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PRODUCER RESPONSIBILITY AND SUPPLEMENTARY TRANSPORT OF MUNICIPAL PACKAGING WASTE

Case: Päijät-Häme waste management region

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ABSTRACT

At the moment municipalities are responsible for management of the packaging waste generated in households. When the producer responsibility is enforced, responsibility for the waste management and the associated costs of the packaging waste is transferred to producers. Producers are obligated to arrange a regional network of reception points for inhabitants from the beginning of 2016 and regional terminals for the municipal packaging waste collected in properties have to be operational by May 2015.

Municipalities may regulate about the reception and the treatment point of the packaging waste if the organisation of the transport is ensured by the municipality. The strict interpretation of transport does not include storage in transit and transloading, but in order to efficiently transport packaging waste that should be possible. If a municipality sorts packaging materials from mixed waste and energy waste, it is not transport of packaging waste and therefore separated cardboard, plastic, metal or glass does not have to be delivered to the producer.

The number of regional collection points will most likely increase for cardboard and decrease for glass and metal in the Päijät-Häme region, and collection points may centralise to urban areas. According to this study the waste carriers are satisfied with the current waste management regulations and confident about reaching a higher recycling level of packaging waste in the future and making the service accessible all inhabitants in the region, whereas Päijät-Häme Waste Management Ltd does not rely as much on the current sorting system and functionality of the market.

This study was conducted in connection with the preparation of revision of the Päijät-Häme regional waste management regulations. Interviews, questionnaires and workshops of local and national actors were used as material. Realistic options would be to continue with the current sorting instructions or to require properties with at least 10 households to collect glass and metal, in addition to cardboard.

Keywords: waste management, packaging waste, producer responsibility, waste act, sorting of waste, municipal waste

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TIIVISTELMÄ

Kunnat ovat tällä hetkellä vastuussa kotitalouksissa tuotetun pakkausjätteen jätehuollosta. Kun tuottajavastuu astuu voimaan, pakkausjätteen tuottajat ovat vastuussa pakkausjätteen jätehuollosta ja sen kuluista. Tuottajien tulee järjestää vastaanottoa paikkojen verkosto asukkaille vuoden 2016 alusta ja terminaaliverkosto kiinteistöiltä kerätylle pakkausjätteelle toukokuusta 2015 alkaen.

Kunta voi määrätä huolehtimansa pakkausjätteen kuljetuksen vastaanotto- ja käsittelypaikan. Tiukka tulkinta kuljetuksesta ei sisällä väliavarastointia ja siirtokuormausta, mutta tehokkaan kuljetuksen takaamiseksi sen tulisi olla mahdollista. Jos kunta lajittelee pakkausmateriaaleja seka- tai energiajätteestä, se ei ole pakkausjätteen kuljetusta, eikä lajiteltua kartonkia, muovia, metallia ja lasia tarvitse viedä tuottajien vastaanottoon.

Alueellinen pakkausjätteen keräyspisteverkosto tulee parantumaan kartongin osalta ja heikentymään lasin ja metallin, ja pisteet voivat keskittyä suuriin taajamiin. Tämän tutkimuksen mukaan jätteenkuljetusyrietykset ovat tyytyväisiä nykyisiin jätehuoltomääräyksiin ja uskovat nykyisten kiinteistökohtaisen lajitteluvaihtoehtojen turvaavan entistä korkeamman kierrätysasteen ja takaavan palvelujen tasapuolisen saatavuuden asukkaille. Päijät-Hämeen Jätehuolto Oy ei luota yhtä paljon nykyiseen lajittelujärjestelmään ja markkinoiden toimivuuteen.

Opinnäytetyö on tehty tukemaan Päijät-Hämeen jätehuoltoalueen jätehuoltomääräysten valmistelua. Materiaalina käytettiin paikallisten ja valtakunnallisten toimijoiden haastatteluja, kyselyjä ja työpajoja. Realistiset vaihtoehdot lajittelumääräyksille ovat joko nykyiset lajittelumääräykset tai lasin ja metallin keräyksen lisääminen yli 10 asunnon kiinteistöille kartongin lisäksi.

