one of the best European countries in the term of recycling. However some doubts have appeared lately considering the methods of computing the values of recycled share of the garbage generated which supposedly does not express the those numbers correctly. According to studies of EKO-KOM, Czechs are very good at recycling, the calculations of Eurostat are less positive.

4.1.1.2 Collective law fulfilment methods and its rules

Any traders who handle packages anyhow might sign in the EKO-KOM company and transfer them the duty by paying registration fee and the other fees that rely on the amount on produced packages. For every product the fee needs to be paid just once. There is a transferring system similar to Czech VAT system

EKO-KOM takes care of further processing of the recyclable garbage collected into the bins that it supplies. More than 95% of the separated package material is transported to sorting lines where the materials are redistributed to different recycling factories.

By joining the association the town or village gets assured the recycling facilities in their premises. The company also continuously organises the consultancy about the packages issues and does an education and advertising programmes.

The company does not do the recycling itself, but it manages the whole system including administration (e.g. it helps also with the duties of recording the amount of produced packages that is required by the ministry of environment.)

EKO-KOM collects money mainly from the producers of the packages and the cities and communities to be able to provide the recycling facilities and redistribution of the collected waste to relevant recycling companies.

The municipalities are motivated by the EKO-KOM system. They are being rewarded according to the results of collection. Basically they are given some amount of money derived from the amount of waste collected. This money has to be transparently used to environment amelioration projects. Also they can gain special bonuses for quality of their collecting network such as bonus for accessibility, efficiency, etc. Financial rewards are supposed to be used for the purposes connected with local waste management such as educational and informational programmes, consultancy, the collecting system and so forth. [27]

The non-profit joint-stock company assures the fulfilling the duties about back collection of the packages. It assures the sorting, recycling and re-usage of the package material by strategies to connect appropriately the producers of the materials, communities and recycling firms.

Picture 4: **EKO-KOM logo including the united Green dot system source: www.ekokom.cz**

EKO-KOM is included under the European PACKAGING RECOVERY ORGANISATION EUROPE which is the umbrella organisation of the green dot systems of handling package waste in Europe. In other European countries there exists the green dot alternative, called differently but represented by the same logo and covering the similar

rules and responsibilities. Thanks to this united system the equivalent companies can be recognized anywhere.

4.1.1.3 Packaging recovery organisation Europe

The PRO EUROPE company it the umbrella organisation that treats packages and packaging waste recovery and recycling schemes. It uses the "Green Dot" sign as a trademark of which is the licensor. Green Dot serves as a financing symbol used by organisations of recovery, sorting and recycling of sales packaging. It implements producer's responsibility. The symbol represents the producer's duty and its presence in a product claims; the financial contribution has been paid to a qualified national recovery organisation. The system is followed in many European countries.

Picture 5: **Green dot representatives in EU countries, source: www.valorlux.lu**

PRO EUROPE co-operates also with similar systems overseas. The organisation is based in Brussels since 1995. Under PRO EUROPE there are 31 member organisations active in 31 countries. The Green Dot is used by 28 packaging recovery organisations as a financial symbol. There are about 170,000 companies licensed. Approximately 300 million

people have access to separate collection financed by systems that are under PRO EUROPE. Worldwide about 460 billion packages are labelled by the “Green Dot” every year in more than 170 countries. [28]

4.1.1.4 Development of sustainable (domestic) waste management in the CR

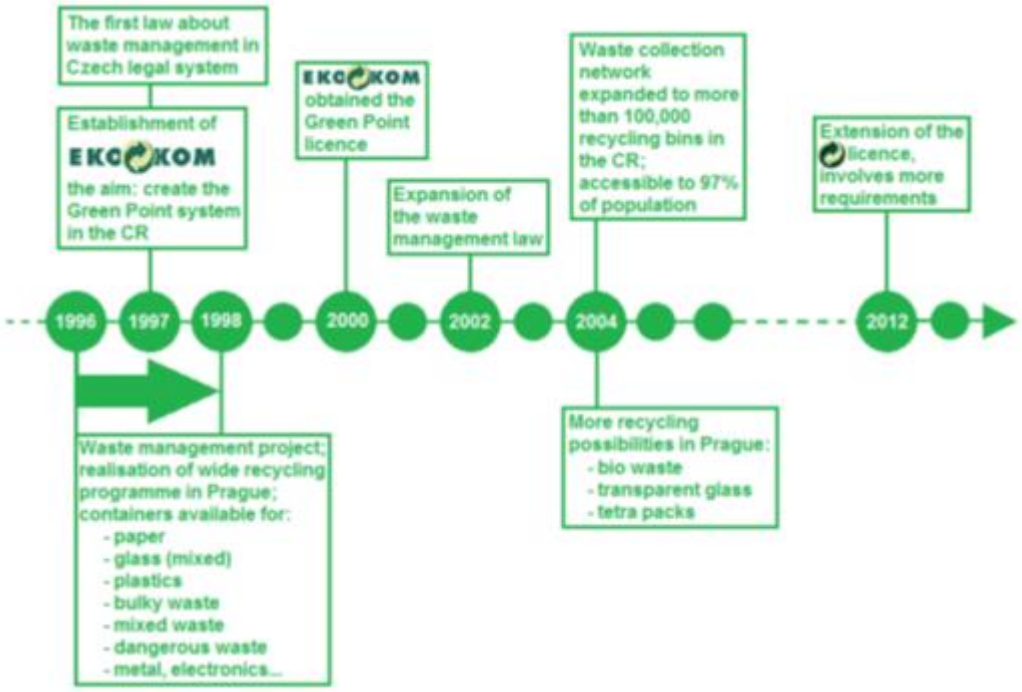
EKO-KOM was founded in 1997 and its aim was to create the local green point system. Those days the company started with experimental programs of sorting systems. The legal frame considering packages was very poor. The firm got licence in 2000. [28, 29, 30]

Czech legal system defines communal waste as any waste produced by natural person in the area of a community. A community has legal obligation to ensure the waste collection, transport, sorting, re-using and disposing.

In the evolution of sustainable waste management the most important is the EKO-KOM company. It was established in 1997; in the same year when the first small law about the waste, the issue of packages was mentioned only in two paragraphs. EKO-KOM was founded with the intention to create national system of the Green Point, which means to get the license from Packaging Recovery Organization Europe to use the label.

Meanwhile in the city of Prague the establishment of recycling facilities network was being performed during 1996-1998. Since then it was possible to sort out paper, glass and plastics; the waste management system classified also bulky waste, mixed waste (i.e. the communal waste, not recycled), dangerous waste and many other specific materials such as metals, electronics, pneumatics etc.

In 1999 EKO-KOM was working on the waste management strategy to fulfil the demands of European Union rules. In the following year EKO-KOM finally got the Green Point licence. The company has started organizing the research and education processes. EKO-KOM got the contracts with firms and communities; 42% of packages and communities with 8 million of people were under their control. In Following years the EKO-KOM gained more and more clients, in 2004 also more than 100 contracts with people who are authorized to handle the waste. The recycling network was being developed. There were more options to recycle, the bin for transparent glass, tetra packs and possibly bio waste were introduced.



Picture 6: **Timeline of the Czech recycling system development, author's own elaboration based on information from www.ekokom.cz**

In 2012 the license was extended, in condition to follow more demanding requirements such as reusing of 80% of the package materials, higher density of the collecting network, information activities that reach at least 90% of population every year and the more advanced education of youth.

The system is expanding, thanks to the effort the 71% packages has been recycled in 2012. The most we recycle paper (85%) and glass (82%). It is estimated that the active recycling is practiced by 70% of population. [29, 31, 32]

4.1.2 EU targets

Czech Republic is also supposed to fulfil the EU-target to recycle 50% of the waste produced by 2020. Considering the current trends this aim will be very difficult to reach because it will require more complex changes of the system. However the recent improvement has been significant. The percentage of recycled domestic waste rose from 1% in 2003 to 14% in 2010. Unfortunately there are some differences in the values and their measurement reported by different subjects. Unfortunately it has been reported that the local calculation in the CR does not correspond with the methods of Eurostat, so the information are often misleading.

One of the current most serious deficiencies in the system is lack of the possibility to sort out the biodegradable waste which creates the majority of the waste produced by households. There is not even any Mechanical Biological Treatment station to recycle the bio-waste in the CR. [51]

4.2 Case study of recycling in Prague

To give an example of recycling system within particular city, the case of Prague will be presented. In spite it is not the typical Czech municipality the capital of Prague is by far biggest city with dense population of about 1,350,000 people. Therefore we assume the recycling system is well designed and functioning.

The majority of waste management in Prague is organised by joint-stock company called Pražské služby a.s. (Prague Services) that does not only manage the collection, processing and reusing of all kinds of waste, but also the cleaning of the public spaces etc. The recycling system is obviously run by organization EKO-KOM that brings people opportunity to dispose their domestic waste in eligible way; particularly the packages made of recyclable materials.

Basically the citizens have two options of what to do with their waste (assuming that majority of the waste is possible to be disposed in a responsible way); they can throw it into black rubbish bins that are paid directly by any owner of a residential propriety or put it into specialised containers or other places.

EKO-KOM provides so called recycling nests. Any recycling nest comprises always the yellow container for plastics, the blue one for paper and the green bin for glass. There are about 4,300 recycling nests in Prague. More than half nests includes also the orange rubbish bin dedicated to tetra pack packages and some of the places even sort the coloured and transparent glass. These containers are available to anyone on the streets.

Speaking about the green container for glass; often there are even two kinds of glass bins; one for the coloured glass and one for the transparent one.

The containers for tetra paks are less often, however in Prague there are numerous.

