

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

Department of Economics



Bachelor Thesis

**Analysis and Recycling of Beverage Cartons in The Czech Republic –
Case Study of Tetra Pak**

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BACHELOR THESIS ASSIGNMENT

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Economics and Management

Thesis title

Analysis and recycling of beverage cartons in the Czech Republic – Case study of Tetra Pak

Objectives of thesis

The thesis is concentrated on the recycling of beverage cartons in the Czech Republic with the focus on Tetra Pak Company. There are 2 main objectives. The first one is to analyze beverage cartons, their composition, collection and sorting. The second objective is the determination of beverage cartons recycling, the analysis of FSC (Forest Stewardship Council) and the investigation of Czech inhabitants opinion about recycling.

Methodology

The descriptive and comparative methods were used in the thesis. The thesis contained the questionnaire about recycling of paper, cardboards, plastic and glass.

The proposed extent of the thesis

40 pages

Keywords

Beverage cartons, Czech Republic, Tetra Pak, FSC, recycling

Recommended information sources

Leander, L., 1996. Tetra Pak: A Vision Becomes Reality: A Company History with a Difference, ISBN-10: 9163047896, Tetra Pak International AB, ISBN-13: 978-9163047893, pp. 329

Synek, Miloslav. Podniková ekonomika. 4. přeprac. a dopl. vyd. Praha: C. H. Beck, 2006, xxv, 475 s. ISBN 80-717-9892-4.

Worrell, E., Reuter, M. A., 2014. Chapter 2 – Definitions and Terminology, Handbook of Recycling, State-of-the-art for Practitioners, Analysts, and Scientists, ISBN: 978-0-12-396459-5, pp. 600.

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Statutory Declaration

I declared, that I have worked on my bachelor thesis “Analysis and Recycling of Beverage Cartons in The Czech Republic-Case Study of Tetra Pak“ individually, only with the use of sources, which are listed in the references.

In Prague, February 24, 2015

.....

Lucie Straková

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Author: Lucie Straková

Analysis and Recycling of Beverage Cartons in The Czech Republic – Case Study of Tetra Pak

Analýza a recyklování nápojových kartonů v České republice – Případová studie společnosti Tetra Pak

Summary:

This bachelor thesis is devoted to beverage cartons produced by Tetra Pak. The whole process from the pure beginning of the processing of raw materials, to the final sorting and recycling of them is described in this work. The theoretical part is focused on the introduction of Tetra Pak Company, Tetra Pak packages and it also deals with the collection and sorting of beverage cartons. This part is also concentrated on various methods of beverage cartons recycling and on the analyses of FSC (Forest Stewardship Council). This nongovernmental organization is closely united with Tetra Pak, because it certifies Tetra Pak Company.

The practical part is based on the results, obtained through the questionnaire. The questionnaire is focused mainly on beverage cartons. The aim of this questionnaire was to find out how Czech inhabitants face the problem of recycling, what kind of waste they sort, if they buy Tetra Pak products and how do they sort beverage cartons.

Souhrn:

Tato bakalářská práce se věnuje nápojovým kartonům, produkováných společnostmi Tetra Pak. Je v ní popsán celý proces od zpracování surovin, které tvoří nápojový karton, až po třídění a recyklaci. Teoretická část je zaměřena na společnost Tetra Pak, obaly Tetra Pak a pojednává také o sběru a třídění nápojových kartonů. Tato část se také soustředí na různé metody recyklování nápojových kartonů a na analýzu FSC (Forest Stewardship Council). Tato nevládní organizace je úzce spojena se společností Tetra Pak, protože tuto společnost certifikuje.

Praktická část je založena na výsledcích, získaných z dotazníku. Dotazník je zaměřen především na nápojové kartony. Jeho hlavním cílem bylo zjistit, jak české obyvatelstvo čelí problémům recyklování, jaké druhy odpadu třídí, jestli kupují výrobky společnosti Tetra Pak a jak třídí nápojové kartony.

Key words: Beverage cartons, Czech Republic, Tetra Pak, FSC, recycling

Klíčová slova: Nápojové kartony, Česká republika, Tetra Pak, FSC, recyklování

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1. Introduction

People from nearly all over the world know the beverage cartons very well, as they buy their favourite milk, juice or other drinks in this kind of package. After the consumption of the content of beverage carton, they usually just throw it away without knowledge of its composition or if they throw it into the correct container. This work is focused on analyses of these beverage cartons from the whole beginning of production to the final appearance of this product and on the consecutive sorting and recycling.

Recycling is the method of reducing the waste which suppose to be disposed. There are a lot of methods how to get rid off the waste, but for example dumping, incineration and landfills are associated with environmental threats. Recycling might be the tool for reducing external costs at landfills, dumps and incinerations. Recycled material might be used effectively as environmentally effective substitute for non – renewable materials. The mining of these materials is often connected with costs to the environment (Kinnaman, 2014).

„About 70 billion tons of raw materials are extracted world wide annually. That is twice as much as at the end of the 1970s. This trend is continuing – even with finite resources. One way to have enough materials available for manufacturing new goods in future is to recycle continually“ (Science daily, 2014).

Tetra Pak is the leading company producing beverage cartons in the Czech Republic. This company has an origin in Sweden, where the head office also takes place. „In the second half in the twentieth century, Tetra Pak became perhaps the most prominent symbol of innovative thinking in Swedish industry“ (Lars Leander, 1996).

SIG Combibloc and Elopak are other important beverage carton producers. However, Tetra Pak is spread all over the world and as it was already mentioned it is the leading company producing beverage cartons in the Czech Republic. This is the reason why this thesis is focused on products which are produced by this company.

2. Thesis Objectives

The thesis is focused on the beverage cartons. The important part and one of the main objectives of this thesis is covered by questionnaire. The attitude of Czech inhabitants to recycling can be obtained from the results of this quantitative research. This research is devoted mainly to beverage cartons and how Czech inhabitants face to the problem of beverage cartons recycling and sorting. The thesis is also directed to analyze the whole life cycle of beverage cartons from the processing of raw materials, through the analysis of various kinds of beverage cartons and their composition to collecting systems, sorting and recycling of beverage cartons. The whole thesis is concentrated on the Czech Republic and on the Tetra Pak Company.

3. Literature Review

3.1 Tetra Pak Company

3.1.1 Tetra Pak – Swedish Packaging Company

The production of beverage cartons by Tetra Pak company, is one of the main objectives, that this work is concentrated on, so few words about this company should be said first.

Tetra Pak is the family owned company, with the origin in Sweden, which provides anything, that is needed for processing, packaging and distribution of beverages and food. „TetraPak is the world leader in liquid food processing and packaging“ (Tetra Laval, 2014).

This private company is presented around the whole world, but the head offices are situated in Lausanne, Switzerland. 1951 is the crucial year for the beginning of this company. Ruben Rausing established the AB Tetra Pak company in Lund, Sweden that year. The new packaging system was presented to the public on 18th May the same year (Tetra Pak, 2014).

Tetra Pak is the market leader in food processing and packaging. In a close cooperation with its customers and suppliers, Tetra Pak delivers safe and environment – friendly products, which every day satisfy the needs of billions people in more than 170 countries

all over the world. The complex company activity corresponds to the principles of environmental policy and sustainable development with an effort to support environmental protection at the maximum. Tetra Pak uses renewable resources, constantly reduces the consumption of raw materials and energy, monitors the life cycle of its products, promotes environmental programmes, the recycling itself and secondary processing of beverage cartons. The company is the holder of combined FSC forest management certification (Pohadkové lesy, 2014).

3.1.2 The Most Important Tetra Pak Milestones

1943: Development work started in order to create a milk package. This package provided maximum hygiene, but on the other hand, required a minimum of material.

1946: This year was well known for the fact, that Erik Wallenberg came up with the idea of using tetrahedral form of packaging. Also Harry Jarund developed the conceptual basis for machine design. These 2 events meant a huge support for future Tetra Pak's success.

1950: AB Tetra Pak was registered as a company in December.

1951: In Lund, Sweden, AB Tetra Pak was established by Ruben Raising. The new packaging system was presented to the public on 18th of May.

1952: In this year, the first Tetra Classic filling machine for the production of tetrahedral carton packages was delivered to the Lundaortens Mejeriforening dairy in Lund.

1953: The Swedish Mjolkcentralen in Stockholm installed its first machines from Tetra Pak. The cream was the first product, for which Tetra Pak carton was used in Sweden. Polyethylen was used as the protection from humidity.

1954: The first machines for the wrapping of milk in 500 ml cartons were installed at Mjolkcentralen, Stockholm and in Eskulstuna, Sweden. The first exported machine went to German dairy Alster Milchwerk in Hamburg.

1956: Tetra Pak started working on the development of aseptic packaging system and moved the new production area in Lund, Sweden, where it exists till now.

1957: This year was crucial, because in Sweden, there was the first machine for 1 litre milk carton package installed in the dairy Linköping.

1958: Portfolio of Tetra Classic machines was extended by to 200 ml carton package for milk and non-sparkling beverages.

1959: In this year, the work on the development of Tetra Brik packages started. The capacity of production reached 1 billion of beverage cartons/year.

1960: The first factory for the production of packaging material was opened outside of Sweden. The factory was placed in Mexico and the capacity of production achieved 1 billion/year.

1961: In September, the first aseptic filling machine for milk was introduced in Sweden.

1963: Tetra Brik packages was launched in Sweden.

1964: The first Tetra Classic Aseptic machine was installed in Libanon. It was the first installation of this machine outside of Europe. The capacity of production was over 3,5 billion of cartons/year.

1965: Tetra Rex gable – top package was introduced. The capacity of production exceeded 4,3 billions of cartons/year.

1971: Two new beverage carton production sites were opened in Japan and France.

1973: The factory Latina in Italy started with the production of packaging material. The capacity of production exceeded 11 billion of cartons/year.

1974: The new industry for packaging material was established in Australia. In Canada, Tetra Brik Aseptic system was presented.

1975: An extensive social programme supporting the protein supply was signed with Iran.

1977: The total production of Tetra Pak packages over exceeded 20 billion of beverage cartons. The system Tetra Brik was introduced in the USA.

1979: Tetra Pak delivered the first Tetra Brik Aseptic machine to People's Republic of China.

1980: The total production of Tetra Pak packages surpassed 30 billion pieces.

1981: Tetra Pak Group Management moved from Swedish Lund to Laussane, Switzerland.

1982: Tetra Pak Company developed new technology of offset print.

1983: The founder of Tetra Pak Company, Dr. Ruben Rausing died on 10th of August. Tetra Pak opened the production factories in in Pakistan, Kenya and Finland. New Tetra Pak technological training centre for education of technical service of customers was opened in Lund, Sweden. The capacity of the centre was 600 students/year. The global capacity of production was 33 billion of cartons/year.

1985: Two new factories for production of packaging material were opened in Argentina and Canada.

1987: The crucial factory was introduced in People's Republic of China and Taiwan. Tetra Pak machines were presented in more than 100 countries around the world.

1988: New factories in Ukraine, Turkey and India were opened.

1989: New factories were introduced in USA and Korea. The global capacity of production was over 51 billion of cartons/year.

1991: Tetra Pak finished the acquisition of Alfa-Laval Company which was one of the largest worldwide suppliers of machines and components for food, processing and agricultural industry. Tetra Pak Alfa – Laval Group was established.

1993: Tetra Laval was established on the 1st of August. The new group of companies consisted of 4 industrial units: Tetra Pak, Tetra Laval Food, Alfa Laval and Alfa Laval Agri.