Asiasanat: jätehuolto, pakkausjätteet, tuottajavastuu, jätelaki, jätteiden lajittelu, yhdyskuntajätteet

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ABBREVIATIONS

AFLRA - Association of Finnish Local and Regional Authorities (Suomen Kuntaliitto ry).

FSWA - Finnish Solid Waste Association (Jätelaitosyhdistys ry).

LCA – Life cycle assessment

MoE - Ministry of the Environment

MRF - material recycling facility

MSW - municipal solid waste

PHJ - Päijät-Häme Waste Management Ltd (Päijät-Hämeen Jätehuolto Oy).

PYR - Environmental Register of Packaging PYR Ltd (Pakkausalan Ympäristörekisteri PYR Oy).

1 INTRODUCTION

1.1 Background

Packaging waste can be divided into glass, metal, plastic, paper, cardboard and paperboard, wooden materials, textile and composite materials (The government decree on packages and packaging waste 518/2014 appendix 2). This study deals with the packaging waste generated from households, i.e. glass, metal, plastic and cardboard. At the moment municipalities are responsible for the organising of the management of packaging waste from households. The municipal waste management companies have organised regional networks of reception points for packaging waste. There is also separate collection of different types of packaging waste (cardboard, glass and metal) in properties.

From the beginning of 2016 packaging producers have the responsibility for the waste management and associated costs of packaging waste (The waste act 646/2011 section 46). At the same time, the producers have the right to control the packaging waste streams and receive the financial benefit from the material reuse. The producers are obligated to arrange a regional network of reception points for packaging waste generated in households to be in operation on 1 January 2016 and separately collected packaging waste in properties is ordered to be delivered to producers' terminals from 1 May 2015 (The waste act 646/2011 section 152).

The number of the packaging waste collection points is decreed in the government decree on packages and packaging waste (518/2014). At the moment there are more collection points in Finland than the packaging waste decree demands. This creates a situation where municipalities have to consider if there is a need to ensure supplementary transport or reception of packaging waste. The supplementing can be arranged by either regional reception points or transport from properties. Transport from properties can be voluntary or mandatory. In latter case it is regulated mandatory in the waste management regulations.

The Päijät-Häme waste management region consists of the municipalities of Asikkala, Heinola, Hollola, Hämeenkoski, Kärkölä, Lahti, Myrskylä, Nastola, Orimattila, Padasjoki, Pukkila and Sysmä. This study is carried out in connection

with the preparation of the revision of the Päijät-Häme regional waste management regulations. Some aspects to be considered during the revision are the measures to increase recycling of the packaging waste and the possible need to regulate the collection of packaging waste in properties. Reasons for supplementing the collection can be ensuring an acceptable service level in the packaging waste management and reaching the target level of the municipal waste recycling.

1.2 Research questions

This study is a qualitative case study, which supports the revision of the waste management regulations. The scope of the study is limited to packaging waste generated in households: plastic, metal, glass and cardboard. The collection system for deposit-based systems for beverage containers is not included in this study.

The objective of this study is to explore what options there are for sorting instructions in the revision of the waste management regulations in order to support the increase of recycling of packaging waste in the Päijät-Häme waste management region. More specifically, the objective was studied through the following research questions:

1. How do different stakeholders interpret the waste act and the government decree on packages and packaging waste, especially in relation to organising the supplementary transport of packaging waste from properties?
2. How does the producer responsibility affect the service level of the municipal packaging waste collection?
3. What kind of preferences do different stakeholders have for the municipal steering instruments and technical solutions for collection from properties in order to increase recycling?

There are several questions concerning the interpretation of the legislation that affect the organising of the supplementary transport of the packaging waste collected in properties. The government decree on packages and packaging waste

(518/2014) has recently been enforced and all the waste management regions in Finland are in the same situation. Therefore, solutions cannot be replicated from other regions. Some of the implementation questions were not explored in detail during the preparation of the waste act.

The service level of the packaging waste management has to be considered in order to decide whether there is a need to supplement the packaging waste collection organised by producers.