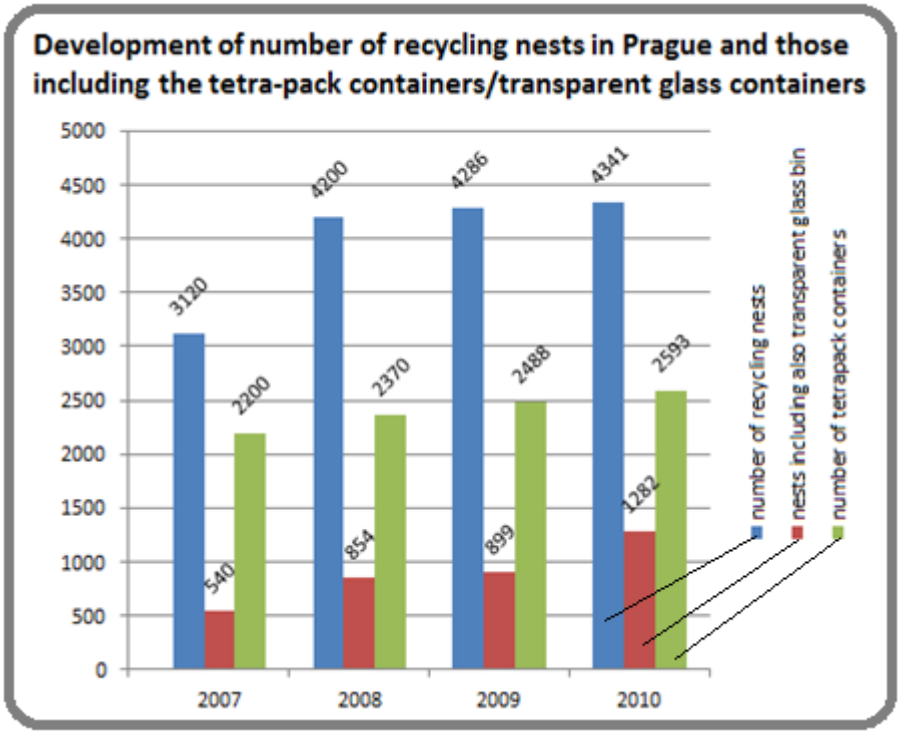


Chart 2: Amount of recycling nests in Prague comparing to those including tetra packs/transparent glass. author's own graph, data source: http://envis.praha-mesto.cz

Considering the paper waste; actually EKO-KOM statistics normally includes into the amount of collected paper also paper disposed in collecting yards (poorly paid) and paper collected during the collection action collecting by primary school. These two ways of collecting are nothing new and have been a significant resource of recyclable paper long time before the establishing of the blue rubbish bins.

EKO-KOM organises the selection of different kinds of materials and its redistribution to diverse recycling processes.

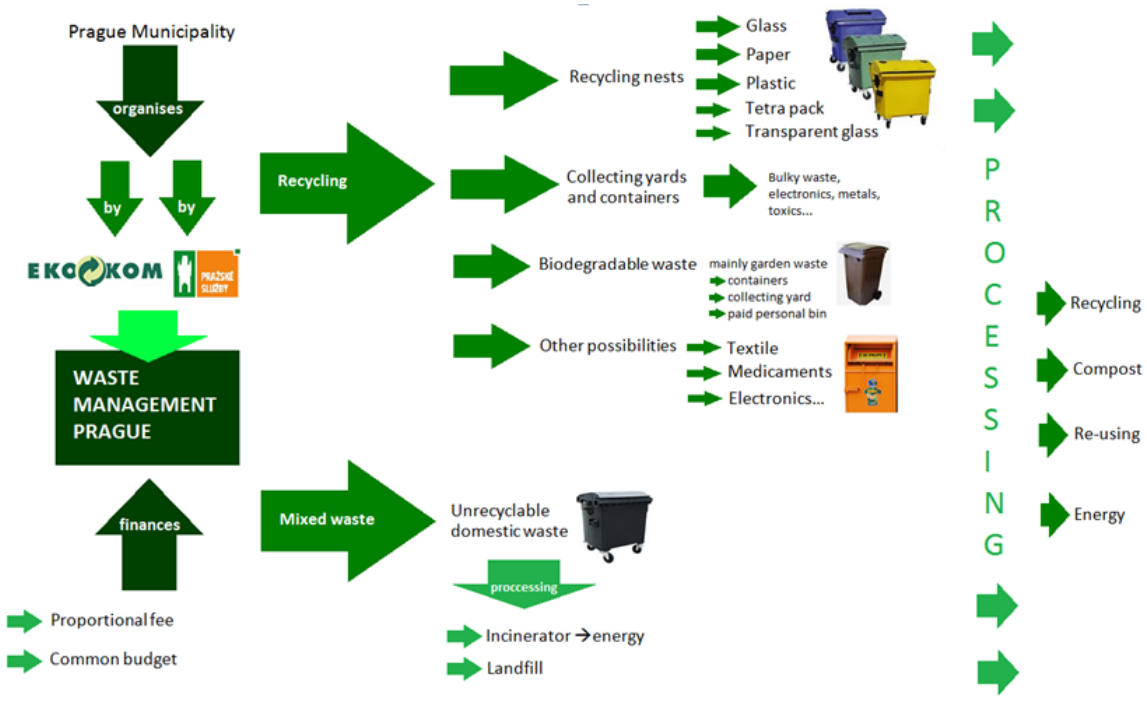
Normally the recycling containers are distributed on public places on the street (average distance to the nearest recycling nest is nowadays 106 m in the Czech Republic).

Recently the collecting bins for aluminium drinking cans have been introduced for a test period. In May 2013 there were 45 containers dispersed in Prague. The project should last until the October and the results will influence the continuation of the project. [32]

4.2.1 Placement of recycling facilities

Prague is a big city with many types of urban areas. Majority of people live in panel houses dispersed mainly in the suburb, there are also smaller apartment buildings, the

historical centre is monument reservation, and due to continual increasing of the surface there are also plenty of countryside like areas. Different types of settlements have their own specific characteristics of the organisation recycling facilities. People living in different areas do not have the same opportunities of recycling. For example the residents of the giant blocks of flats need to step down to get outside of the building where there are usually all the possible containers right next to their paid rubbish bin for the mixed waste, so it is easier for them to put the waste into the correct bin in comparison to residents of family house area who has usually its own black rubbish bin at their house and on the contrary they must walk to reach the nearest recycling nest. In historical centre sometimes the containers are even hidden in the building.



Picture 7: **Scheme of Prague Waste management system, author's own, data source: www.psas.cz, ekokom.cz, envis.cz**

The Pražské služby company assures to its residents the possibility to dispose the bulky and other unusual waste into one of its 8 collecting yards. Normally the service is free. Sometimes people are given (very little) money for the disposed material such as paper of various kinds of metal. It also provides times by time the huge container to throw away high volume objects such as old furniture, mattresses etc. The schedule is organised by the management of each district. [33]

The collection of biodegradable waste is not yet very developed. Usually the giant containers are provided regularly for free during the season of vegetation. There exists also collecting yards specialised for the garden waste. The compost garbage is possible to dispose into special brown waste bins but this service is paid. One Prague district has recently started to distribute the bio garbage bins free of charge to the households but it is just a test operation. There are also some more systems to dispose various used material.

According to positive statistics of separated waste; many people are already aware of the usefulness of sorting out the waste, those would recycle even without any monetary incentives, because they do it mainly for their inner feeling.

However the system offers economic benefits for those who recycle. Throwing the recyclable waste into proper containers reduces the amount of the mixed waste which has to be paid (according to its volume). Anyway the system has many gaps and does not work perfectly, but at least there is a clear intention to encourage recycling. The main imperfection is, that the amount of saved money is not high enough to be worthy to time sacrificed by recycling. So in general the people who recycle do not do it mainly to save money. Secondly; in many kinds of domiciles the waste collection is organised by the proprietor, so the recycling effort of one individual cannot influence the savings. [8]

4.2.2 Mixed waste

The mixed waste collection must be according to law assured by the proprietor of any inhabited building. In the whole city of Prague there are about 113,000 collecting bins. The majority of this waste is transported to Incineration Station Malešice where it is re-used for production of energy. Alternatively the rest is stored into the landfill. In Malešice about 213,400 tons of solid communal waste is processed per year. In the incineration station the amount of the waste is reduced to 10% of its volume. Almost all harmful components remain in an ash which is stored in landfill. By the energetic usage of 215,000 tons of domestic waste we can gain for example heating for 25,000 households, metal for building of 20 km of railway and the building material for 12 km of a road. [8]

4.2.2.1 Local processing paper

Paper from containers is transported to the sorting line which belongs to Pražské služby. The first stage of sorting is cleaning by removing the contaminants which creates

about 9% of the content. The prepared material is given to local but also to foreign paper factories where the technologies allows creating more new paper, carton or cardboard. For example; in 2011 more than 27,000 tons of paper was collected which is 22 kg per capita. 22 kg can be re-used for example for creation of 44 new textbooks. [8]

4.2.2.2 Recycle plastics

The final sorting of local plastics is organized by the EKO-SUN Prague-based company. After removing the contaminants (10 and 15%) the individual commodities are sorted out i.e. PET, polyethylene, polystyrene etc. The separated material is pressed or ground up and redistributed to specialized recycling factories.

The current processing of all types of plastics depends on the actually demand for the given material.