1995: Thanks to Tebel MKT Company, Tetra Pak extended its ability to supply machines for production of hard and semi – hard cheeses. The total production capacity of Tetra Pak was 76 billion of cartons.

1997: In this year, 7 new factories were opened, which meant the significant increase in production capacity of Tetra Pak. These factories were placed in Italy, 2 in India, China, Columbia, Mexico and UK. 3 new packaging systems were introduced: Tetra Prisma Aseptic, Tetra Wedge Aseptic and Tetra Fino Aseptic.

1999: Tetra Pak acquired the French company Novembal, which dealt with the production of caps for packages.

2000: Tetra Pak published its first Corporate Environmental Report (CER). It was the report about the influence on environment.

2001: Tetra Top carton package machine with reclosable screw caps was installed in Carinthian Milk company, in Austria. It helped to increase the turnover of Carinthian Milk by 20%.

2002: In September, Tetra Pak celebrated its 50th anniversary and deployed the first integrated processing and packaging line for the soya based products.

2003: Tetra Recart package system was launched. It offered an alternative solutions for food categories which were traditionally packed in cans or glass jars. During 2003, Tetra Laval Group acquired Sidel, one of the major global producer of plastic bottle filling lines.

2007: Tetra Gemina Aseptic, the first roll-fed gable-top shaped package was launched to the market.

2009: Tetra Brik Edge was revealed in this year. More than 2,3 billion packages were produced with FSC certificate.

2010: In this year, Tetra Pak was received Climate award from Swedish Forest Industries Federation. One of the reason for this prize, which was given to Tetra Pak by H.R.H.

Prince Carl Phillip was: „Tetra Pak also takes a responsibility for the forests the raw material originates from. Few organisations in the world have the same drive.”

2011: The Tetra Evero Aseptic which was the first global aseptic carton bottle was launched in this year.

2012: Tetra Pak celebrated 60th anniversary. 26,4 billion of FSC™ labelled packages were delivered to customers in 37 countries around the world.

2013: Tetra Pak delivered FSC labelled packages to its customers in 53 countries (Tetra Pak, 2014).

3.2 Tetra Pak Beverage Cartons

3.2.1 The Life Cycle of Tetra Pak Packages

Raw materials

Tetra Pak uses raw materials with maximum respect to the environment, the cardboards are made of wood-a renewable resource.

The transformation into the cardboard

The cardboard is laminated in order to conserve the nutritional values of drinks and prevent the entry of impurity and oxidants.

Filling

Tetra Pak supplies filling systems to its customers. These systems guarantee the highest quality and processing efficiency.

The transportation

The transportation and logistics are the basis of the effective distribution. Reduction of environmental impact and the increase in the customer value is very important priority for Tetra Pak.

Processing

Tetra Pak also offers the equipment for food processing with emphasis on safety and high quality products.

Milk and juice

The main objective of processing and packaging is to preserve the natural characteristics and the maximum freshness of beverages without the preservatives.

Consumers

The beverage cartons are designed with the regard on customer's needs. They are practical, highly hygienic and the products inside keep its original taste.

Recycling

The used beverage cartons are recycled. Exercise books, boxes, napkins, isolation boards and toilet paper and many other products might be made out of them (Pohádkové lesy, 2014).

3.2.2 Beverage Cartons

First beverage cartons were sold in Sweden, 1952, but the bigger use on the Czech market started in 90s of 20th century. Beverage carton is the very important phrase which will be repeated in this work relatively often. So first, we have to define it. It is several - layered package which is designed for the preservation of beverages. We often know them under the name Tetra Pak. Special components by which the beverage carton is made of, enables the conservation of quality of the beverage for quite a long time. Nowadays, grocery stores in the Czech Republic offer a wide range of beverages which are preserved in these cartons. Among some of the basic ones are milk, fruit and vegetable juices, kefirs, creams, vines and many others. Beverage cartons are sold in the Czech Republic are supplied by several firms as Tetra Pak, SIG Combibloc or Elopak. This bachelor thesis is focused only on beverage cartons made by Tetra Pak company (Hrbková, 2008).

Tetra Pak company presents its carton packages by following words: „We offer you the most attractive and complete carton packaging range for consuming fresh products. All our packages offer consumer convenience, easy opening, optimal shelf life – and the ability to give your brand maximum exposure. They protect flavours, protect brands, and protect the environment“ (Tetra Pak, 2014a).

Tetra Pak packages are high quality products which keep 100% quality of the beverage. They are not designed only for beverages but also for soups, sauces and loose musli are packed into them. These packages are strong, unbreakable, waterproof, hygienic and light (Bez konzervantů, 2009).

The disadvantage of them can be the fact, that these packages are only one-time packages, so they can not be used again for packaging other beverages or food (Hrbková, 2008).

There exist a lot of Tetra Pak marks and it is important to define them. Every mark begins with the Tetra, but then, it can continue with Brik, Classic, Evero, Gemina etc. To understand the whole system of Tetra Pak packages, you need to distinguish among 3 basic groups.

3.3 Types of Tetra Pak Beverage Cartons

3.3.1 Aseptic Packages

Aseptic packages consist of 6 layers (1 layer of paper, 1 layer of aluminium foil, 4 layers of polyethylen), (Ecoservis, 2014).

Aseptic procedures used by Tetra Pak enables to preserve color, texture, natural flavor and nutritional values of liquid food for up to 12 months with no need for preservatives or refrigeration. The combination of aseptic processing and packaging minimizes losses during the production, ensures cost-effective non-refrigerated distribution and storage and it enables the consumer to purchase long term high quality and safety packed products. All aseptic cartons produced by Tetra Pak are made of renewable materials, recyclable paperboard and without the need for refrigeration during the distribution and storage. TetraPak has 6 groups of aseptic packages and each of them offers a variety of sizes and opening options (Tetra Pak, 2014b).

These 6 groups of packages are: Tetra Brik Aseptic (1969), Tetra Classic Aseptic (1961), Tetra Evero Aseptic (2011), Tetra Fino Aseptic (1997), Tetra Gemina Aseptic (2007), Tetra Prisma Aseptic (1997) and Tetra Wedge Aseptic (1997), (Tetra Pak, 2014b).

The aseptic beverage cartons are most frequently used for packaging of long-life milk and cream, flavoured milk, juices, fruit drinks and wine. In the Czech Republic, there are several firms, which use aseptic filling lines for the packaging of milk and beverages to Tetra Pak beverage cartons. Pragolaktos, Lactalis, Madeta, Linea Nivnice, Olma, Bohemilk and Bohušovická dairy are the biggest customers using Tetra Pak carton packages (Vitalia, 2013).

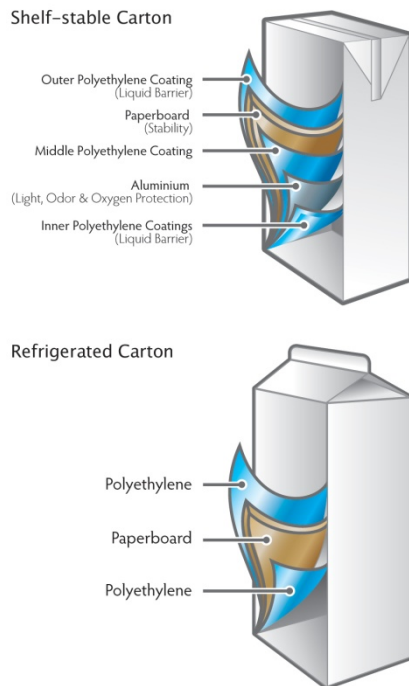
In a combination with heat treatment of the content, the package protects the food and beverage from all external influences-high temperature, light or microorganisms contained in the air. Therefore, beverages in Tetra Pak Aseptic carton packages can be stored at room temperature without the need of adding preservatives for several months (before opening it, because the additional oxygen can damage the content of package), (Bez konzervantů, 2009).

3.3.2 Non-aseptic Packages

Non-aseptic beverage cartons consist only of 4 layers (1 layer of paper, 3 layers of polyethylen), (Ecoservis, 2014).

These packages are designed to protect fresh products: fresh milk and fresh milk products like jogurt drink, kefir, fresh juices and more. They need to be distributed and stored under the refrigeration. They include rectangular shaped Tetra Brik, gable top-shaped Tetra Rex and versatile Tetra Top. Non-aseptic packages do not include the aluminium foil and the shelf life is approximately 3-4 weeks (before the opening), (Tetra Pak, 2014c).

Figure 1: The composition of Tetra Pak beverage cartons



Source: Recycle cartons, 2011

This figure describes the composition of aseptic (shelf-stable) and non-aseptic (refrigerated) beverage cartons. As it is detailed in the text above, unlike non-aseptic beverage cartons, aseptic ones contain one layer of aluminium. This layer prevents oxygen and light from entering the beverage carton and so damages the content.

3.3.3 Food Packages

Food industry is evolving quickly. Consumers, retailers and food producers are searching for fresher and more convenient solutions of food packaging that would have a minimum impact on the environment. Tetra Recart is the kind of package, which meets all these requirements (Tetra Pak, 2014d).

Tetra Recart (2003) is the first carton package on the market which enables the sterilization of food with particles directly in a carton package. Nowadays, Tetra Recart is the package for hundreds of products in more than 30 countries worldwide. There is no food production using Tetra Recart packages in the Czech Republic currently (Tetra Pak, 2014d).

3.4 Product Treatment

3.4.1 UHT (Ultra High Temperature)- Aseptic Technology

The Tetra Pak aseptic carton packaging is also known under the name Long life packaging. The system of this technology was introduced in 1960s and it is considered as a very important breakthrough in the liquid packaging industry. The aseptic process is derived from the principle which guarantees that food and also packaging material do not contain any harmful bacteria at the moment, when the food is actually packed. In order to achieve this idea, everything which is involved in the production chain (including machinery, food and packaging material) have to be sterile (Mourad *et al.*, 2008).

The aseptic process itself is quite complicated. The rollfed packaging material is used during this process, it is sterilized and subsequently shaped into a tube. Then, the tube is filled up with the appropriate products and the whole package gets the shape and it is sealed below the liquid level. This process causes, that the package is completely with no air space. Ultra high temperature (UHT) treatment is the crucial part of aseptic carton packaging technology. Through this treatment, the product passes to the packaging machine where it is packed under specific aseptic conditions in a packaging material. This material is sterile and keeps the air and light out. The sterilization of the packaging material is carried out in a bath of hydrogen peroxide and all possible residues are eliminated with the heat. This process ensures, that the packaging material is dry and it also makes a sterile environment in the filling section (Mourad *et al.*, 2008).

„Long life packaging“ is created of six layers. These layers are paper, polyethylen and aluminium. Long fibres of paper creates about 75% of the weight, low density polyethylen (20%) and aluminium foil (5%), (Mourad *et al.*, 2008).

UHT (Ultra high temperature) technology processes the milk at 140°C for 4-10 seconds and it ensures that the product is shelf stable for up to 12 months. There are 2 common methods of UHT technology. Using steam or superheated water as the heating medium is more popular method. Electro-heating method is the second option of UHT technology, but it is not as popular as the previous one. In steam-based methods, the steam is used to heat the milk directly or indirectly. Direct method means, that the steam is directly combined

with the milk which is then heated quickly. Required high temperature is achieved and there is minimal chemical change to the milk. On the other hand, the indirect method uses tubular or plate heat exchangers. During this method, the milk is heated more slowly which causes some chemical changes with the same bactericidal effect as in the previous method. To use the combination of direct and indirect method is the best way how to achieve the best product quality and also the optimize processing efficiency (Deeth and Datta, 2011).