The third research question deals with the municipal steering instruments in increasing the recycling of municipal packaging waste and practical solutions of supplementary packaging waste collection. Because of the waste transport system in the region, all the stakeholders need to work together in order to increase packaging waste revenue. Municipal sorting regulations and different collection methods are considered in detail.

1.3 Material and methods

The study material was collected from interviews and workshops. Statistical information was retrieved from the ecocharge register of Päijät-Häme Waste Management Ltd (Päijät-Hämeen Jätehuolto PHJ) and calculated from the register of municipal waste transports from properties kept by the Päijät-Häme waste management board.

In this study stakeholders which were asked about their interpretations of the waste legislation are Environmental Register of Packaging PYR Ltd (Pakkausalan Ympäristörekisteri PYR Oy), PYR, Association of Finnish Local and Regional Authorities (Suomen Kuntaliitto ry), AFLRA, and Finnish Solid Waste Association (Jätelaitosyhdisty ry), FSWA, and the Ministry of the Environment MoE. PYR represents the producers, AFLRA municipalities, FSWA municipal waste management companies, and ministry the perspective of the law maker. AFLRA, FSWA, and MoE answered to questions by writing. The questions are in Appendix 1.

Concerning the second research question of the service level, PYR was

interviewed. The questions are in Appendix 2. The interview was carried out in person. The questions also dealt with PYR's interpretation of the waste legislation.

Perspectives of waste carriers, PHJ and the waste management authority to the different packaging waste collection options are based on interviews carried out by the author, workshops and questionnaire. The author works for the Päijät-Häme waste management board and gave the perspective of the waste management authority.

Five of the six waste carriers that operate in the area and altogether seven people from waste carriers were interviewed. The interviewed waste carriers were Lassila & Tikanoja Oyj, Hämeen Kuljetuspiste Oy, HFT Network Oy, SITA Suomi Oyj and RTK-Palvelu Oy. One interview was performed in writing and four were carried out in person and recorded for further analysis. The waste carriers were asked to tell their views about sorting of packaging waste, waste management regulations and practical solutions for transport. The questions are in Appendix 3. The interviews were semi-structured specialist interviews. Themes and some of the questions were given to the interviewees beforehand. The aim was to cover the entire set of questions but to allow interviewees' own initiatives. For instance, some of the possible waste collection options were outlined prior to the interviews but questions concerning them were asked only if they did not emerge otherwise in the discussion. The interviewer tried to understand the interviewee and adjust the dialog according to that.

After the interviews the findings made were complemented with the observations from a joint workshop for waste carriers and employees of PHJ and the Päijät-Häme waste management board. Following the workshop, the same three actors prioritised criteria for the decision making of future packaging waste collection options and evaluated a few collection systems in the questionnaire performed by PHJ (Honkanen 2014). The prioritisation and evaluation questionnaire was sent to the people present in the workshop and also PHJ management group, personnel working in the Päijät-Häme waste management board and management of waste carriers. Overall, the questionnaire was sent to 18 people and 15 of them answered

(Honkanen 2014). Later, members of the PHJ board and Päijät-Häme waste management board had also a joint seminar, which gave the point of view of a municipal decision maker to prioritisation.

The answers provided by the private waste carriers to the interviews and to the questionnaire are treated anonymously in this study and answers are not identified. In the results, answers from personnel of PHJ and the waste management board to the questionnaire are treated together, since only one person from the waste management authority responded to questionnaire.

Statistical information was received from the PHJ ecocharge register and the waste transport register of waste management authority (The waste act 646/2011 section 143). The ecocharge register is the client register of the municipal waste management company and has the number of properties in the region. The transport register has information on properties from which waste is transported, and the number of times waste containers have been emptied, by property and type of waste. The waste management authority also has information on transport prices from properties.

1.4 Key concepts

Commingled collection means collection of different types of recyclable waste in a single waste container. For instance glass and metal can be collected in a single container.

Material recycling facility (MRF) means a facility can accept recyclable commingled materials that have already been source separated from municipal mixed waste or mixed solid waste to separate recyclable materials.

Municipal solid waste (MSW) means solid waste generated in permanent dwellings, holiday homes, residential homes and other forms of dwelling, as well as waste comparable in its nature to household waste generated by administrative, service, business and industrial activities (The waste act 646/2011 section 6).