In 2010 in Prague approximately 14,500 tons of plastics were separated which means about 12 kg per capita, 12 kg of plastics can be for example 286 PET bottles. [8]

4.2.2.3 Glass recycling

Glass is transported without being pressed or broken during its manipulation because this would make the following sorting more difficult. The processing of the collected glass is assured by the company that removes normally about 8% contaminants. The glass must be well cleaned then it is crushed to make glass sand that is added into the basic glass mixture.

Since 2004 in certain recycling nests we can separate even coloured and transparent glass. It was a response to demand of the glass processors, because it is not possible to produce transparent glass out of the coloured recycled material. In 2010 in Prague it was separated 11,000 of glass which is the equivalent of the 9 kg per person. [8]

4.2.2.4 Tetra pak

Tetra pack cartons are sorted and pressed into the packages. Then it is distributed to paper factories where the specific layers are separated and the paper fibers of high quality (creating 75% of the whole) are extracted to make a paper. This material can be also used also for the production of board usable as a heating insulation on the buildings which is not happening now because of lack of processing companies in worthy distance to Prague.)

4.2.2.5 Bio waste

Collection of biodegradable waste is emphasized especially on the rests produced on gardens. Normally the Prague municipality assures high volume containers but also there is a possibility to separate the bio into the rubbish bin in any households that orders it. The collected waste goes compost station JENA, nearby the city of Prague. [8]

4.2.2.6 Bulky waste

There is also a stable collecting yard available for Prague citizens. The collection is also focused on the garden waste. It is opened since March to the first half of December. The services to these collecting yards are for free for any permanent residents of Prague. There is a limitation, more than 250 kg of waste cannot be disposed per year per person. According the amount of disposed waste people can obtain compost which is produced out of the collected bio waste. [8]

4.2.3 Disposing the other kinds of waste

Today society produces much more things. The disposability is typical for today consumption. Within the environment protection other collection programmes are necessary to reduce the landfilled mass of waste. There are also special systems to collect used textile, electronics, batteries, light bulbs etc. For example also the producers of any electronic appliances are obliged by the law to accept back their products. Many of them use a system of disposing the gadgets, batteries or light bulbs similar to the structure of EKO-KOM but in much smaller scale. There exist several companies that unite the producers and distributors of this type of waste who pay a fee to transfer their obligation into the specialized company. Let us see how other waste materials are recycled not only in Prague. [8]

4.2.3.1 ECOBAT

ECOBAT s.r.o. is the organization that assures back collection of used batteries. It receives contributions for the companies that produce or distribute portable batteries in the Czech territory. The firm assures a dense net of collecting bins spread mainly in chain stores but also in many other public places all around the country. The non-profit organization than ensures the recycling of this dangerous waste that contains heavy metals

and it is strictly forbidden to dispose it into the communal waste bins. The waste are redistributed into special recycling factories that process the batteries and make new ones using the used ones. ECOBAT has nowadays more than 16,800 places of back collection spots. In 2012 it handled more than 16 million of portable batteries. [34]

4.2.3.2 EKOLAMP

The similar system of collecting network works also for lightings. The EKOLAMP company works on a same bases as EKOBAT. It gives producers an option to fulfil their obligation to assure the re-collection. It unites producers and distributors of many kinds of halogen fluorescent lamps containing harmful components. EKOLAMP has almost 6,000 of places of take back collection in Prague. The collected light bulbs are later on safely processed and recycled ecologically. [35]

4.2.3.3 Collecting of used textile

The used textile products are also significant part of domestic waste. Luckily the system of collecting it is quickly developing. The main purpose of collecting textile is to reuse it. Some charity organisations not only accept it at their site but also provide the special containers among population.

For example the company of POTEX runs 339 containers in the CR placed either at the recycling nests or places like supermarket parking of Prague and other cities. But there are more similar companies. People are asked to dispose preferably reusable clothing to be passed to the humanitarian purposes or sold to second-hands. The essential reason of this project is the reutilisation however the non-reusable textile is recycled. The clothes are torn and chopped and the low quality textile products are made, for example the pipe isolation, floor clothes etc. Some non-recyclable rests are incinerated. Today rarely produced pure natural material clothes can be composted as well. [36, 37]

4.2.3.4 Electronics take-back

The similar system of re-collection and disposal of electronic appliances is assured by the collective system ELEKTROWIN a.s. that takes care of take back collection, reusing and disposal of e-waste such as small and big electronic appliances, machines and tools. [38]

Collective system ASEKOL.s.r.o. is specialized on processing of the electro waste, but only the kind of IT and telecommunication gadgets, toys, leisure time equipment or medical appliances. [39]

4.2.4 Promoting reducing and recycling

It is necessary to keep in people's mind the consciousness about recycling. Globally in the Czech Republic the most significant promotion of recycling habits is performed by EKO-KOM. Except that there are many local companies and institutions trying to assert the ecological behaviour in general. For example in Prague the significant word has also the Pražské Služby companyas well. EKO-KOM has the propagation of recycling as one of its main objectives so it creates plenty of various events to support the knowledge and willingness to recycle within the whole country.

4.2.4.1 EKOKOM effort

The propagation of recycling organised by EKO-KOM is effected mainly by education, media and other various small activities.

The most accessible way is the website jaktridit.cz. There is information about how to separate domestic waste, how works the recycling process etc. The website is comprehensible for anybody and well ranged, not too long. Jaktridit.cz is more likely dedicated to the broad public. There is also more dynamic webpage samosebou.cz that mixes presents the issue of recycling in an interactive way connected with music, films and games. The project is quite new and started in occasion to creating the short films that 'recycle' the classic film genres to bring the message of demolishing the myths about recycling. Some TV spots are even emitted on television.

EKO-KOM provides education about domestic waste recycling. It runs continuously the programs of intervention in primary schools. There are three levels of programme with different amount and proficiency of the information according to age of the children. It means during their basic school studies (age of 6 to 15) pupils should go through by three education programs. There are also seminars organised for primary school teachers. In every region there are at least two such seminars. The education of children and teachers is for free. Professional public might participate every year the 'Waste and Communities conference'. The event involves the more topics, provide exhausting information about the

progress in the problematic and lets meeting the colleagues from the field of waste management. Participation is paid.

EKO-KOM organises or supports many other events that variously promote recycling. There are for example access-free exhibitions about packages and their processing, information stalls promoting recycling in festivals and others.

4.2.4.2 Pražské služby effort

PS also organises supportive events to deepen the public consciousness about recycling. It runs for example traditional school competition in collecting old paper. It coordinates also information point about recycling and handling waste at the fair ‘Den Země’ (the Earth Day) that takes place every year in Prague to remind the environmental issue not only to children and youth.

Recyklohraní is a project organised by the EKO-KOM, EKOBAT, EKOLAMP, ELEKTROWIN etc. supported by ministry of environment. It involves schools into a program of recycling the electronics. There is a competition for schools with an award system for reached results accompanied by the educational education programmes that teach pupils thinking correctly about the waste recycling and its proper disposal. [32, 40, 41, 42, 43]

5 Scientific and theoretical background

Many economists have already studied people's motivation within the recycling. However economic theory is not enough, it is necessary to include some more aspects from psychology and sociology.

People sometimes feel responsible for the environmentally friendly behaviour by themselves, otherwise they need to be motivated and rewarded. Smartly chosen policies can increase the efficiency of recycling activities, but should be designed carefully to do not have contra productive effects.

It is not easy to design optimal policies to maximize the recycling performance. The problem is that we cannot apply any one-size-fits-all rule, because people are not the same. Different regulatory instruments have diverse effect on different people.

Few general terms have been defined to describe the problems occurring in connection to recycling policies design.

Feldman & Perez: The recycling programme can be based either on command and control measures or voluntary programmes. The command and control means that the rules are given and must be followed, the compliance is assured by the taxes, fines or deposit. Voluntary programmes are based on willingness possibly involving some rewards. We can also distinguish economic instruments (including deposit and taxes) and criminal sanctions (that uses fines as a way of coercion). The efficiency of both of these types is influenced a lot also by what the intrinsic and extrinsic motivation of people is. [47]

5.1 The intrinsic vs. extrinsic motivation

To think about the people's willingness to recycle or perform any other environmental activity we should distinguish two types of motivation; intrinsic (that is based on inner feelings of one's moral satisfaction) and extrinsic motivation that makes us doing something in order to get some reward (e.g. monetary). Extrinsic motivation can work very well in certain cases because it makes people perform something they do not even care about. [47]

5.1.1 Warm-glow effect

Generally the reason of intrinsic motivation is characterised as the warm-glow effect. It is simply the pleasant feeling emerging when doing pro-environmental gesture. The nice feeling works as reward. [47]

5.1.2 Crowding-out effect

The conflict of intrinsic and extrinsic motivation is called crowding-out effect. The extrinsic motivation simply pushes out the intrinsic one. People do not want to be rewarded by money for good behaviour. If they are the original inner motivation disappears.[2] Also there was already several times proven the monetary sanctions might work as a tuition for doing something bad, therefore it is understood as forgiven. [47]

The effect of crowding-out is undesirable but quite likely to happen because it is not possible to design a policy that motivates everybody the same way. There are always some people with rather intrinsic or rather extrinsic motivation in particular cases. The crowding out effect can still be mitigated. So called framing or earmarking is the way of calling and explaining things in a nice way, adjusted to the situation. For example when demanding a fee for throwing out the garbage, we can call it "environmental tax" to renew the intrinsic motivation and the feeling of doing something good. [47]

5.1.3 Origin of intrinsic motivation

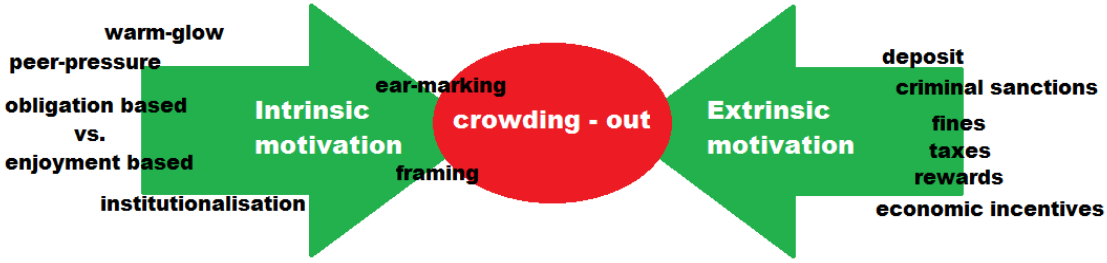
Where the intrinsic motivation comes from? Some theories have been stated. For example the institutionalisation is an assumption that intelligent people with academic background are more likely to have intrinsic motivation to recycle waste and understand some more pro-environmental activities.