3.4.2 Pasteurization

Pasteurization is the process used in non-aseptic packages. The main task of pasteurization is to kill pathogens which occur in milk and to make the shelf life of the product longer. Basically the objective of pasteurization is to guarantee the safety of fluid dairy products. This is achieved by destroying unwanted enzymes and also by reducing the amount of viable spoilage microorganisms. The aim is to reduce the viable microorganisms by 99.999%. During pasteurization, water soluble vitamins loose approximately 5-20% of their activity, because they are very sensitive to heat. Pateurized products are not sterile, so the refrigeration system is important for storage and distribution of such products. Whole milk, skim milk, reduced-fat milk, flavored milk, low-lactose milk and organic milk are the most common pasteurized milk types (Meunier-Goddik and Sandra, 2011).

Thermal pasteurization was developed in 1860s by Louis Pasteur. In the dairy industry, there are three main methods of pasteurization. The first method is called Continuous high-temperature-short-time pasteurization. During this method, milk is heated minimum to 71.1°C for at least 15 seconds. The second method is called low-temperature-long-time pasteurization. The purpose of it is, that the milk is heated to minimum 62.8°C in an enclosed vat for at least 30 minutes. The third method is known as ultrahigh-temperature pasteurization. During this process, the milk is heated to minimum 135°C for at least 1.0 seconds. Shelf stable product is produced by this method. The product does not require the refrigeration until it is opened. All these methods of pasteurization provide the products, which are free of all milk-borne pathogens which can cause many human illnesses. The most common pathogens are Salmonella and Escherichia coli (Ryser, 2011).

3.4.3 Superpasteurized milk

Superpasteurized milk is extended shelf life milk (ESL). It basically means, that the fluid milk product has significantly greater shelf life than the fluid milk product which is conventionally pasteurized. For better imagination, ESL product with shelf life of 45 days and conventionally pasteurized milk with 15 days of shelf life. Superpasteurized milk does not have noticeable cooked or scorched of flavours which are typical of shelf stable ultrahigh temperature milk. There is the necessity of refrigeration when storing the ESL milk. ESL milk has two or three times greater shelf life over the conventionally pasteurized milk. To heat milk in ESL processes, there are used both direct and indirect systems. Typical heat treatments are between 125-145°C and it is used for 2-4 seconds. Aseptic filling technologies are used in order to control microbial contamination when packing ESL milk. There are several factors which affect the shelf life of ESL milk including physical, chemical and microbial quality of raw material, hygienic practices during processing and the occurrence of thermoduric microflora (Rankin *et al.*, 2011).

3.5 Individual Layers of Tetra Pak Beverage Cartons

As already mentioned, Tetra Pak aseptic beverage cartons consists of 3 raw materials: paperboard, polyethylen and aluminium foil. The proportion of paperboard is 75%, proportion of (low density) polyethylen is 20% and the aluminium constitutes about 5% of the package. All these 3 components can be recycled in special mills (Korkmaz *et al.*, 2009).

3.5.1 Paperboard

Paperboard creates the main part of Tetra Pak beverage cartons. It is a renewable raw material, which is made of wood. Thanks to it, the final product is stable, strong, and also it provides smoothness, so the printing of required design on the carton is easy. Tetra Pak uses only a certain amount of paperboard, in order to create a stable carton with no need of adding unnecessary weight (Tetra Pak, 2014e).

Renewable means, that the supply (in our case wood) regrow naturally. Tetra Pak buys the paperboard only from the certain suppliers, who guarantee that the wood which they supply comes from known sources. (Tetra Pak, 2014f)

Almost all wood comes from well-managed forests. In 2008, the proportion of paperboard in Tetra Pak packages coming from responsibly managed forests was 97% (Tetra Pak, 2014g).

Under the responsibly managed forests we understand, that these forests give us the wood for producing paperboard, but also they preserve biodiversity and they provide the abode for plants, insects and animals. Raw materials are not the only thing, which well-managed forests offer to us. One of other thing, which is worth to mention is, that they provide natural environment and turn CO₂ into oxygen which is necessary for all fauna and flora (Tetra Pak, 2014f).

3.5.2 Aluminium

This foil is important for the maintenance of right nutritional value and flavours of the content in the package, because it prevents from the entry of light and oxygen through the package (Tetra Pak, 2014e).

The aluminium foil is not presented in all Tetra Pak beverage packages. We have to distinguish aseptic and non-aseptic packages. Aseptic packages, which are intended for long shelf life products, contain 1 layer of aluminium foil. Non-aseptic packages, which are intended for products for immediate consumption do not contain this foil. These packages are designed for pasteurized and fresh products with relatively short shelf life. These products are fresh milk, cream, kefirs and other (Příroda, 2014).

3.5.3 Polyethylen

The significant role of this component is to make the paperboard resistant to outside moisture and microorganisms and it also facilitates the paperboard to paste to the aluminium foil (Tetra Pak, 2014e).

The thickness of polyethylen layer used in beverage cartons is only 0,05 mm. Polyethylen layer sufficiently close the fluid or granary content regardless of the thickness and it isolates the content perfectly against microorganisms and moisture (Bez konzervantů, 2009).

3.6 Collection and Sorting of Beverage Cartons

3.6.1 Collection and Utilization of Beverage Cartons in The Czech Republic

Since the early 90s, beverage cartons presence on the Czech market increases. So far after their use they ended up in mixed waste and subsequently in incinerator boiler or in a landfill. Nowadays, there is the possibility to collect, sort and recycle beverage cartons separately (Arnika, 2004).

The beverage collection project started during the autumn of 2002 and it was managed by Ekokom. In the early stages of this project, it was necessary to ensure the separate processing of sorted packages. Following the European countries, few selected paper mills were approached. The agreement with two paper mills was made after the series of negotiations. It was the paper mill Bělá pod Bezdězem and the paper mill called Kappa Morava Paper Žemrovice which is the member of Kappa Packaging Czech. Both mills have the mechanisms for the processing of waste paper, which is used as the raw material for the additional processing, especially the processing of cardboards. Paper mill Bělá pod Bezdězem have processed beverage cartons from the January 2003. Kappa Morava Paper started in 2000, regardless of the mentioned project (Arnika, 2004).

3.6.2 Ekokom

Ekokom is the authorized packaging company which was established in 1997 by industrial enterprises producing packaged goods (Ekokom, 2011).

It is also the leading company in the Czech Republic which deals with the system of collection and recycling of packaging materials (plastic, paper, beverage cartons, glass). This company guarantees the operation of the whole process of sorting, recycling and recovery of packaging waste. This can be realized due to active collaboration of industrial enterprises, towns and municipalities and because of this, the waste of already used packages can be sorted by means of 241 thousand of colored containers. Further, the waste is taken to the sorting device, it is split up to secondary material and afterwards it is recycled into new products (Ekokom, 2013).

So Ekokom in cooperation with industry and other system partners, which are especially municipalities and towns, participates in provable environmental improvement. System

Ekokom covers the collection and recycling of more than 80% of packages in the Czech market and cooperates with the municipalities, where about 99% of Czech population live.

The whole system works according to valid legislation in the Czech Republic. During the preparation of Packaging Act in 1998-2001, Czech Republic was inspired, with the respect to specific conditions in the Czech Republic, by already established EU states, like France and Belgium. According to this, it was possible to develop the system of sorting and recycling of package waste. The results of such system surpass the established EU states over a long period. For example, in the extend of recycling plastic packaging waste, Czech Republic achieves 67%. This represents the second place in the whole EU (Ekokom, 2013).

3.6.3 Sorting of Waste

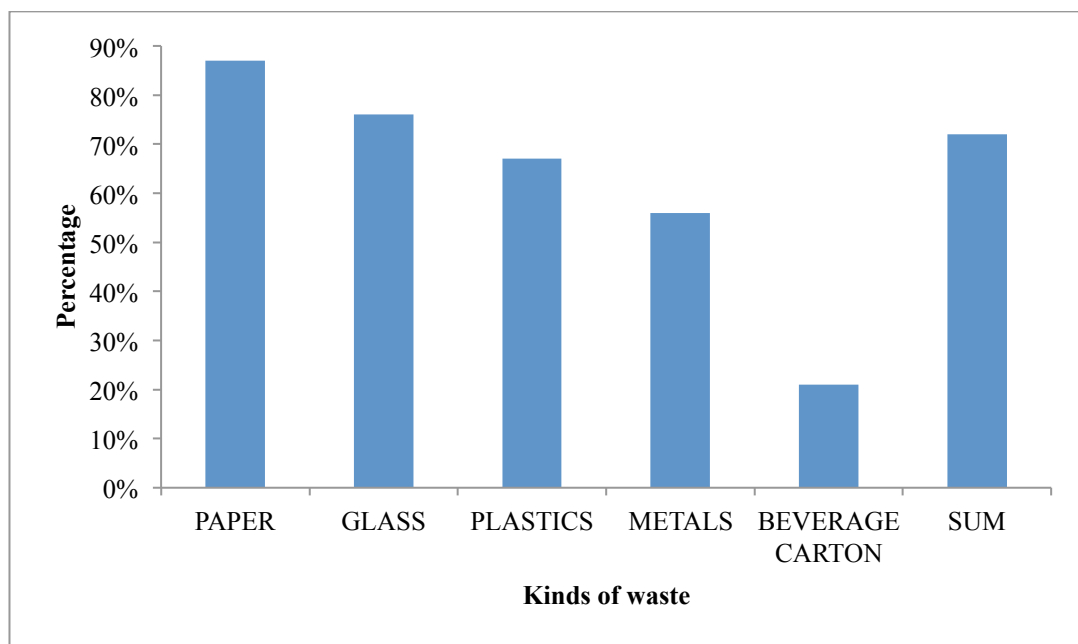
According to Ekokom (authorized packaging company dealing with the system of collection and recycling of packaging materials) about 90% of czech population is convinced, that the sorting of waste has possitive impact on the environment. The survey about this topic was conducted in 2008 for the villages within the Czech Republic. Approximately 50% of Czech population think, that the sorted waste is actually really further used and processed. According to the data obtained in 2008, roughly 68% of czech households sorted the waste actively. Long-term trend indicates a progressive increase in the proportion of these households sorting since 1999. The attitudes of the inhabitants in each region in the Czech Republic differ. They are affected by site structure of the region, the population's education and by the other social characteristics, by the location of containers for the assorted waste etc (further as colored containers), (Ekokom, 2008).

Some questions on this topic are the part of questionnaire which I have conducted for the purpose of this thesis.

The systems of sorting the waste in towns in the Czech Republic further developes every year, which is confirmed by the survey from 2012 carried out by Ekokom. In 2012 Ekokom arranged the recycling for 607 005 tonnes of packaging waste. So in the same year, Ekokom ensured recycling for 71% of non-returnable packages. This way, Ekokom noticeably contributed to the environmental protection. The yield of assorted collection of

recoverable waste of paper, plastics, glass and beverage cartons which were sorted in the systems of municipalities and towns of the Czech Republic was 39.1 kg/capita. Thanks to annually growing collection network of colored containers for utilizable components of municipal waste, there is an increase in volume of assorted waste every year. For the imagination, while in the end of 2005, 128 749 colored containers were available, in 2012 this number rised up to 229 000. As a result of this, the average walking distance in Prague and some villages in the Czech Republic to colored containers is 102 metres. 6 025 villages are currently involved in the system of waste sorting. 10. 488 millions of inhabitants live in these villages. This number represents 99% of population in the Czech Republic. The system of waste sorting is sufficiently accesible and comfortable for Czech citizens (Ekokom, 2013a).