MSW which the municipality responsible for means that the municipality is responsible for organising the waste management of MSW generated in permanent dwellings, holiday homes, residential homes and other forms of dwelling, other waste if the waste holder so requests due to the lack of other services provided, and the waste is suitable in quality and quantity for transport or treatment within the municipality's waste management system, and packaging waste not delivered to waste management organised by the producer or distributor (The waste act 646/2011 section 32 and 33).

Package means single-use or other product which is meant to preserve or cover a substance or product, to ease the presentation or enable its handling or transport from producer to consumer or other user and which fulfils additional elements of selling, group and transport packages in Appendix 1 of the government decree of packages and packaging waste and other additional criteria (The government decree on packages and packaging waste 518/2014 section 3).

Packaging producers covered by producer responsibility means packagers of products or importers of packaging products regarded as producers. With the exception of section 52 [Measures for promoting reuse], the provisions of this chapter [Producer responsibility] shall not apply to a producer of packaging whose turnover is less than EUR 1,000,000 (The waste act 646/2011 section 48).

Packaging waste means packaging or packaging material that is waste defined in the waste act section 5 (1), apart from the waste generated in the manufacturing process of the packaging (The government decree on packages and packaging waste 518/2014 section 3).

Packaging waste decree means the government decree on packages and packaging waste 518/2014.

Recycling of waste means operations by which waste is reprocessed into a product, material or substance, either for the original or some other purpose; recycling of waste does not include recovery of waste as energy or the reprocessing of waste into fuel or material to be used for backfilling (The waste act 646/2011 section 6).

Reuse means reusing the product, or a component thereof, for the purpose for which it was originally conceived (The waste act 646/2011 section 6).

Separate collection means the collection of waste where waste is kept separately by type and nature so as to facilitate recycling, other types of recovery or other specific treatment (The government decree on waste 179/2012 section 1).

Urban Settlement means a group of buildings which has at least 200 inhabitants and where the buildings are located not more than 200 m from each other (The government decree on packages and packaging waste 518/2014 section 3).

Waste carrier means anyone responsible for the transport of waste (The waste act 646/2011 section 6), in this study private waste transport company.

Waste collection means the collection of waste at a reception point provided by the property holder, municipality, producer, distributor or other party, for on-site treatment or for the purpose of transportation for treatment, including preliminary sorting and temporary storage of waste (The waste act 646/2011 section 6).

Waste management means the collection, transport, recovery and disposal of waste, including monitoring and supervision of such operations and the aftercare of disposal sites, and actions taken as a broker (The waste act 646/2011 section 6).

2 PRODUCER RESPONSIBILITY OF PACKAGING WASTE AND WASTE MANAGEMENT IN MUNICIPALITIES

2.1 Packaging waste and producer responsibility

2.1.1 Targets of recycling and reuse

A package means single-use or other product which is meant to preserve, or cover a substance or product. Packages can be divided into consumer packages, group packages and transport packages. Package becomes packaging waste when it is not used anymore (The government decree on packages and packaging waste 518/2014 section 3).

Packaging materials can be divided into glass, metal, plastic; paper, cardboard and paperboard; wooden materials, textile and composite materials (The government decree on packages and packaging waste 518/2014 appendix 2). This study deals with the packaging waste generated from households, i.e. glass, metal, plastic and cardboard.