Two kinds of intrinsic motivation can be distinguished. There is an enjoyment-based and obligation-based motivation. Enjoyment based is the good feeling we get by doing the green gestures and the obligation based is explained rather by the feeling of responsibility to protect the environment. [47]

[2] An appropriate definition is that generally: "If a person is rewarded for performing an interesting activity, his intrinsic motivation decreases." [50] Gneezy and Rustichinni even specify the theory by claiming "the negative effect is significant only if the reward is contingent on the performance ; subjects who are paid a fixed positive amount, independent of their performance, do not display reduction in intrinsic motivation. " [50]

The ethical values that cause the intrinsic motivation might be also caused by "peer pressure". People care about what others think of them. We might distinct the negative and positive peer-pressure. Negative means we do right things just to avoid social sanctions and the positive is motivated by the recognition of the society. This links to the type of municipality. It is supposed that people living in villages where they know each other are more rather to be affected by the peer-pressure than the inhabitants of big impersonal urban areas. [47]

It is not easy to collect the information about the level of intrinsic/extrinsic motivation of the people to design the most convenient level of tax or other policies however it is useful to take into account all these issues.



Picture 8: **Conflict of intrinsic and extrinsic motivation according to Feldman & Perez, author's own image based on [47]**

Purely economic view suggests that considering the economic theory of utility, the recycling of bottles is quite costly considering the opportunity cost of time (expressed as wage rate sacrificed) we spend by sorting out the waste and carrying it to the special containers.

When creating a policy that functions only by the monetary incentives we need to consider the opportunity costs. Actually the benefit of the consumer is usually higher because it reflects also private values and social norms utility. By studying the case of recycling the plastic bottles by the system of deposit an observation has emerged. The time opportunity cost of returning bottles correctly must be lower than the deposit sum plus private benefits which comprise of the virtue, environmental valuations and averted guilt. [48]

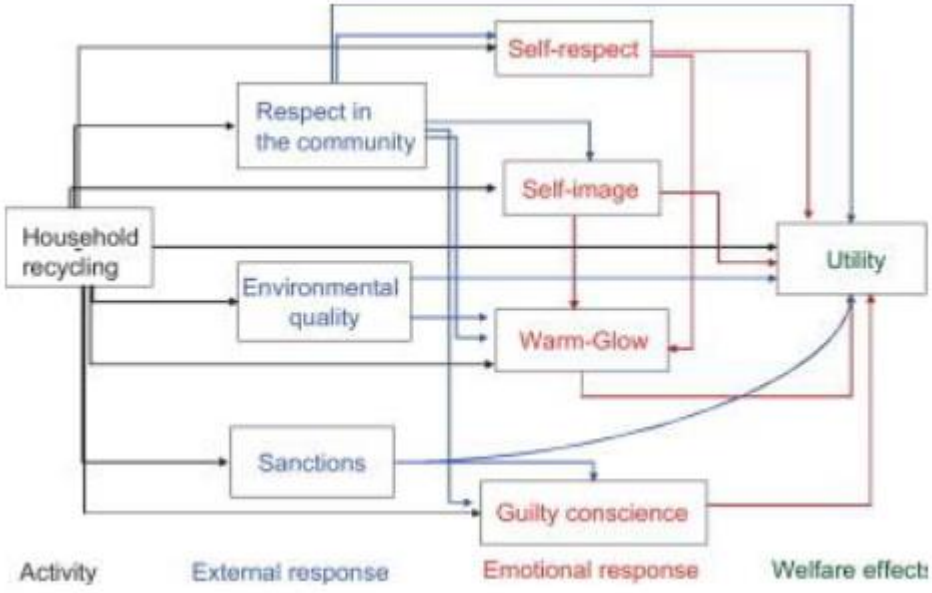
The theory assumes that the linear tendency of these conditions (the more you recycle, the more benefits you gain) makes people decide just whether recycle properly or not at all. Therefore it suggests there is not going to be many people who recycle only a

little bit or time by time. More likely there would be diligent recycles or non-recycles. But naturally this depends on the level of income and how much one cares of the environment. [48]

5.2 Utility and opportunity costs of recycling

According to other study of the incentives of recycling introduced by Bente Halvorsen the household recycling is affected by opportunity cost spent on recycling activities. Monetary incentives are often in conflict with the presence of social norms, because the combination of these two factors can provoke the warm-glow effect. However the final recycling behaviour is very influenced by various cultural background which is different over the countries.

Picture 9 shows the scheme of the possible factors assuring the utility of households.



Picture 9: **Main effect on utility of household recycling according to Halvorsen, source: [49]**

Each household decides how much recycling effort they make to maximize their utility. Its value depends on how high or low is their moral commitment. Normally there are people with low or high social commitment. If it is low people recycle only as long as it costs them almost nothing. The strength of the norm is important too. The stronger the norm is, the more effort people need to make in order to get the desired level of utility. [49]

Other author agrees; when creating a policy that functions only by the monetary incentives we need to consider the opportunity cost. Actually the benefit of the consumer is

usually higher because it reflects also private values and social norms utility. By studying the case of recycling the plastic bottles by the system of deposit an observation has emerged. The time opportunity cost of returning bottles correctly must be lower than the deposit sum plus private benefits which comprise of the virtue, environmental valuations and averted guilt. [48]

6 Results & discussion

6.1.1.1 Characteristics of the gained population sample

Totally 138 survey forms were collected. 118 of them claimed they recycle and 20 claimed they do not. Some of the demographic indications are appropriately represented some are not very well proportioned.

6.1.1.2 Recyclers vs. non-recyclers

Out of our sample it was figured out all the 138 people 86% recycle and 14% do not. According to EKO-KOM's data for 2012 the 70% of Czech population recycle actively. [24]

The results of the survey are slightly different but it is probably caused by insufficient representativeness of the used sample.

Actually there are 118 recyclers and 20 non-recyclers. 20 persons is too small result to derive some general factors influencing recycling performance. Therefore the common signs of recyclers that have been found out seem to be more relevant.

6.1.1.3 Gender

The sample consists of 68 men and 70 women (49.3% and 50.7%). The following chart shows the proportion of men and women among recyclers and non-recyclers. In general it seems the non-recyclers are more likely to be men.

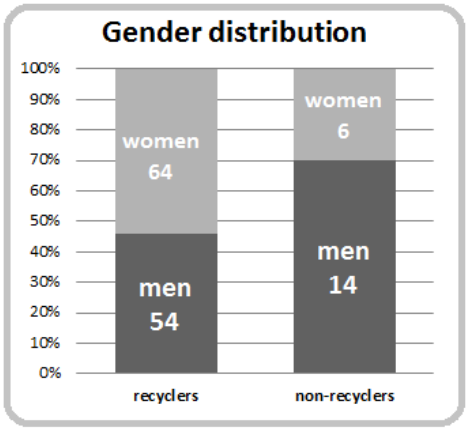


Chart 3: Gender distribution of the respondents of the recycling survey, author's own elaboration

6.1.1.4 Age

Majority (60%) of the sample are people between the age of 21-30. It is convenient at least because the young generation concerns the most the results of the environmental issues such as recycling.

The age does not seem to influence recycling habits a lot. The proportion of age groups is more less the same at the both of them (recyclers and non-recyclers). There is only one significant difference; at the non-recyclers' group there are 25% of people from the age group of 31-40 compared to 9% of recyclers.

6.1.1.5 Region

The significant fraction of the respondents (54%) is from Prague or Brno, the two biggest Czech cities. Almost 20% respondents are from a village with less than 3000 people. Nevertheless 7 choices according to number of inhabitants in the municipality was offered, there is a chart to show such demographic structure of recyclers vs. non-recyclers. The multiple choice question concerning the region was more detailed in the questionnaire however the more brief partition seems to be relevant. The following pie charts no 4. show the structure of respondent according to the size of a municipality where they live.