Figure 2: The achieved level of recycling and recovery of waste from packages in 2013



Source: (Ekokom, 2011a)

Paper followed by glass, metals, plastics and cartons were the most recycled packages in the Czech Republic in 2013. 39.7 kg of waste/capita was sorted in 2013. This high number ranks the Czech Republic among the top countries in Europe. It is the prove, that the system of waste sorting is sufficiently accessible, understandable and comfortable for

Czech citizens. More than 70% of Czech population is actively involved in waste sorting. 72% of sorted packages were recycled (Ekokom, 2011a).

The level of recycling and recovery of packaging materials can be achieved also due to several Ekokom activities. These are: In addition to the funding of separate collection in municipalities, Ekokom also implements regional projects, which have 2 main goals. One of them is providing a **technical support** to municipalities during the collection and sorting of packaging waste. The aim of the technical support is to provide sufficiently dense collecting network and to ensure the improvement of sorted waste quality. The collecting network was fortified under the projects dealing with the sorted wastequality improvement. This network is currently made up of approximately 241000 containers. The other one is the **education of inhabitants** and ensuring the improvement of awareness about waste sorting and recycling (Ekokom, 2011a).

Since 2000, authorized packaging company Ekokom organizes an annual professional conference called Waste and Municipalities. During this conference, the representatives of municipalities have the opportunity to gain new information about waste issues and they can also meet experts in waste management (Ekokom, 2011a).

Since 2003, Ekokom develops the cooperation with processors of sorted waste. This helps to improve the recycling quotas, effectiveness and quality of the waste recycling systems (Ekokom, 2011a).

3.6.4 Sorting of Beverage Cartons

Beverage cartons contains large amount of valuable raw material which can be used again for the production of building material or in the paper factories.

In order to recycle beverage cartons properly, the municipal waste needs to be sorted out. A lot of people just throw the carton into the blue container, which is used mainly for sorting of paper. But not everyone knows, that there exist special containers for sorting beverage cartons. If people sort this carton properly to special containers, it can facilitate following separation from normal paper and it can enables simpler recycling as well.

Unfortunately these special containers are located hardly anywhere in the Czech Republic, except Prague (Jak třídít, 2014).

Information which should followed when sorting waste, can be found directly on colorful garbage containers. Certain labels with sorting information are placed on these containers. The urban area always decides about the local conditions of separate collection system, so the way how to sort the waste can differ from place to place (Jak třídít, 2014).

After sorting beverage carton into the proper container, several substantial steps follows.

The beverage carton collection is the following step after the sorting. The amount of beverage cartons is significantly lower than other kinds of sorted waste, that is why, the intervals between collections of beverage cartons might be longer. Somewhere, the baverage cartons can be sorted together with other types of waste such as plastic or paper. In this case they are subsequently sorted on the final sorting lines (Jak třídít, 2014a).

Final sorting lines which are determined for sorting beverage cartons are in most cases the same ones, as those, which are determined for sorting paper and plastic. Their task is to remove unwanted impurities from sorted beverage cartons and prepare the required raw material for processors. Where beverage cartons are collected together with other recycled waste like plastic or paper, the task of the final sorting line is to separate individual materials from the waste. Then, the compressed packages of beverage cartons are transported for final processing, the recycling (Jak třídít, 2014a).

A separate part of the work is dedicated to the recycling of beverage cartons. 2 ways of processing the beverage cartons are used in the Czech Republic. Processing in paper mills and the production of structural and isolating boards by crushing (Jak třídít, 2014a).

There are 2 main products as a result of beverage carton recycling. High quality paper fibre and construction panels. These panels can be used for floor covering (krytiny) or for the construction of entire buildings (Jak třídít, 2014a).

According to the survey conducted by Tetra Pak in October 2013, 55.3% of Czech inhabitants sort the used beverage cartons. 26.1% out of this number sort beverage cartons

regularly. Czech citizens sort out about 9 tons of beverage cartons daily, which is 3.319 tons annually. But considering other waste material, especially glass, plastic and paper these numbers are still lagging behind (Tetra Pak, 2013).

About 20% of the total volume of used beverage cartons are selected out by Czech citizens. For the comparison, the European average is around 37% and this number increases annually. In the majority of Western European countries, the population sort more than 50% of beverage cartons which are intended for recycling. The largest proportion is recycled in Luxembourg and Belgium (80%) and in Germany (70%), (Tetra Pak, 2013).

The absence of special containers for beverage cartons in respondents neighbourhood (36.3 %) and the lack of space for the storage of used packages before their disposal (26%) are the main respondent's barriers for the sorting according to the Tetra Pak survey. Up to 27% of respondents even state, that they do not know about the possibility of beverage cartons sorting. In the Czech Republic, the amount of containers specialized for beverage cartons increase annually. In 2013, about 230.000 of these containers were available in the Czech Republic (Tetra Pak, 2013).

3.7 Recycling

Before analysing the recycling of beverage cartons and used technologies it is important to define, what the word Recycling really means. Recycling is the manner of utilization of the waste. Some of the original material gets back from the waste by the suitable producing process and after that, this material is industrially transformed to other product (Enviweb, 2014). The most common recycled products which people use almost every day is toilet paper, handkerchiefs, napkins, press and so on.

Recycling is the tool for managing natural resources effectively. It is important to look at the recycling from this point of view. It has to be understood within the idea of effective usage of resources (Worrell and Reuter, 2014).

Therefore, recycling is closely connected to the nature. The nature resources are limited. Nowadays, we live in a time of excessive consumption, people have unlimited needs and wants and they buy many things which they do not really need. Crammed waste dumps are

the result of this behaviour. Recycling could eliminate the amount of waste in the dumps, because it basically creates new products from the old waste which people want to get rid off.

„Recycling is the process of recovering and reusing waste products from household use, manufacturing, agriculture, and business and thereby reducing their burden on the environment.“ (Questia, 2014).

In the 1990s, the recycling of materials, after they were used by consumers, came into focus. The solid waste was accumulated in dumps or landfills, which soon became fullfilled and disposal of waste, by which the ladfills were filled, constituted the environmental problems. Recycling is the option to such disposal (Qestia, 2014).

3.7.1 Global Recycling of Tetra Pak Packages

Recycling is very important for Tetra Pak, so it sets clear goals for increasing recycling around the whole world. This goal proved to be very ambitious (Tetra Pak, 2014h).

Tetra Pak actively supports increasing access to recycling of beverage cartons and collaborates with social, industrial and governmental organizations. It also helps the paper mills through the entire world to conduct various tests and verify the feasibility of carton packages recycling in their operations. Since 2002, approximately 40 tests like that were carried out. The global recycling of used Tetra Pak cartons has increased by 10% in 2012. It means from 528 to 581 kilotons, which is 22.9% of the total amount. This number also says, that it is around 3.6 billion of Tetra Pak recycled packages more in 2012 compared to 2011 (Tetra Pak, 2014h).

As it was already said, the recycling rate in Luxembourg and Belgium is about 80%, in Germany, this rate is more than 70%. With these values, Luxembourg, Belgium and Germany rank among the stellar states, whilst China, Russia and Arabia which started with a low basis over the last 3 years almost doubled its recycling rates. Tetra Pak invests tens of millions of euros to support the consumer´s awareness and it also works with local communities to increase recycling rates world wide (Tetra Pak, 2014h).

Tetra Pak is the member of many organizations which promote the environment. Among the most significant and well-known, there are for example CEMPRE-The Business Commitment for Recycling in Argentina and Brazil, ACE (The Alliance for Beverage Cartons and the Environment) in Europe and TIMPs-Thailand Institute of Packaging Management for Sustainable Environment in Thailand (Tetra Pak, 2014h).

3.7.2 Recycling of Beverage Cartons

In general, the recycling of multi-layer cartons is quite difficult. The beverage cartons in the Czech Republic are recycled in 2 main paper factories. First of it takes place in Bělá pod Bezdězem and the name of the paper factory is Papírny Bělá a.s. The second one is situated in the east part of the Czech Republic, in small village called Žemrovice in Kappa Packaging Czech s.r.o. Company R.P.O., a.s., located near Brno, takes care about the production of boards from carton packages (Hrbková, 2008).

3.7.3 The Technology of Recycling

Basically, we recognize 2 main technologies how to recycle beverage cartons.

3.7.4 Recycling in Paper Mills

Recycling in paper mills (also called mechanical recycling) is the most common way how to recycle beverage cartons. It is called wet method. To separate individual layers of beverage cartons is the main purpose of this method. The recycling mills get the beverage cartons and put them into large barrel of water. There the cartons are whirled around. This hydropulping process lasts for 15-30 minutes and it puts the fibres apart. These fibres subsequently create a water suspension-roughage. There is no need to use auxiliary chemicals or hot water during this process. The contamination of sorted beverage cartons should not be higher than 10% in order to make this whirling process successful. That is why this process uses a system, which can remove all non – fibrous materials like residue cardboard content, polyethylene and aluminium foil, printing colors, mud, sand, metal waste and other. These components might sink or float and they can be picked or sieved off. 70-90% of wood pulp fibres can be obtained by this whirling process. These fibres are used for reproducing of paper and napkins, printing paper, paper bags, toilet paper and other products might be made of it (Třídění odpadu, 2014).

3.7.5 Aluminium Foil and Polyethylen

The aluminium and polyethylen layers can be recovered in 3 different ways.

Generation of Energy via Incineration

The remainders of aluminium foil and polyethylen are ordinary burned in paper mills during the production of steam. This steam is usually used during the drying of the wood pulp or during the electrical power production, which is used for the necessities of whirling process. Sometimes, aluminum foil and polyethylen are further used in some countries and the palletes for the transportation of goods, various containers, roof tiles and plastic pots can be made from them. It is always up to the processor (Třídění odpadu, 2014).

Aluminum foil has a high economic value, mainly due to the difficulty of aluminum production from bauxite, which is its natural source. Therefore, the mechanical recycling of aluminum foil residues is commercially interesting. Conversely, the production of polyethylen is very cheap, and therefore the mechanical recycling of polyethylen contained in beverage cartons is economically less attractive (Třídění odpadu, 2014).

The Pyrolysis

It is the preferred method when using these 2 non-fibrous materials. This process is based on the controlled heating of aluminium and polyethylen mixture to a sufficient temperature. This enables polyethylen gasification. The aluminium remains intact and clean. Gasificated polyethylen has a high calorific value and it is an excellent fuel for drying up the wood pulp and also for the pyrolysis itself (Třídění odpadu, 2014).

In other words, pyrolysis is another method, how to treat waste Tetra Pak packaging. It has been broadly applied to organic waste, like for ex.old tyres, agricultural waste and plastic waste. During the process of pyrolysis, organic material is heated and the products of pyrolysis (gas,oil and carbonaceous residues) are generated. All these 3 materials can be effectively used. The gas is primarily used as a fuel for parolysis reactor heating. Oil is also used as a fuel and it is also a raw material for various chemical production. The carbonaceous residues might be burnt as a fuel or they can be eliminated. Polyethylen is

easily thermally decomposed. Particularly light paraffins are gained during the pyrolysis at approximately 700°C (Korkmaz *et al.*, 2009).

Plasma Technology

It is the technology through which individual components of Tetra Pak beverage carton can be separated. The production of a jet of plasma at 15000°C is the crucial activity of this technology. This can be achieved by using electrical energy. After this heating, plastic component (polyethylen) is turned into paraffins and the aluminium component is recovered (Korkmaz *et al.*, 2009).