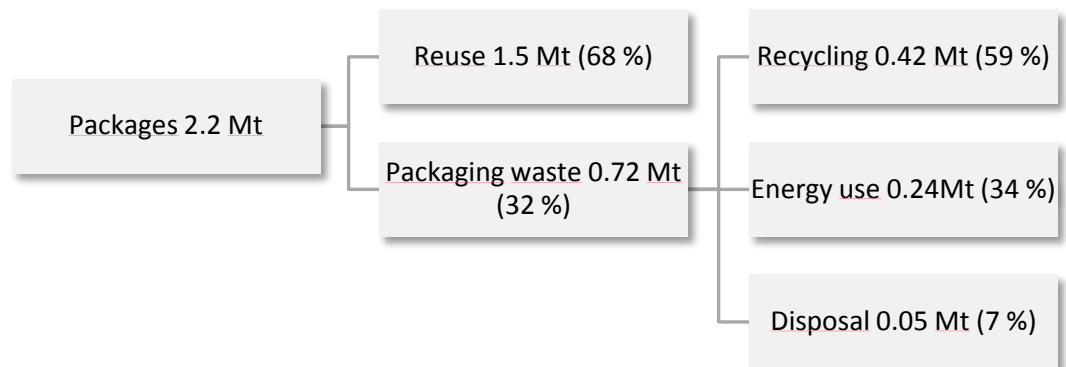


FIGURE 1. Amount of packaging material placed on market and reuse recycling and energy use levels in 2012 according to PYR. (The Environmental Register of Packaging Ltd PYR 2014).

Overall, 2.2 million tonnes of packages were used in Finland in 2012, of which 68 % was reused. 720 000 tonnes of packaging waste was produced i.e. placed on market in 2012 (Environmental Register of Packaging PYR Ltd 2014) (Figure 1).

Only 30 % of the packaging waste is generated in households (Background note of the government decree on packages and packaging waste 2014, 8).

The national general recycling target of packaging waste is 65 % by 2020 (The government decree on packages and packaging waste 518/2014 section 7). The current EU target level for 2020 is 55-80 % but it has been proposed to increase gradually to 80 % by the year 2030 (Directive 94/62/EC on packaging and packaging waste article 6; EU Commission 2014, 20-21) (Table 1).

TABLE 1. Recycling and reuse targets of packaging waste and achieved levels (Directive 94/62/EC on packaging and packaging waste article 6; EU Commission 2014; The government decree on packages and packaging waste 518/2014 section 7 and 8; Background note of the government decree on packages and packaging waste 2014, 10).

Type of packaging waste	Recycling and reuse targets							Recycling and reuse level 2012
	Eu directive*	Draft directive*			Packaging waste decree			
		2020	2025	2030	General 2020*	Binding 2016**	Binding 2020**	
Metal	50	70	80	90	87	75	80	74** / 83*
Fibre-based	60	85	90	90	81	80	-	77*** / 97*
Plastic	22.5	45	60	60	30	16	22	12** / 25*
Glass	60	70	80	90	80	27	40	24** / 72*
Wood	15	50	65	80	18	17	-	17*
All	55-80	60	70	80	65			86*

* Packages with deposit included

** Packages with deposit not included

*** Estimation of the real recycling level

The recycling and reuse level of the packaging waste in Finland is estimated to be 86 % of the packages that producers placed on market in 2012. It has to be noted that producer responsibility applies only to the firms with a yearly turnover of over one million euros (The waste act 646/2011 section 48). The achieved reuse and recycling level in statistics includes packaging waste from small businesses and internet stores, which leads to overestimation of the real level (Background note of the government decree on packages and packaging waste 2014, 11). The

binding national targets for 2016 are about the same level as achieved levels when the full producer responsibility begins.

The producer responsibility is estimated to increase the amount of recovered packaging waste (Moliis, Salmenperä & Rehunen 2014, 23). The estimation is based on the assumption that collection in properties will continue at the same level or even increases.

2.1.2 Conceptual framework of the producer responsibility

The general reform of waste management legislation in Finland began with the revised waste act (646/2011) in 2011 and followed by the government decree on Waste (179/2012). Waste hierarchy was introduced to the waste act from Waste Framework Directive (Directive 2008/98/EC on Waste and repealing certain directives Art. 4). It was not an essential change to the old waste act (1072/1993), it only strengthened the order of priority in legislation (Background note of the waste act HE 199/2010, 34). Order of priority must be used in waste reduction (The waste act 646/2011 section 8) (Figure 2). The first priority is the reduction of waste. Secondly and thirdly, waste must be either prepared for reuse or recycled. Reuse means the use of a product for the same purpose. Beverage bottles with deposit are an example of this. Recycling means material recovery. Only after that can waste be used in energy production or disposed of. However, one can deviate from the order of priority based on life cycle assessment (The waste act 646/2011 section 8). Similar waste hierarchy and life cycle assessment regulations are given in European legislation.