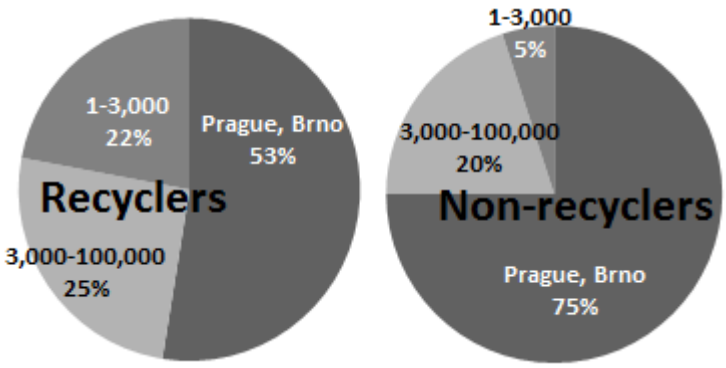


Chart 4: Recyclers vs. non-recyclers distribution according to size of their municipality, author's own elaboration according to the survey results

6.1.1.6 Education

The tertiary education (done or in the course) prevail among all the respondents. Anyway basically the following two pie charts prove the effect of institutionalisation that

was already mentioned above because the proportion of tertiary educated people is higher at recyclers than non-recyclers.[3]

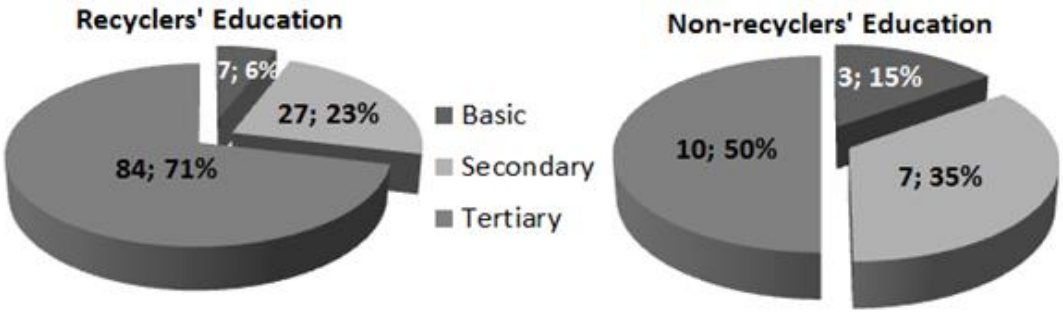


Chart 5: The level of education of recyclers vs. non-recyclers, authors own elaboration according to the survey results

The pie charts 5 above show the comparisons of proportions of people according to the different levels of education. It proves that people with the tertiary education are more likely willing to recycle. Within policy making this might be implicated for example to put more recycling bins and the bins allowing to sort more materials near the universities or any other academic institutions such as to quarters where a lot of intelligent people live. There the potential of such facilities might be exploited more than somewhere else where less educated inhabitants prevail.

[3] The institutionalisation says people with higher education tend to recycle more because they are more aware of environmental issues. However as it was already mentioned, that the amount of non-recyclers are not in sufficiently high to be able to derive conclusions that are relevant enough. [47]

6.1.1.7 Income group

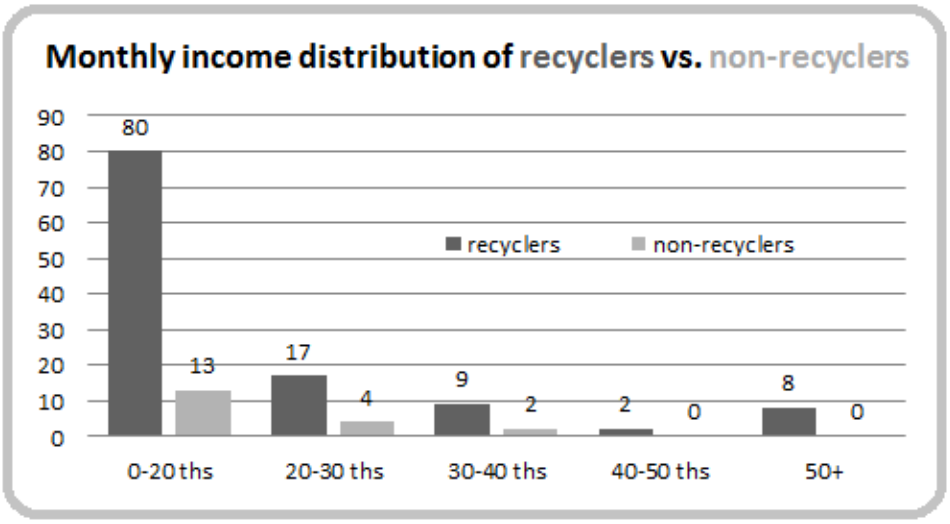


Chart 6: Income groups representation within the survey respondents, authors own elaboration according to the survey results

Majority of the respondents are from the lowest income group. That is unfortunately caused by the age structure and the fact many of them are students. The chart proves that making conclusions based on the income group distribution among the investigated population sample is not relevant because the vast majority of respondent gains up to 20k CZK.

6.1.1.8 Household type

More respondents have answered they live in a flat than the family house. However, as we can see in the following pie charts 7 more non-recyclers live in a flat than recyclers. Therefore we can conclude out of our sample the recyclers live more likely in a family house whilst the non-recyclers live rather in a flat.

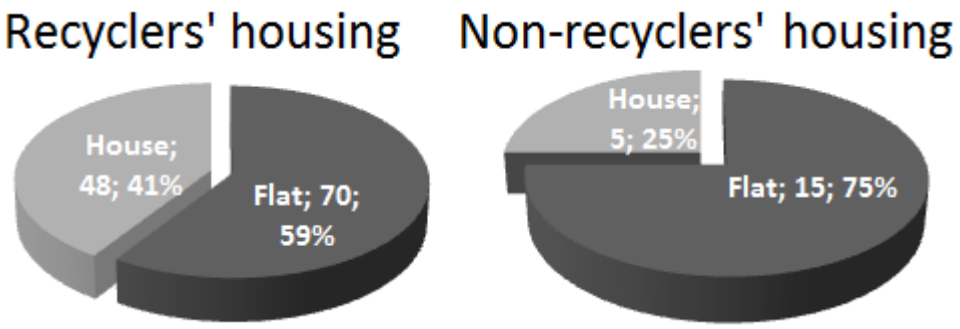


Chart 7: Housing type of recycler comparing to non-recyclers, authors own elaboration according to the survey results

On the other hand according to the research the number of household members does not affect the recycling attitude because there is a similar distribution of recyclers and non-recyclers living alone and sharing the apartment with others. On the pie charts 8 the percentages can be compared and it is almost the same.

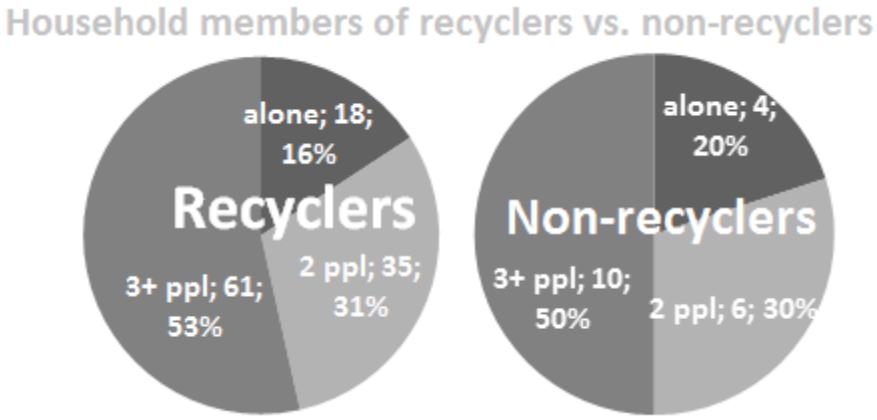


Chart 8: Number of household members, recyclers vs. non-recyclers, author's own elaboration according to the survey results

The presence of the other people in the household seems to be quite important because almost 20% of recyclers that do not live alone stated (usually also among other things) they recycle because they adapt habits of the others at home.

6.1.1.9 Distance to the nearest recycling nest

Distance to the nearest recycling spot seems to be an influencing factor. The respondents were asked how far it is to their nearest recycling nest expressed by number of minutes, because it is more legit considering the issue of opportunity costs. The majority (43%) or recyclers has optioned it is 1-3 minutes from their home. More 36% of recyclers

have it even closer; 0-1 minute and only 22 recyclers (19%) has it 3 and more minutes far. It might suggest that people are willing to recycle more likely if they have the facilities closer. In the CR the density of recycling nests is quite high. However it is very unequal in the different regions. What about non recyclers; on the following pie charts you can see that the proportion of different distances to the containers is very similar. It suggests the walking distance to the recycling nests does not influence the recycling performance anyhow. (Except some non-recyclers do not even know where it is.)

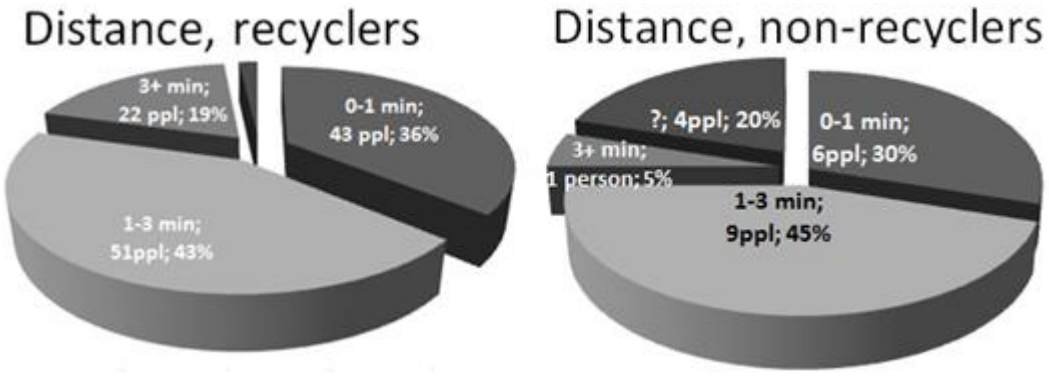


Chart 9: Distance to the nearest recycling containers: recyclers vs non-recyclers, author's own elaboration based on the survey results

6.1.1.10 Compost

The type of household can significantly influence at least the separation of the bio-waste. It has been proven by the research that the 76% of recyclers that separate even compost live in a family house. Probably that is because they have a garden available. Only one recycler has indicated the bio waste rubbish bin is at the nearest recycling nest. There is a lot of space for the municipalities to provide rubbish bins to biodegradable waste among those for paper etc. Because 7% of recyclers that were able to express what kind of waste they produce the most said it was the bio waste.