3.7.6 Crushing, Thermally Pressed Boards

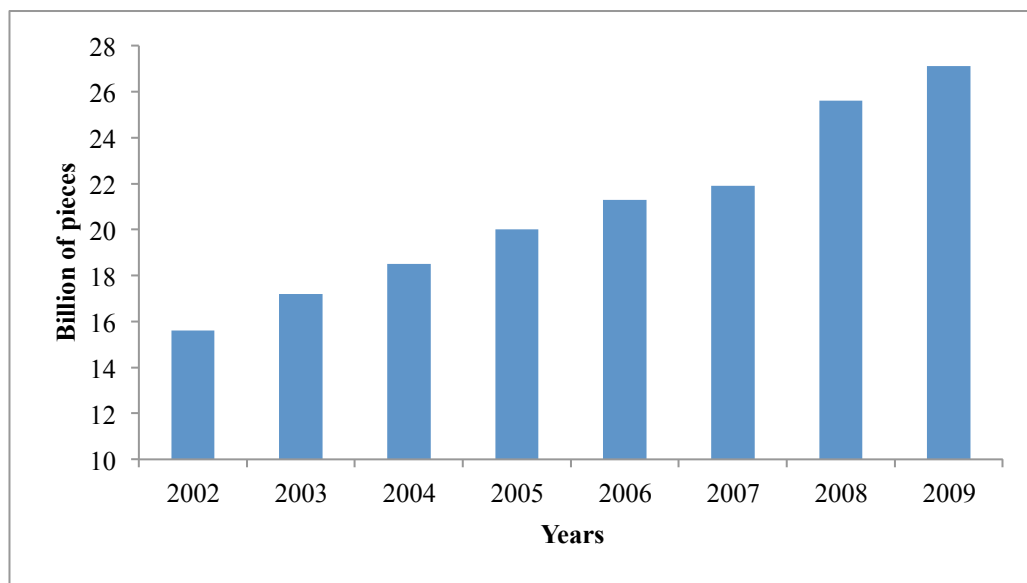
Crushing is the other way how to recycle beverage cartons and it is usually used in construction. This process does not require the separation of individual layers of the beverage carton. During this technological process, which is used world wide (Hrušovany u Brna in the Czech Republic) the cartons are crushed, laudered, dried up and subsequently they are poured into the special forms in required thickness. After this, the material is thermally pressed under 170°C. Because of the presented heat, the polyethylen is melted and the compressed mixture of pulp fibres and aluminium is linked into a flexible material. This material is then rapidly cooled. Solid board with a shiny impervious surface is the final result of this process. This new building material is widely used in both interior and exterior. By the thermally pressing, the material can be arranged into various shapes. This gives designers the ability to create a wide variety of interesting objects. It is also environmentally attractive alternative to wood or plastic furniture (Bez konzervantů, 2009).

These boards developed by Tetra Pak exist on the market under the name Tectan. They are manufactured in Germany and similar material is also produced in Slovakia and the Czech Republic (Bez konzervantů, 2009).

In the Czech Republic, there are produced well known boards Flexibuild. This process is realized on a special processing line in Hrušovany u Brna in the Czech Republic. Compressed layered packages are crushed on the small fragments, they are scattered equily to the forms and finally thermally pressed. A polystyrene foam is added between 2 boards

in order to secure insulation. The boards have low weight, high strength, tenacity and elasticity. They are supplied in various thickness and in many designs. There is possibility to create an entire system of building components-isolating and cladding boards, self-supporting panels for different kinds of crossbars and other constructions and last but not least these boards can be used for lightweight floating floors or for partition and walls (Žižková, 2014).

Figure 3: Tetra Pak beverage cartons recycled from 2002 to 2009



Source: (Tetra Pak, 2014i)

This graph shows, that 27,1 billion Tetra Pak cartons were recycled in 2009 globally. From 2002 to 2009 the recycling increased by 73%. However the recycling of Tetra Pak beverage cartons increases every year, there is always a need for improvement (Tetra Pak, 2014i).

Few examples of Tetra Pak steps for this improvement are listed below.

1. Tetra Pak recycle its own manufacturing waste and promote beverage companies to recycle their waste.
2. Tetra Pak collaborate with scientific institutions and businesses to progress new recycling technologies.

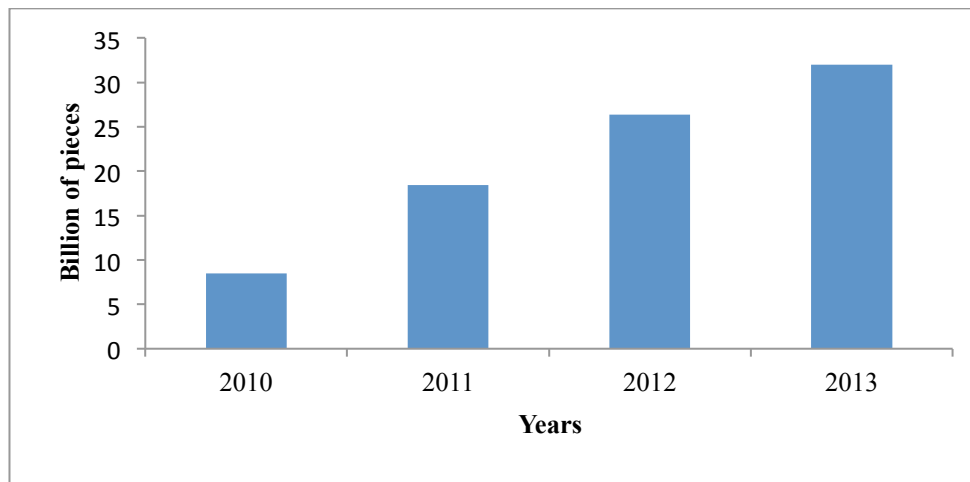
3. Tetra Pak sends his technicians to paper mills where the used beverage cartons are processed to show the value of recycling cartons (Tetra Pak, 2014i).

3.8 FSC – Forest Stewardship Council

As already mentioned, the majority of wood used in beverage cartons comes from forests, which are certificated by FSC. FSC is an independent non profit organization, which supports economical forest management around the world. The FSC certificated system was created in 1993 from the initiative of representatives of international environmental organizations, wholesalers and retailers with timber, foresters, wood processing industry, trade unions and certification organizations from entire world. The basic idea of FSC is to support environmentally responsible, social beneficial and economically viable forest management around the whole world. Thereby FSC wants to help to protect the disappearing, threatened and devastated world's forests. FSC meets all the basic criteria for trustworth certification system such as openness to all parties, transparency, independence from industry and it requires real improvement in forest management. For its openness and transparency, FSC maintains the support of non – governmental environmental and socially oriented organizations (FSC, 2009).

Only 15% of world's forests are managed responsibly and every 35 hours, forest of area of Prague, disappears from the face of the Earth. By selecting the FSC labelled products, consumers help to prevent an illegal wood cutting. FSC helps to protect the natural character of forests, its fauna and flora and simultaneously ensure running recovery of the forests by seeding of the new trees (Pohádkové lesy, 2014a).

Figure 4: Tetra Pak labelled beverage cartons by FSC from 2010 to 2013



Source: (Pohádkové lesy, 2014b)

The offer of Tetra Pak beverage cartons labelled by FSC increases annually. The figure below is showing the increase from 2010 to 2013 (Pohádkové lesy, 2014b).

3.8.1 Who Pays FSC?

As it was already mentioned, the Civic Association of the Czech Republic FSC is non-profit organization. The financial resources for its activities are obtained by various foundations, international institutions and supporting members. The examples of following foundations and international institutions have supported FSC so far:

The European Union

The World Wide Fund for Nature (WWF)

Greenpeace (FSC, 2009).

3.8.2 FSC's Standards

FSC has already created 10 globally applicable principles and 56 criteria for forest management. National FSC standards are created by individual national branches of FSC in collaboration with experts on the basis of these criteria. In countries, where the national FSC standard has not yet been created or approved, certification companies certify based on common standards. These standards come out from international FSC standard. In the

Czech Republic, the Czech FSC standard has been already created by national branch FSC Czech Republic. Forest properties are FSC certified from August 30, 2006 according to this standard (FSC, 2009).

3.8.3 FSC Certification

FSC certification is a credible system of the 1. forest certification and of the 2. C-o-C, chain of custody with a global presence. Many organizations support FSC certification, among them for ex. IKEA, Hornbach or Home Depot (FSC, 2009a).

FSC Forest certification is the process of particular forest control in order to find out whether the forest is managed in agreement with FSC standards. If so, the forest owner has the right to use the certain logo for the wood from his forest. This logo then distinguishes his wood from the wood of unknown origin (FSC, 2009a).

The area of FSC certificated forests is increasing quickly. Over 114 million hectares of forests in 82 countries were certificated in June 2009. Roughly half of this area is situated in Europe (FSC, 2009a).

C-o-C, chain of custody: by means of C-o-C it is possible to guarantee, that the final product comes from FSC certificated forests. In practice it means, that every processor in the processing chain, from the forest to the customer, must obtain the FSC certification. This gives the customer the confidence, that he/she buys a product from responsibly managed forests (FSC, 2009a).

Products with FSC logo already represent several percent of the market in Western European countries. Their share is growing rapidly. Over 13 706 products in the have the right to use FSC certification (FSC, 2009a).

3.8.4 Who Does The FSC Certification?

To maintain the independence and impartiality, FSC itself does not certificate (even not through its national branches such as FSC Czech Republic). The certification companies deal with the certification. Certification companies are those, which were accredited by international FSC company for the certification of forest management in agreement with

FSC principles and criteria. Currently, 18 accredited certification companies offer certification audits (FSC, 2009).

These companies are for ex. Asociación Española de Normalización y Certificación (AENOR) (Accredited since 30 March 2012) and Forest Certification LLC (FC) (Accredited since 30 March 2009), (ASI, 2014).

3.8.5 FSC Certification In The Czech Republic

In the Czech Republic, FSC certification is used less in comparison with our neighbours. Prestigious certificate is owned by School Forest Enterprise Mendel University in Křtiny u Brna, Forests of City of Prague, associations of municipal and private forests Svitavsko, Krkonoše National Park Authority. Other forest's enterprises are considering the FSC certification or they are currently in the certification process. The FSC certificate is owned by 117 wood processing companies (FSC, 2009b).

Among them, there is for ex. AF BKK, s.r.o. – printing company in Prague, Bohemia Sport Trade, s.r.o. - garden furniture or CPI Moravia Books, s.r.o. – printing office (FSC, 2013).

According to the National Office FSC Czech Republic, the interest in responsible forest use from the enterprise's side and also from the customer's side is increasing. „During the last year, there was the increase in the number of companies holding the FSC certification by 11% to current 27 543 companies around the world“ (Tomáš Duda-Director of FSC Czech Republic, 2014), (Tetra Pak, 2014j).

The interest in responsible approach to forest management is increasing, since large international companies are realizing, that the recovery is the key step to sustainability. „We believe that sustainability can be achieved only through the usage of renewable resources. The usage of renewable resources such as wood, other natural materials and energy is the only way for future sustainable development and growth. However, only responsibly managed renewable resources are truly renewable and inexhaustible resources. FSC certification is the evidence of such behavior and forest management.“ (Roman Straka-Tetra Pak Marketing Director, 2014), (Tetra Pak, 2014j).