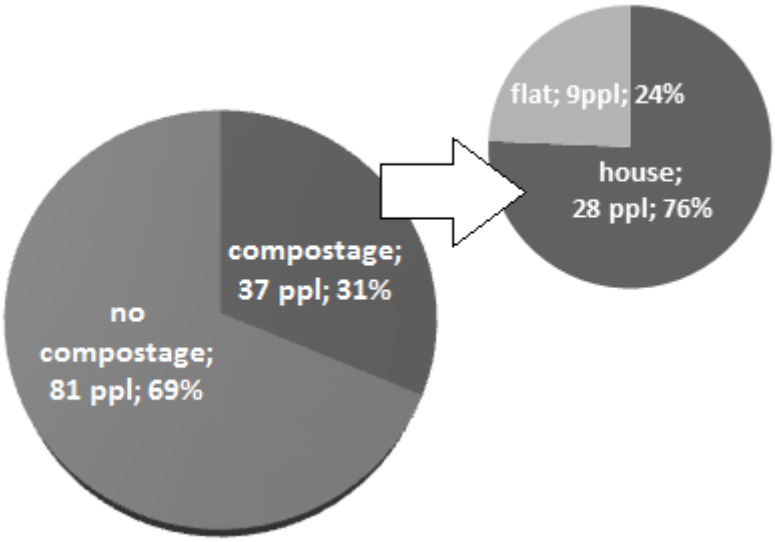


Chart 10: People living in a family house (with a garden) are more likely to recycle bio degradable waste, author's own elaboration based on the research

6.1.1.11 What the recyclers actually recycle

Indicating oneself as a recycle does not necessarily mean the person is a diligent recycler. The chart 11 summarises what all the recyclers actually recycle. The first column represents how many people (out of the 118 recyclers) recycle the particular type of waste. The percentage of the whole group of the recyclers is indicated as well. The graph allows us to see that naturally people are most used to recycle the three most common wastes; paper, plastics and glass. The tetra paks are worse off probably because lower number of facilities. People are generally lazy to find the information about the recycling opportunities so they tend to do only the most easy and accessible part of recycling to comfort their feeling of responsibility.

It is actually not very appropriate compare the peoples' habitude to recycle the electronics and paper because both types of waste have different characteristics, it is disposed in different frequency etc. However all those wastes are included into the research because it is necessary to care about those items as well in order to protect the environment.

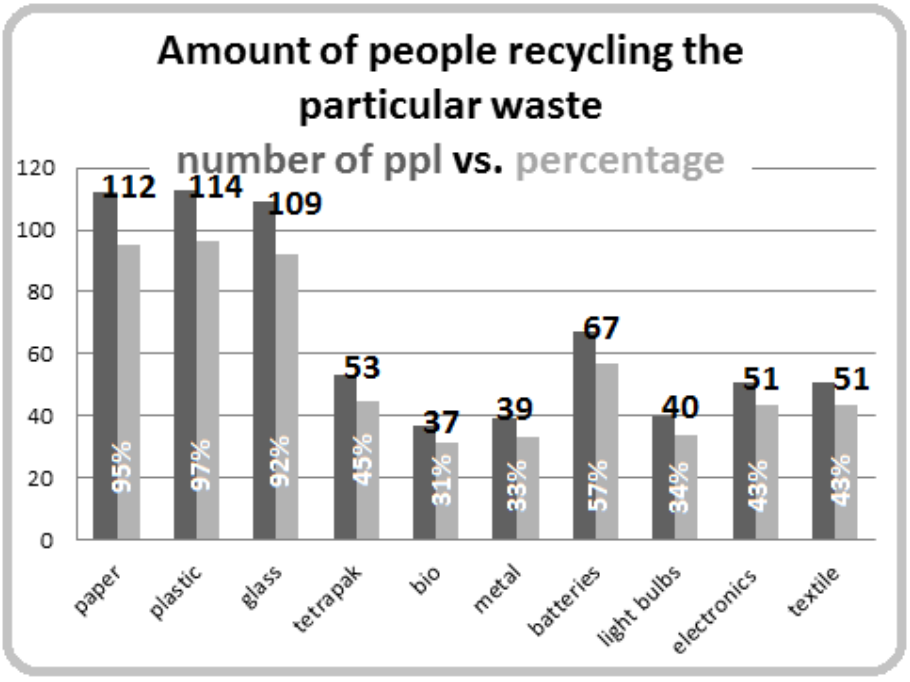


Chart 11: Amount of people who recycle the particular waste, author's own elaboration based on data from the survey

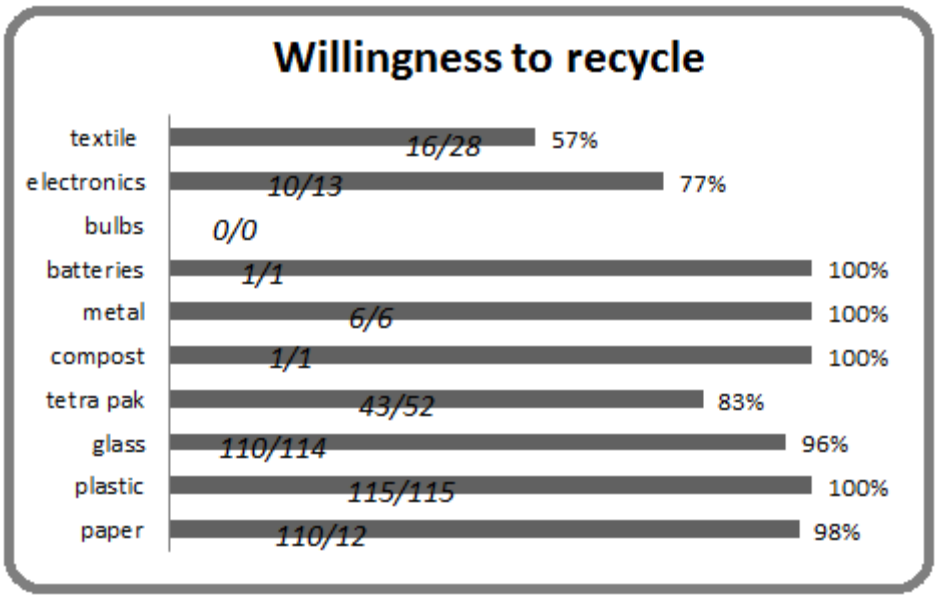


Chart 12: Willingness to recycle; shows the percentage of the people that indicated they have the container at their nearest recycling nest and they really use it to recycle. The numbers in italics indicate the number of people recycling the type of waste when it

Let us see the same issue from another facet. While the chart above shows what recyclers recycle in general no matter where, the chart no.12 illustrates the more particular

information concerning the nearest availability to dispose particular types of waste. The willingness to recycle investigates rather the tendency of people to adapt themselves to the surrounding conditions while the number of people recycling is more general and can include also the feeling of responsibility of people that are willing to recycle even when it is more complicated.

6.1.1.12 Availability of the recycling facilities

By the performed research in general it was proven that if people have the recycling bins available they adapt themselves and recycle those items more likely and more easily. Let us look at the same problem from one more perspective by exploring one more particular case of recycling nests availability in the city of Prague.

According to Pražské služby data there are currently about 3,200 recycling nests to dispose at least the three basic recyclable items; (paper, glass and plastics) in the city of Prague. At approximately the half of these recycling nests there are also individual bins for tetra paks. The tetra paks are often accepted in the bins for paper or plastic but not everybody is aware of it and the label claiming this information is usually very unobtrusive.

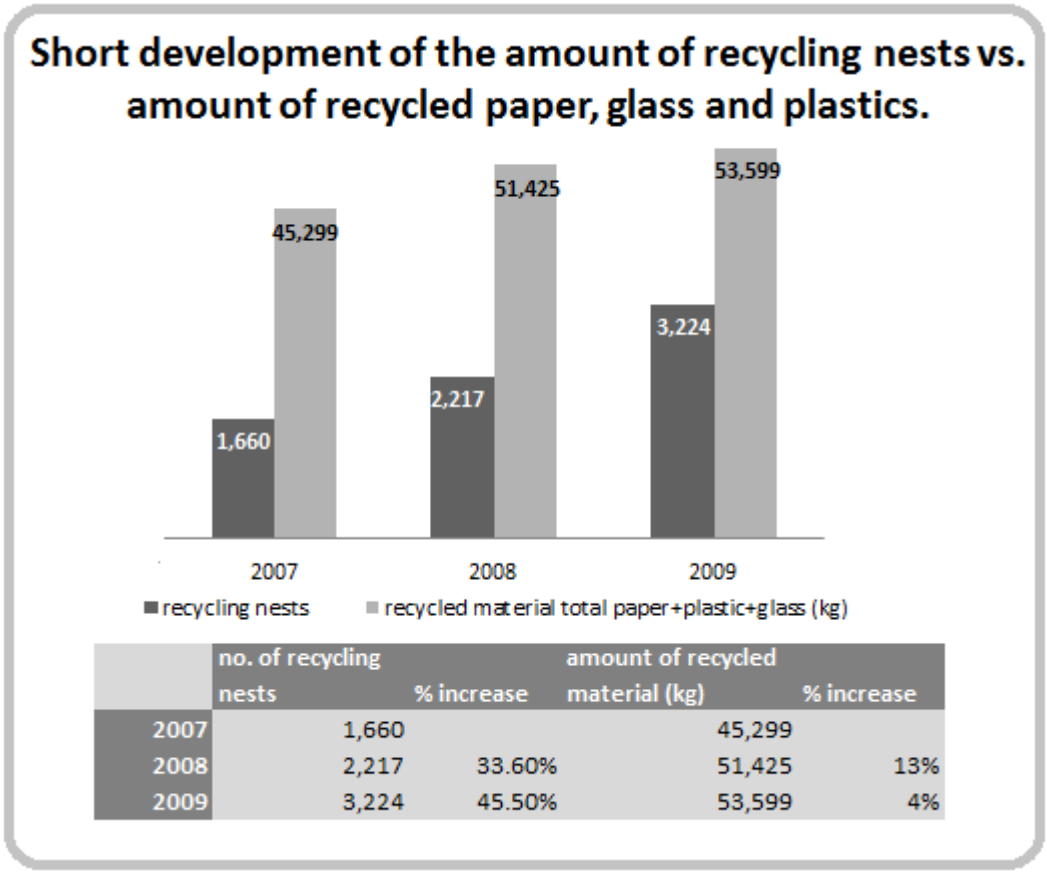
If we reduce our research sample and consider only the Prague citizens we can notice that out of 52 of Prague based recyclers the 49 recycle at least paper, plastics and glass. Only 26 (slightly more than 50%) recyclers sorts out the three items plus the tetra paks. It corresponds very well with the information there is just half of the nests including the separated bin.