3.8.6 What Does FSC Czech Republic Do?

FSC Czech Republic is an independent, non-governmental, non-profit organization and also the national FSC branch in the Czech Republic. The main activities of this association include the promotion of forest certification by FSC system, the promotion of certified products, creation and revision of the Czech FSC Standards and monitoring of the certification process in the Czech Republic (FSC, 2009).

3.8.7 Why To Buy FSC Certificated Products?

Forests belong among the most endangered ecosystems on our planet. Scientists estimate, that only about 22% of the original forests remained in original and undamaged state. We loose forest area which covers approximately the area of the Czech Republic every year. Thousands of plant and animal species are living in these areas of course and the serious problem is also an illegal mining. It is estimated, that about 80 % of trees are cut down illegally in the Brazilian Amazon (FSC, 2009c).

The future of the world's forests is based on their sustainable management. „Due to an illegal extraction, the Amazon forest is actually dying.” (Jakub Vágner – well known explorer, 2014), (Tetra Pak 2014j).

Neither Czech nor European forest management always avoid economical forestry practices. The health status of Czech forests belong to the worst in Europe, forests have reduced ability to hold precipitation and to resist various calamities, for ex. during the bark beetle infestation (FSC, 2009c).

Due to high environmental and social requirements and due to thorough system of checking its fulfilment, FSC certificate guarantees the customer, that the wood product with FSC label comes from responsible managed forests (FSC, 2009c).

The market currently offers thousands of FSC labelled products. Garden furniture, tool handles, toys, office parer and many other products are among these products . Some books are also printed on FSC paper by Czech publishing houses. The FSC label means for us the guarantee, that we do not contribute to the forest devastation and also we do not support an illegal logging by the purchasing of such products. According to the market

survey in the spring of 2006, the most FSC products were offered in Hornbach, Jysk, OBI and Bauhaus (FSC, 2009c).

Figure 5: FSC labels for certificated products



Source: (FSC, 2009c)

These are 3 basic labels which are used to mark the FSC products. Below the logo, there is always written the license number of the company which manufactures or sells the product. By this number it is possible to find the producer or seller of this product in an international database (FSC, 2009c).

3.8.8 Broadening of The FSC Certification In The World

In February 2012, over 149 billions hectares of forests in 80 countries were certified by FSC system. Nearly half of the area is in Europe, where the most certified forests can be found in Sweden, Poland, Croatia, Great Britain, Estonia, Latvia, Lithuania, Romania and Germany. Also over 22 466 enterprises in the manufacturing chain in 105 countries worldwide were certified by FSC (FSC, 2009b).

The following table describes the proportion of FSC certificated forests in the Czech Republic, its neighbours and in Sweden. These data were obtained in May, 2014.

Table 1: The proportion of FSC certificated forest area in selected countries

Countries	Number of certified companies	Certified forest area (ha)	Proportion of certified forest are upon entire forest area in the country
Czech Republic	159	50 077	2%
Slovakia	109	142 708	7%
Poland	1 063	6 352 746	80%
Germany	2 071	658 971	6%
Sweden	279	12 054 448	44%

Source: Tetra Pak, 2014j

Czech Republic, with 2% of certificated productive forests considerably lags behind its neighbours. Sweden is one of the top countries with FSC certificated forest area (44%) and it is also the main supplier of wood for Tetra Pak beverage carton production (Tetra Pak, 2014j).

3.8.9 The Cost of The FSC Certification

The price of the FSC certification differs and it depends on the size of forest assets and the selection of certification company. The price fluctuates between 0.10 to 1 EUR/ha/year. The certification price of enterprises in consumer chain can fluctuate between 750 – 3500 EUR/year (FSC, 2009d).

3.8.10 Why To Have Certificated?

By obtaining the prestigious worldwide valid FSC certificate it is confirmed, that the owner manages the forest according to strict environmental, ecological and social standards. The

FSC certification is highly regarded award for the company and it enables better evaluation of wood on the market and better sales and export opportunities. The FSC certification becomes a condition for export to many market mainly Western and Northern Europe and in countrie overseas (FSC, 2009d).

„The FSC system allows us to follow the path of raw materials and the product across the product chain, so we can be sure, that all the materials for our products come from responsibly managed forests and other controlled sources.” (Roman Straka, 2014), (Tetra Pak, 2014j).

4. Thesis Methodology

The significant data were collected and processed for the purpose of this thesis and for the clarification of the definitions and terms. The descriptive method was used in this thesis and all important issues of beverage cartons, their composition, processing, sorting and recycling were described and explained.

The methodology of the practical part was based on the quantitative research. Questionnaire was the tool picked up for this quantitative research.

The questionnaire was sent via email in the period from January 5, 2015 to February 5, 2015 and 100 of them were further processed and evaluated by using comparative method for the puspose of this thesis. The most relevant data obtained by the questionnaire were emphasized and processed in the form of graphs and figures which graphically explain the answers of the certain question. The main focus was on the differences between men´s and women´s answers and attitudes.

5. Results and Discussion

5.1 Research, questionnaire

The research was conducted as a part of the thesis and questionnaire was the tool for this research. The questionnaire contains 15 questions about recyling which are divided into 2 parts. The first 5 questions deal with basic information about respondents such as their

gender, age, highest achieved education level and the type of their housing. The 10 further questions are about recycling. They are focused mainly on beverage cartons and on sorting the waste. The main purpose of these questions was to find out if people sort the waste, why they sort it, what kind of waste they sort, how they sort beverage cartons and if they buy products in beverage cartons. There are also questions about FSC, what are the main factors for buying a product in beverage carton and about Tetra Pak. One of the objectives of this research was to figure out, if people know Tetra Pak and if they buy products in Tetra Pak packages.

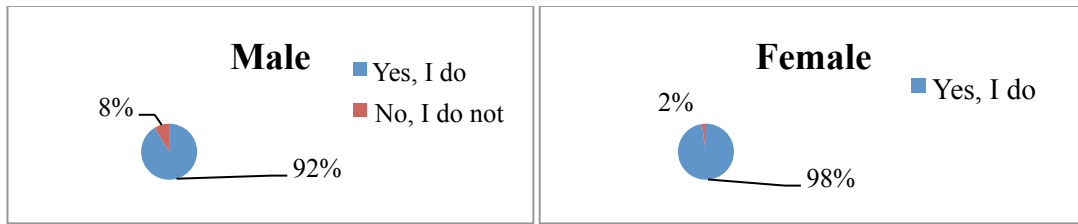
The comparison of womens' and mens' opinions was crucial for this research and each chart processed from the results contains both womens' and mens' ideas. The questionnaire was sent via email in the period from January 5, 2015 to February 5, 2015 and 100 of them were processed for the purposes of this research.

5.2 Results of the questionnaire

It is important to emphasize, that the results of this research are not based on the opinions of people from entire Czech Republic, because 89% of the respondents is from Prague and 11% is from municipalities, mainly around the Prague. It is obvious, that this fact influenced the results of the research.

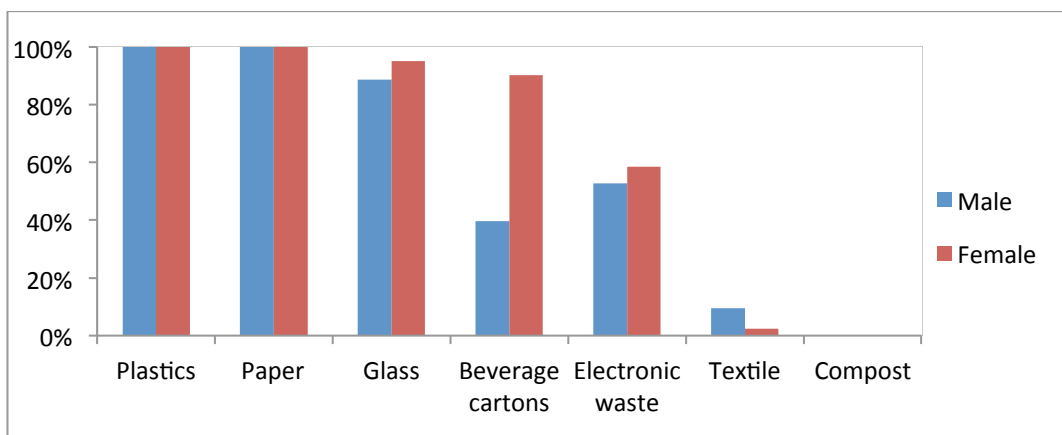
There are 58 men and 42 women among a 100 respondents. According to results from the first part of the research, 43% of men and 55% of women are in the age of 41 to 65 years, 34% of men and 26% of women are in the age of 26-40 years and 23% of men and 19% of women are in the age of 10-25 years. 62% of respondents achieved the university level and remaining 38% finished secondary school. 88% of man and 90% of women live in the city and 83% of men and 88% of women live in the flat. These 2 questions were related mainly to the possibility of composting, but none of the respondents said, that they devoted to it.

Figure 6: Respondents' attitude to sorting the waste



The question about respondents' attitude to sorting the waste was the first question in the second part of the questionnaire. Data obtained by men and women were processed separately and these 2 charts are the results of it. Almost everybody answered positively to this question, but generally it can be said, that women sort a little bit more than men. 98% of women and 92% of men sort the waste. It is great result, because it says to us, that the sorting the waste is not uncommon for people in the Czech Republic (in Prague would be more accurate, because all respondents answering this questionnaire live in the Prague or its surrounding). In this question, there were no big differences in answers from the age, education level and type of housing point of view. Generally, men and women in the age of 41-65 answered positively to this questions. Why respondents sort the waste was the following question. 82% of men and 95% of women responded, that they sorted the waste, because they believed, it was a good thing for the environment and remaining 18% of men and 5% of women sorted it, because of social pressure (e.g. other people do it).

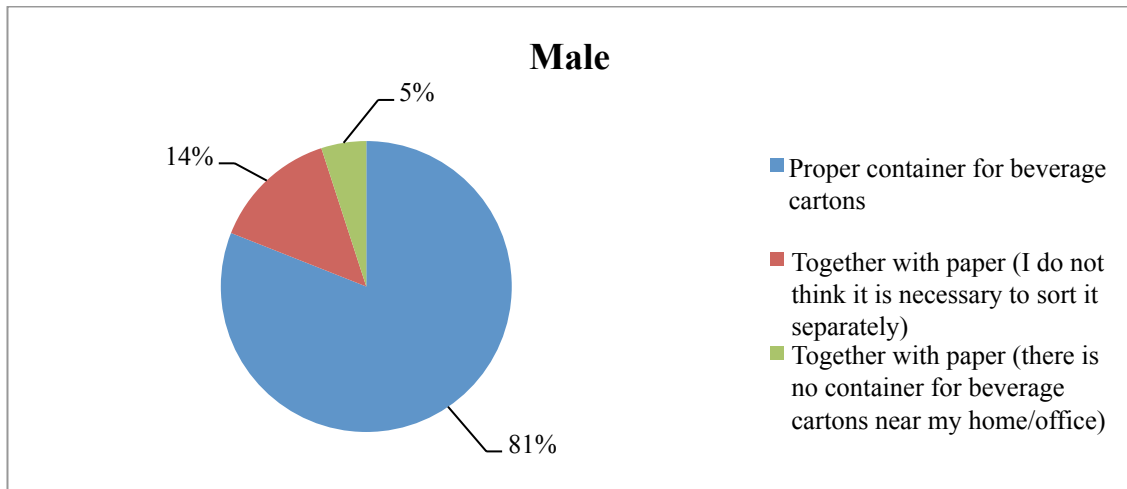
Figure 7: Kinds of waste which respondents sort