Only one citizen of Prague has a bin for metal available at the nearest nest. 12 people form Prague recycle the metal rubbish. It is not so low number comparing the bins available however it could be much more if the facilities were more frequent. The vast majority of people (including the whole country) who claimed they have some recycling bin available are also willing to recycle there.

It seems that the more comfortably equipped the recycling nests are, the more likely people recycle properly. It has to be clear what for the bins are. Then people might get used to recycle even more. The graph 21 shows us how many percent of people who have the container available at the nearest nest are actually using it and recycle the items there.

The shares are quite high especially at the most important materials. It suggests also the more facilities available the more garbage is separated

Also the officially available data shows the more bins available the more waste collected and separated. Let us prove it by simple graph based on data considering Prague as well. The chart shows us short development of how many recycling nests were place all around the Prague (dark grey columns) and the development of total weight of the three main recycled materials recycled (i.e. paper, plastics and glass).The chart shows clearly that when the number of recycling nests available is increasing the results of recycling are also better. However in the table we can see it the increments of the both numbers does not correlate very much. In 2008 the number of recycling nests increased by 33.6% but the amount recycled grown only by 13%. The following year the difference is even more irrelevant because after increasing the number of the nests by 45.5% the recycled amount was only 4% higher.



	no. of recycling nests	% increase	amount of recycled material (kg)	% increase
2007	1,660		45,299	
2008	2,217	33.60%	51,425	13%
2009	3,224	45.50%	53,599	4%

Chart 13: The dependency of the collected waste on the number of containers available. Own graph based on data from: envis.praha-mesto.cz

6.1.1.13 Composition of the people's garbage bins

Even though the respondents were asked to mark the material they think they produce the most and therefore dispose and recycle the most. Only 28% have answered (33 recyclers out of 118). Out of these 33 answers the most often chosen was plastic that was marked 18 times. The second place took the paper with 11 votes. One person ticked the glass and 3 people chose the bio waste.

6.1.1.14 Why people recycle

Let us see what the respondents claimed as a reason of recycling/non-recycling. Just to remind, there was a multiple choice question in the survey; Why do you/don't you recycle?

And the proposed answers were: I save the environment, others recycle as well, I adapt my flatmates, I do not care, I do not have appropriate conditions, I am too lazy, I find it pointless, other. Choosing more options was possible.

The vast majority of 118 recyclers have chosen at least one of their options as I save the environment. 20 people adjust their behaviour to other members of a household and 14 of them admit they recycle because "everyone" does it as well. Somebody has added something more or specified their opinion. 5 intrinsic motivation was formulated uniquely such as "Good feeling" or "It is correct". 2 people said they do it also for the financial savings and 3 people emphasized the practical reasons such as, "The garbage bin is not filled in so quickly". Surprisingly 3 recyclers still believes it is pointless to recycle is spite of this option was suggested rather to non-recyclers.

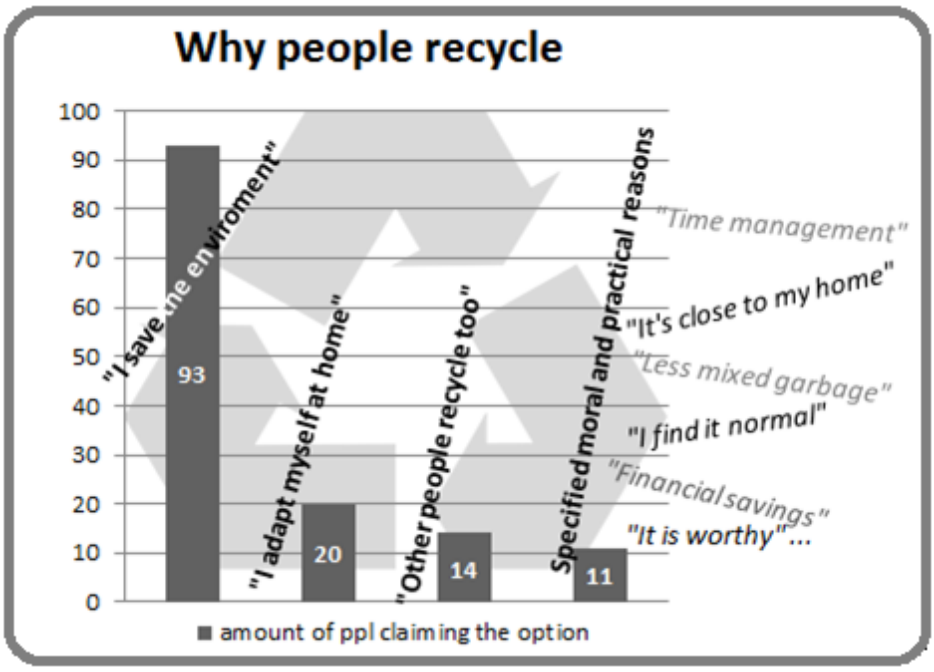


Chart 14: Why people recycle; reasons stated in the survey, author's own elaboration based on surveyed data

6.1.1.15 Why people do not recycle

Out of 20 non-recyclers the mostly chosen reason of non-recycling was "I am too lazy" stated by 6 people. 4 people replied they do not believe it is worthy and four do not have good conditions. Some unique responses were identified such as: "I paid already for the mixed waste" or "I don't enjoy it".

6.1.1.16 Peer-pressure

People care about what others think of them. We might distinct the negative and positive peer-pressure. Negative means we do right things just to avoid social sanctions and the positive is motivated by the recognition of the society. This links to the type of municipality. It is supposed that people living in villages where they know each other are more rather to be affected by the peer-pressure than the inhabitants of big impersonal urban areas. [47]

Considering the phenomenon of peer-pressure we can take into account the consciousness of people whether their neighbours sort the waste or not, or number of the household members in case that they have indicated they recycle because they adapt themselves to them.

Unfortunately the majority of respondents have stated they do not know it. Anyway 35 of the recyclers have answered their neighbours recycle and 5 that they do not. Out of the 20 non-recyclers 4 know their neighbours recycle and only 1 said they do not. It seems the people are more likely to notice the neighbours recycle than the opposite.

Considerable number of people (14) has also stated they recycle (not only) because of other people recycle as well, it has just become a social habit that is polite to follow.

6.1.1.17 Expected dependencies

There might be found out some more points of interest in the spreadsheet filled with the data considering the recycling habits of different group of people.

It might be expected that for example women recycle more textile because normally they dispose more of clothes than men. However our sample does not prove this idea. According to the collected data 42% of females recycle also the textile comparing to 44% of men.

However the other less obviously recycled products are more likely to be recycled by women. It was figured that 59% of women recycle the metal opposite the 31% male metal recyclers.

The bio-degradable waste is separated by 51% women which us much more than 30% of men.

Let us see again more in details to the tetra pak. Also women are more diligent in recycling it. There are 56% of women who do it next to the 31% of men only. What about the tetra pak correct disposal considering education? Surprisingly 43% university students or absolvents recycle it which is less than 50% people with lower than tertiary education. Concerning the regions half of people in Prague recycle it. In Brno there are only 20% of tetrapak recyclers. In small villages up to 3,000 people only 23% separate tetra paks. To complete this study; 57% of people living in the cities of 10,000-100,000 people.

6.1.1.18 Final remark

The data obtained from the collection of the questionnaires might be hereafter treated and analysed in order to find out some more even less expected conclusions. However for the scope of this thesis just the most remarkable facts were highlighted to introduce an

insight to the problematic of recycling behaviour and its influencing factors. Supplement C offers the summary of the data collected divided by the recyclers and non-recyclers.

7 Conclusion

The Czech system for separating the domestic waste is quite well organised and working, at least as regards the most important fractions of it. Recycling paper, glass and plastics is more or less perfectly established and organised, therefore nobody can really complain. Those three are available everywhere.

Actually when we are stricter and care about the further recycling of more materials, problems might occur. Bins for the other rubbish are missing or in an insufficient amount.

The pleasant result of our social research is that quite a vast majority of people declare themselves as recyclers. Actually, it doesn't mean they strictly recycle all the recyclable products. Anyway, not all the recyclers are really aware of the possibilities and opportunities of such an activity.

It has turned out that, in general, people are willing to recycle if they have appropriate conditions. It is both good and bad news.

It might be disappointing to hear that people do not mind recycling if comfortable conditions are provided for them. They are not keen on making an effort to recycle and thus protect the environment.

On the other hand, this property might be quite well used to optimise the recycling performance. Generally, people are quite impressible so why not use it for such useful things.

Particularly we have come across recycling of the waste where containers are quite accessible and very numerous. People are already used to recycling even though it was not always easy to enforce it.

It is also obvious from our data that if there are some problems or even small discrepancies within the system it works badly or at least it becomes problematic.

The research has indicated that people might be persuaded to recycle by other people in their surroundings.

Education also has a positive impact on the recycling performance.

A few shortages and mistakes have been revealed too. Some of them could be easily fixed and adjusted in order to achieve favourable recycling results, among them the absence of more various recyclable wastes in the recycling nests. There already exists some general awareness of recycling among the population. Lots of people nowadays separate automatically certain materials. They find it normal; they do not think of it, they

have no doubts about it. This advantage should be used for further enlargement of what people recycle automatically. (For example, adding even bins for metals in each recycling nest).

The vast majority of people claimed they recycle because of the environment protection. Even if it was not really true, people are well aware of environmental protection and the combination of such reasons and more comfortable recycling conditions might optimise and improve the recycling performance and its results on a more global scale.

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10 Supplements

Supplement A: Original questionnaire (in Czech)

Dotazník: Recyklace domácího odpadu

Údaje:

1. ◯ Žena ◯ Muž
2. **Věk:** ◯ 0-20 ◯ 21-30 ◯ 31-40 ◯ 41-50 ◯ 51-60 ◯ 61-70 ◯ 71+
3. **Bydlení :** ◯ rodinný dům ◯ byt
4. **Počet obyvatel v obci:** ◯ 1-300 obyvatel ◯ 300-600 ◯ 600-3000 ◯ 3000-10000 ◯ 10 000 – 100 000 ◯ 100 000+ ◯ Praha **(Obec:** _____)
5. **Vzdělání :** ◯ ZŠ ◯ SŠ ◯ VŠ (i v průběhu)
6. **Příjem (Kč):** ◯ 0-20 000 ◯ 20 001 – 30 000 ◯ 30 001 – 40 000 ◯ 40 001 – 50 000 ◯ 50 000+
7. **Počet členů domácnosti:** ___

Třídění:

1. **Třídíte odpad:** ◯ ANO ◯ NE
2. **Které materiály třídíte?** (tj. vyhazujete do určených kontejnerů, nosíte do sběrných míst atd.) Upřesněte jak.

◯ papír
◯ plast
◯ sklo
◯ nápojové kartony
◯ kompost (bioodpad)
◯ železo, kovy
◯ baterie
◯ žárovky
◯ elektronika
◯ textil
◯ jiné:_____

Označte odpad, kterého produkujete a třídíte nejvíc (cca)

3. **Víte, kde máte nejbližší kontejnery na tříděný odpad?** ◯ ANO ◯ NE
Jak jsou daleko: ◯ 0-1 min. ◯ 1-3 min. ◯ 3 a více min.

Jaké materiály se tam dají třídit?

◯ papír
◯ plast
◯ sklo
◯ nápojové obaly
◯ drobné kovy
◯ drobné elektro
◯ textil
◯ jiné:_____
◯ jiné:_____

Jaké materiály tam třídíte? Pokud nejsou na předešlém seznamu, dopište, jak odpady třídíte.

◯ papír
◯ plast
◯ sklo
◯ nápojové obaly
◯ drobné kovy
◯ drobné elektro
◯ textil
◯ jiné:_____
◯ jiné:_____

4. **Třídí Vaši sousedé?** ◯ ANO ◯ NE ◯ Nevím
5. **Proč třídíte/netřídíte** (lze vybrat více odpovědí)

◯ šetřím životní prostředí
◯ ostatní třídí také
◯ přizpůsobuji se ostatním členům domácnosti
◯ jiné:_____
◯ nezajímá mě to
◯ nemám na to vhodné podmínky
◯ jsem na to líná/líná
◯ nevěřím, že to má smysl

Děkuji za vyplnění dotazníků do mojí vznikající diplomové práce „Systém recyklace domácího odpadu v ČR a jeho efektivita". Máte-li dotazy, napište na annamladkova@seznam.cz

Supplement B: The questionnaire translated into English

Questionnaire: Domestic Waste Recycling

Information:

1. ◯ Female ◯ Male
2. **Age:** ◯ 0-20 ◯ 21-30 ◯ 31-40 ◯ 41-50 ◯ 51-60 ◯ 61-70 ◯ 71+
3. **Household :** ◯ family house ◯ flat
4. **Number of inhabitants in the municipality:** ◯ 1-300 inhabitants ◯ 300-600 ◯ 600-3,000 ◯ 3,000-10,000 ◯ 10,000 – 10, 000 ◯ 100,000+ ◯ Prague **(Municipality:** _____)
5. **Education:** ◯ Primary ◯ Secondary ◯ Tertiary (in course included)
6. **Income (CZK/monthy):** ◯ 0-20,000 ◯ 20,001 – 30,000 ◯ 30,001 – 40,000 ◯ 40,001 – 50,000 ◯ 50,000+
7. **Number of household members:** ___

Recycling:

1. **Do you recycle domestic waste:** ◯ YES ◯ NO
2. **What materials do you recycle?** (i.e. you throw them to special containers, carry to the collecting places etc.) Specify how.

◯ Paper
◯ Plastic
◯ Glass
◯ Beverage Packages
◯ Compost (Bio-waste)
◯ Metal
◯ Batteries
◯ Light Bulbs
◯ Electronics
◯ Textile
◯ Other:_____

Mark the waste you produce and recycle the most (approximately).

3. **Do you know where is your nearest recycling spot?** ◯ YES ◯ NO
How far it is?: ◯ 0-1 min ◯ 1-3 min ◯ 3 and more min

What materials can be separated there?

◯ Paper
◯ Plastic
◯ Glass
◯ Beverage Packages
◯ Metal
◯ Electronics
◯ Textile
◯ Other:_____
◯ Other:_____

What materials do you separate there? If it is missing on the previous list you can indicate how you separate it.

◯ Paper
◯ Plastic
◯ Glass
◯ Beverage Packages
◯ Metal
◯ Electronics
◯ Textile
◯ Other:_____
◯ Other:_____

4. **Do your neighbours recycle?** ◯ YES ◯ NO ◯ I don't know
5. **Why do you recycle/do not recycle?** (more answers possible)

◯ I save the environment
◯ The others recycle too
◯ I adapt to the other members of my household
◯ other:_____
◯ I don't care
◯ I don't have appropriate conditions
◯ I am too lazy
◯ I find it pointless

Thank you for filling the questionnaire for my emerging diploma thesis "System of domestic waste recycling in CR and its effectiveness. If you have any question contact me on annamladkova@seznam.cz

Supplement C: The summary of the questionnaires results:

Recyclers	total 118
Gender	54 males, 64 females
Age (years)	0-20: 2, 21-31: 72, 31-40: 10, 41-50: 11, 51-60: 11, 61-70: 1, 71+: 9, unlisted: 2
Housing	Flat: 70, Family house: 48
Number of inhabitants in municipality	1-300: 4; 300-600: 12; 600-3,000: 10; 3,000-10,000: 16; 10,000-100,000: 14; Brno: 10; Prague: 52
Education	Basic: 7, Secondary: 27, Tertiary: 84
Income (ths of CZK/month)	0-20: 80, 20-30: 17, 30-40: 9, 40-50: 2, 50+: 8, unlisted: 2
Household members	1: 18, 2: 35, 3: 23, 4: 25, 5: 10, 6: 1, 7: 2, unlisted: 4
Recycled material (recycle/ do not recycle)	Paper: 112/6 Plastics: 114/4 Glass: 109/9 Tetra pak: 53/65 Bio waste: 37/81 Metal: 39/79 Batteries: 67/51 Light Bulbs: 40/78 Electronics: 51/67 Textile: 51/67
Produce/recyde the most	paper: 11, plastic: 18, glass: 1, bio: 3
Having the recycling bin available/really recycle there	paper: 112/110, plastic: 112/111, glass: 114/110, tetra pak: 52/49, bio: 2/2, metal: 6/6, batteries: 2/2, light bulbs: 1/1, electronics: 13/10, textile: 20/16
The nearest recycling bin (min)	0-1: 43, 1-3: 51, 3+: 22, unknown: 2
Neighbours recycle?	Yes: 30, No: 5, Unknown: 83
Non-recyclers	total 20
Gender:	14 males, 6 females
Age (years)	0-20: 0, 21-30: 11, 31-40: 5, 41-50: 1, 51-60: 1, 61-70: 1, 71+: 1
Housing	Flat: 15, Family house 5
Number of inhabitants in municipality	1-300: 0; 300-600: 0; 600-3,000: 1; 3,000-10,000: 1; 10,000-100,000: 3; Brno: 2; Prague: 13
Education	Basic: 3, Secondary: 7, Tertiary: 10
Income (ths of CZK/month)	0-20: 13, 20-30: 4, 30-40: 2, 40-50: 0, 50+: 0, unlisted: 1
Household members	1: 4, 2: 6, 3: 1, 4: 7, 5: 2, 6: 0, 7: 0
The nearest recycling bin (min)	0-1: 6, 1-3: 9, 3+: 4, unknown: 2
Neighbours recycle?	Yes: 4, No: 1, Unknown: 15