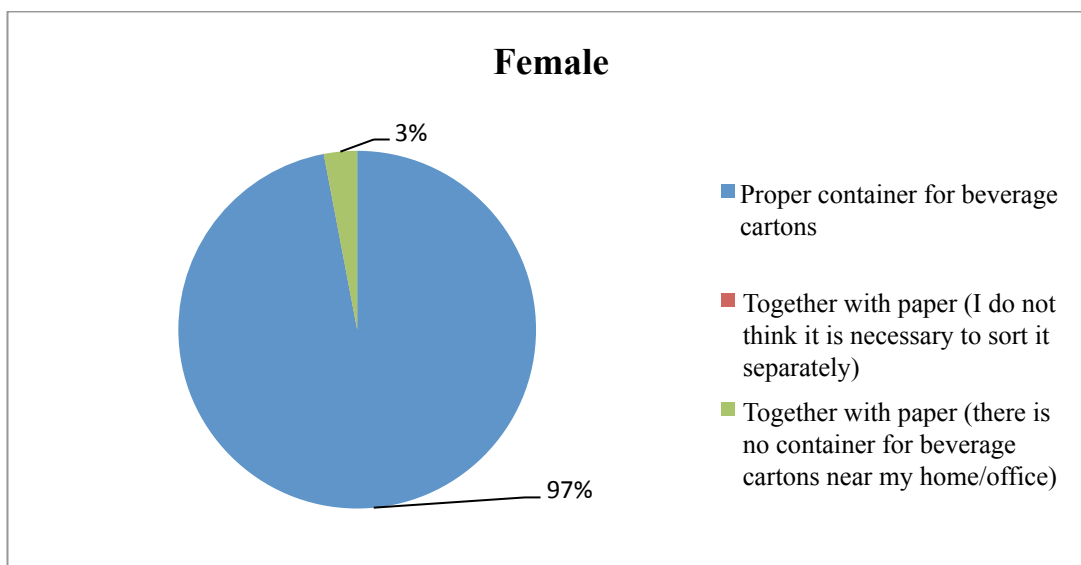
In this question, there were more than 1 possible answers. Considering the previous question, only 92% of men (53) and 98% (41) of women responded to this question. It is

no big surprise, that sorting of plastics, paper and glass is the most popular. 100% of men and 100% of women sort plastics and paper and around 90% of them sort glass. The important for the thesis and for this research was to find out the information about sorting of beverage cartons. There are quite relevant differences between men's and women's answers. Unfortunately, according to results of this question, only 40% of men but around 90% of women sort beverage cartons. 60% of women responded positively to beverage cartons sorting were in the age of 41 to 65. Further 24% were in the age of 26-40 and 16% were in the age of 10-25 years. 24 women finished university and 13 of them finished secondary school. The age category of men was basically similar to the age category of women. 62% of men who sort beverage cartons were in the age of 41-65 and 38% were in the age of 26-40. 18 men finished university and 3 finished secondary school. There is really significant variation between men's and women's answers and it was quite surprising. Based on this question it can be said, that beverage cartons recycling is not fully broadened in Prague and the awareness of beverage carton recycling is still limited for some people. More than half of women answered positively to electronic waste sorting but only 2% of them sort textile. On the other hand, men are better in textile sorting. 9% of men replied positively to this question. None of the respondents compost. This result can be affected by the fact, that almost all of the respondents live in the city and in the flat and that composting is not so broadened. Considering the socio-economic part of the questionnaire, there are again no significant differences as in the previous question. Sorting of plastics, paper and glass is positive regardless of the age, education level or the type of housing. More than a half of women in the age of 41-65 and 90% of women in the age of 26-40 answered positively to this question.

Figure 8: How do respondents sort beverage cartons?

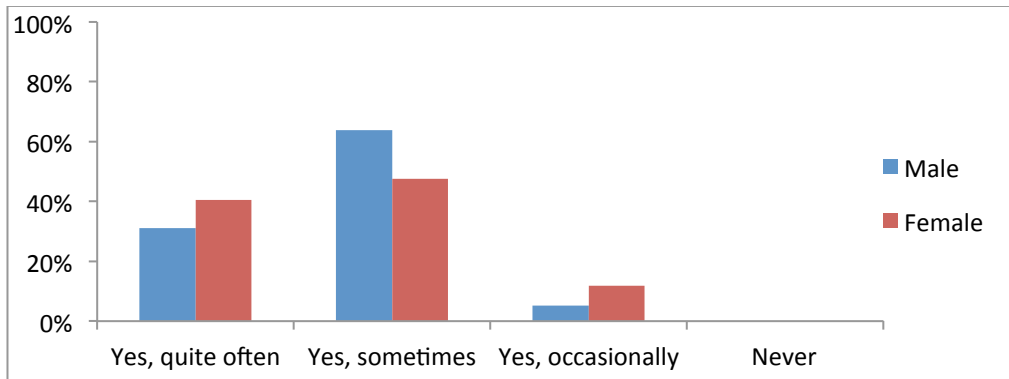


In previous question, 40% of men and 90% of women answered, that they sorted beverage cartons. 21 men and 37 women is the number of respondents who answered this question. This question was focused on the way, how people actually sort beverage cartons, because if they answered positively on beverage cartons sorting it does not mean that they sort them properly. The results of this question are very good. 81% of men sort beverage cartons to proper container, which is very positive. On the other hand, 14% of them sort beverage cartons together with paper, because they do not think it is necessary to sort these 2 items separately and 5% of men responded, that there was no proper container for beverage cartons near their home/office, which was the reason for sorting beverage cartons together with paper.



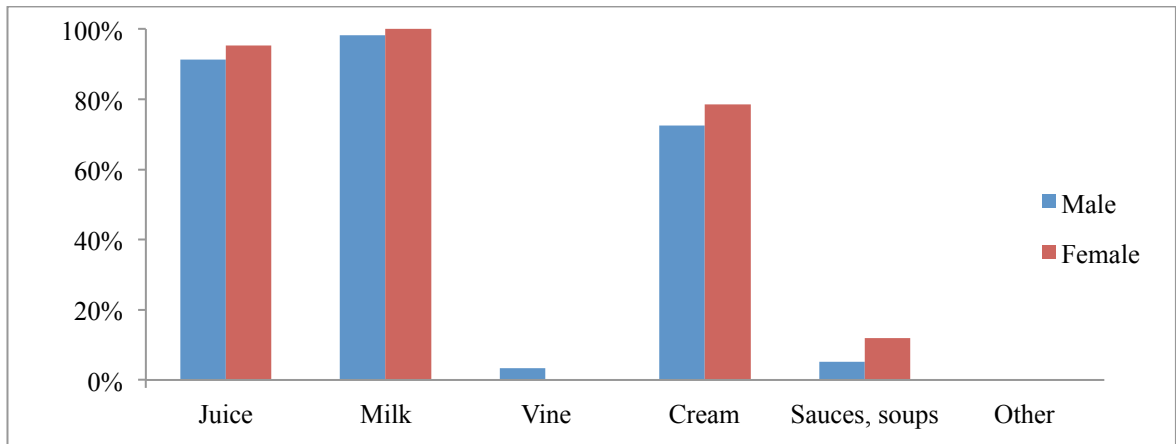
Women's results are also positive. 97% sort beverage cartons to special containers, remaining 3% sort them together with paper, because there is no container for beverage cartons near their home/office and 0% of women think, that it is not necessary to sort beverage cartons and paper separately. Men's and women's answers on this question might indicate, that a majority of people sorting beverage cartons realize the importance of further beverage cartons utilization, they know about the manner how to sort beverage cartons properly and they sort it so. But not all of them are like this. 19% of men and 3% of women who answered, that they sorted beverage cartons, actually did not sort them as they were supposed to (respondents mainly in the age of 26-40). This might insinuate, that people do not take containers for beverage cartons as a natural thing (they know about them, but they just do not care) or that a network of these containers is still unsatisfactory in some places (basically 3% of women and 5% of men said this).

Figure 9: Do respondents buy products in beverage cartons?



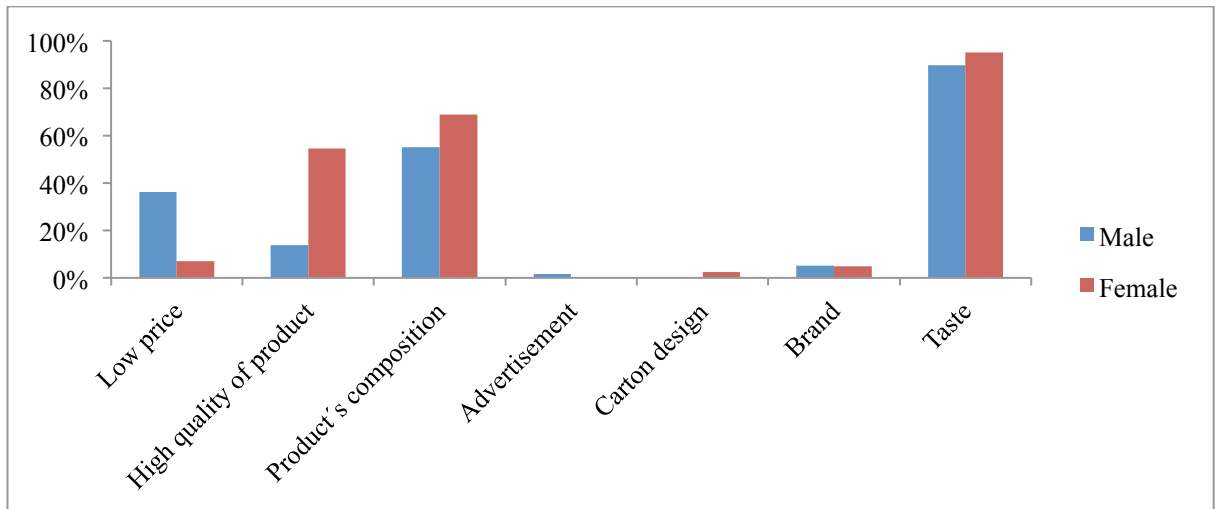
This question was devoted to buying of products in beverage cartons. The first 3 possible answers were more specified in the questionnaire. The way of specification was following: a) Yes, quite often (2 times in a week and more), b) Yes, sometimes (few times in a month), c) Yes, occasionally (few times in a year). Consider all answers, there are no significant differences between men's and women's answers. 57% of all respondents answered, that they sometimes bought products in beverage cartons (64% of men and 48% of women). Other 31% of men buy products in beverage cartons often, 5% buy them occasionally and no men and women answered positively to last possible answer. 40% of women buy products in beverage cartons often and 12% buy them occasionally. Generally, mostly men and women who buy products in beverage cartons often are in the age of 26 to 40 years. Based on this question we can say, that buying products in beverage cartons is quite popular and that the men's and women's answers are broadly balanced.

Figure 10: Kinds of products in beverage cartons which respondents buy



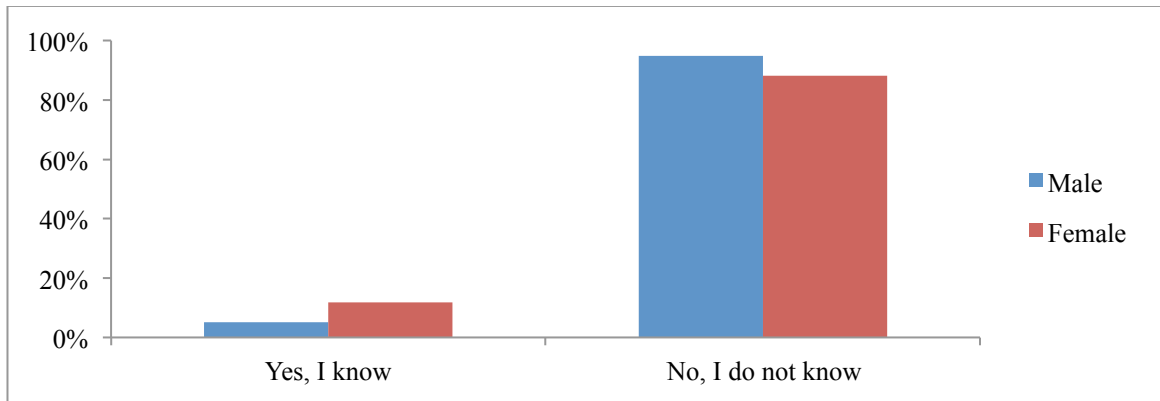
A 100% of men and women answered positively to buying of products in beverage cartons so all 58 men and 42 women answered this question. The question about kinds of those products was following and respondents could mark more than 1 answer. It is no big surprise, that almost all respondents buy juice and milk in beverage carton. More accurately, 91% of men and 95% of women buy juice in and 98% of men and 100% of women buy milk in beverage carton. Immediately after these 2 items, respondents buy a cream. There are again no relevant differences between men's and women's answers. 72% of men and 79% of women buy a cream in beverage carton. Absolute minimum of respondents buy vine in beverage carton (3% of men, 0% of women) and sauces and soups buy only 5% of men and 12% of women. No one filled out the possibility of buying other products. There were no significant deviations in men's and women's answers. Nevertheless, some relations could be mentioned. All women that buy sauces and soups were in the age of 26-40 and 3% of men who buy vine in beverage cartons were in the age of 10-25 and they finished secondary school.

Figure 11: Important factors for buying product in beverage carton



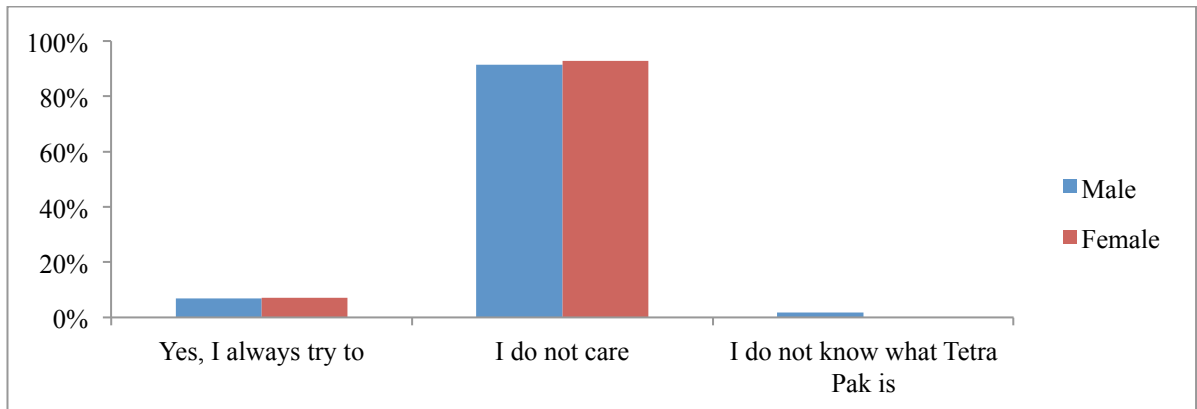
This questions was concerning about the most important factors for respondents, when they buy products in beverage carton. There were 7 possible answers and respondents could mark more than 1 of them. Taste of the product is the most important factor for respondents (90% men, 95% women). Products' composition is also important for 55% of men and 69% of women. The significant deviation can be found in the importance of quality of the product. 55% of women said, that the high quality of products was significant and important factor for them, but only 14% od men replied the same. Contrary, only 2% of men and even 0% of women care about the advertisement. There is no big difference in importance of carton design. It is important for only 2% of women and for none of men. Brand like Hello, Happy Day, Relax, Tesco, as it was explained in the questionnaire, is important factor for only 5% of men and for the same percentage of women. These results are quite surprising, because in these days, media advertisement might has a power over people and producers of the product filled into the carton package constantly develop new designs and versions to attract the customers.

Figure 12: Respondent's awareness about the FSC



The last part of the thesis was dedicated to FSC issue and that is why the question about respondents' awareness of FSC is included in the questionnaire. Based on the answers on this question, it can be said, that respondents generally do not know what FSC means (95% of men and 88% of women answered negatively). Only 5% of men and 12% of women know the meaning of this abbreviation. Those 12% of women were mostly in the age of 26-40 and they finished university. 5% of men who replied positively on this question were also in the age of 26-40 and 2 of them finished university and 1 of them finished secondary school. Considering the results of this question, it can be generally mentioned, that FSC is not much widened in the awareness of Czech inhabitants. Following question was for the respondents who answered, that they knew what FSC meant. The question was directed towards the importance of FSC label on products which respondents buy. All 3 men answered, that it was not important for them if the products which they want to buy was labelled by FSC. By contrast, 2 women answered, that they cared about the FSC label on the products and it was important for them to buy these labelled products. For other 3 of them, it was not important if the products were labelled by FSC and they bought what they want.

Figure 13: Do respondents buy products in Tetra Pak packages?



The last question in the questionnaire was focused on Tetra Pak Company itself. The relevant was to find out, if respondents even know what Tetra Pak is and if they buy products in Tetra Pak packages. The results are very clear. The majority of respondents do not care about the carton package producer and they buy what they want and like. The proportion between men's and women's answers was following: 91% of men and 93% of women do not care about the producer of beverage carton, which they buy. 7% of men and women care about Tetra Pak and they try to buy products in packages produced by this firm. Surprisingly, 2% of men do not know what Tetra Pak is.

6. Conclusion

The theoretical part was focused on analysing the beverage cartons and on Tetra Pak Company. These 2 topics were crucial for this thesis. The life cycle, composition and various kinds of beverage cartons were defined as well as beverage cartons collecting and sorting. Ekokom is very closely connected to these processes and its activities were also mentioned. There are described different surveys, provided by Ekokom and by Tetra Pak and some of the results can be compared with the results from questionnaire. This questionnaire covered the practical part of the thesis and it was chosen as a tool of quantitative research, needed for this thesis. The purpose of this questionnaire was to find out the facts about Czech inhabitants' attitudes towards recycling and the significant part was devoted to the issue of beverage cartons. It has to be mentioned, that this questionnaire was filled out mainly by the inhabitants of Prague and its surroundings.

According to the evaluation of answers on some questions involved in the questionnaire it can be said, that the majority of Czech inhabitants sort at least some kinds of waste (94% of respondents). This is definitely a positive result. According to survey, conducted by Ekokom in 2013, 70% of Czech population actively sort the waste. In comparison with the result from the questionnaire about the attitude towards sorting the waste, these 2 results are in line with each other and obviously, the trend of waste sorting is positive. Respondents mainly sort the waste, because they believe, it is a good thing for the environment. It is another very positive result of the questionnaire and it can be said, that the majority of respondents is interested in the environmental issues.

The result of respondents' knowledge of Tetra Pak is unfortunately quite worrying. Based on the questionnaire, the majority of respondents do not care about the beverage carton producer. Tetra Pak is the largest beverage carton packaging company in the Czech Republic. Consumer's limited knowledge of Tetra Pak trend might be the opportunity for Tetra Pak Company to invest into building the brand and increase the market share.

Most of consumers do not even care about the brand of the producers of the product filled into the carton package (Hello, Happy Day, Relax, Rio, and others). This was very surprising result. Accordingly to this result, respondents are more oriented on product's

taste, composition and price than the brand. It seems that communication campaigns by beverage producers are not effective enough.

The rate of beverage carton sorting, resulting from the questionnaire emphasizes, that sorting of this kind of waste is slightly behind the paper, plastics and glass sorting level and there are significant deviations between men and women. While the majority of women sort beverage cartons and they even sort them properly, only less than half of men's respondents is familiar with beverage cartons sorting. On the other hand, if men sort beverage cartons, they usually know how to sort them correctly.

Briefly said, the results of practical part of this thesis are fairly positive. The majority of respondents sort waste. Even beverage cartons sorting is not strange for more than a half of them and most of the respondents sort the waste, because they think, it is a good for the environment. From this result it can be assumed, that most of the respondents care about the environment. On the other hand, Tetra Pak Company is not in respondents' awareness much and people do not care about it. This is completely negative result. Tetra Pak actively supports environment, responsibly managed forests and recovery of renewable resources. And obviously based on the results of this questionnaire, respondents have no idea about Tetra Pak environmental activities. This can be the opportunity for Tetra Pak to get more into the awareness of consumers and to make people to buy its products.

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8. Appendices

8.1 Questionnaire

This questionnaire is divided into 2 parts. The first part (5 questions) deals with the basic information about the respondents such as the gender, age, education level and type of housing in which respondents live. The second part is concentrated on the sorting issues. The main objective is to find out if respondents sort the waste, why, what kind of waste do they sort and some questions are focused on beverage cartons which create a very important part of the questionnaire. There are questions about buying beverage cartons, sorting them, FSC knowledge and the last question is about the respondents' awareness of Tetra Pak Company. The results of this questionnaire serves only for the purposes of this thesis.

1. What is your gender?

- a) Female
- b) Male

2. How old are you?

- a) 10 – 25
- b) 26 – 40
- c) 41 – 65
- d) 66 and more

3. What is your highest education level, which you have already achieved?

- a) Primary school
- b) Secondary school
- c) University

- 4. Where do you live?**
- a) Village
 - b) City
- 5. What type is your housing? (you can mark more than 1 answer)**
- a) Flat
 - b) Detached house
- 6. Do you sort the waste?**
- a) Yes, I do
 - b) No, I do not
- 7. Why do you sort the waste?**
- a) I believe, it is a good thing for the environment
 - b) Because of social pressure (e.g. other people do it)
 - c) Other (please specify)
- 8. If so, what kind of waste do you sort? (you can mark more than 1 answer)**
- a) Plastics
 - b) Paper
 - c) Glass
 - d) Beverage cartons
 - e) Electronic waste
 - f) Textile
 - g) Compost
- 9. How do you sort beverage cartons?**
- a) To proper container for beverage cartons
 - b) Together with paper (I do not think it is necessary to sort it separately)
 - c) Together with paper (there is no container for beverage cartons near my home/office)
- 10. Do you buy products in beverage cartons?**
- a) Yes, quite often (2 times in a week and more)
 - b) Yes, sometimes (few times in a month)
 - c) Yes, occasionally (few times in a year)

d) Never

11. If so, what products in beverage cartons do you buy? (You can mark more than 1 answer)

a) Juice

b) Milk

c) Vine

d) Cream

e) Sauces, soups

f) Other (please, specify)

12. What factors are important for you when buying products in beverage cartons? (You can mark more than 1 answer)

a) Low price

b) High quality of product

c) Product's composition

d) Advertisement

e) Carton design

f) Brand (Hello, Happy Day, Relax, Rio...)

g) Taste

13. Do you know, what FSC (Forest Stewardship Council) means?

a) Yes, I know

b) No, I do not know

14. If so, is it important for you to buy products with FSC label?

a) Yes, I try to buy products with FSC label

b) I do not care, if the product has FSC label

15. Do you buy products in Tetra Pak packages?

a) Yes, I always try to buy products in Tetra Pak packages

b) I do not care, I buy what I like regardless of the carton package producer

c) I do not know what Tetra Pak is