Life cycle assessment (LCA) is an ISO standardised (SFS ISO 14040:2006 and 14044:2006) assessment method for the systematic evaluation of the environmental aspects of a product or service system through all stages of its life cycle. LCA has four stages: defining the goal and scope, life cycle inventory, life cycle impact assessment and interpretation. In waste management the phases are usually waste delivery, pretreatment, treatment, post treatment, transport to disposal or transport to reuse and recycling (Hämäläinen & Nummela 2012, 6, Myllymaa & Dahlbo 2012, 12). The system produces emissions to air, water and

ground and avoided production compensations come from recycling or energy production. The order of priority and LCA are promoted in the waste management regulations with provisions on sorting and separate collection. The AFLRA recommends the use of LCA in the decision making of a waste management system (Luukkonen, Innala & Nurmikolu 2014, 18).

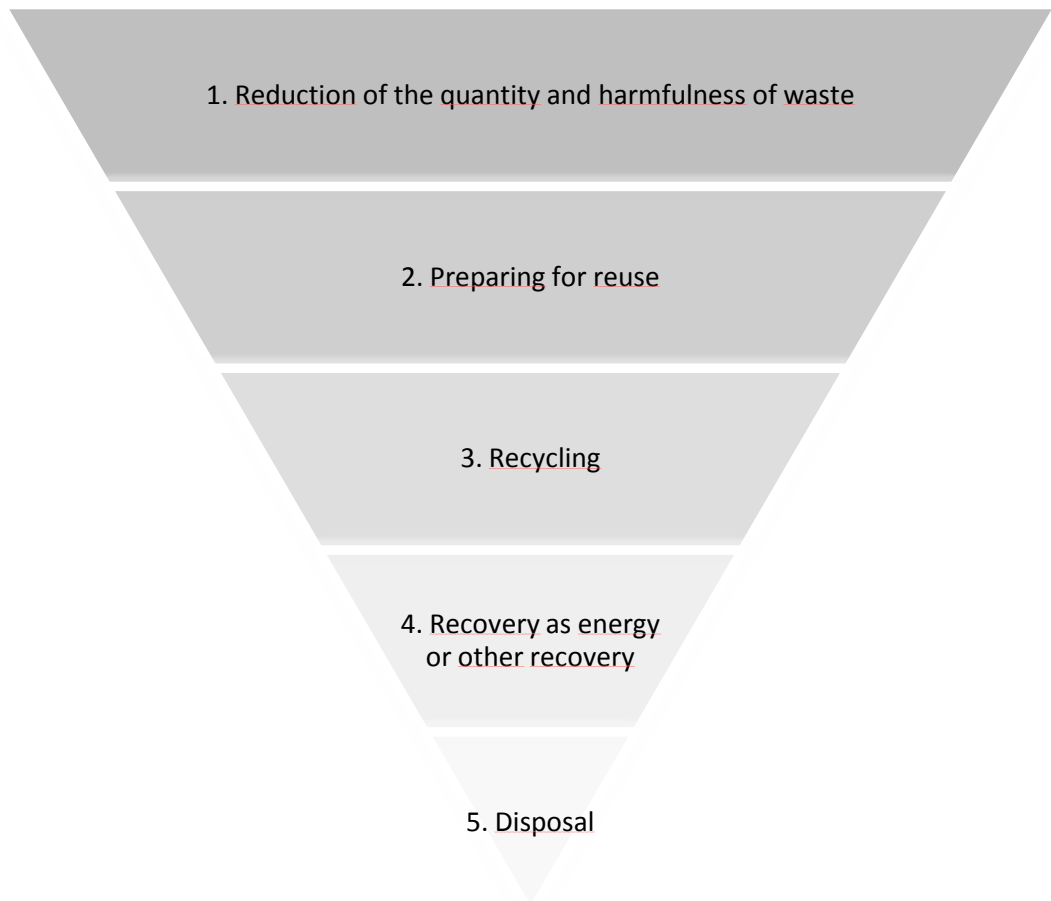


FIGURE 2. Waste hierarchy (After the Ministry of the Environment 2013, 2).

Producer responsibility is consistent with the polluter pays principle. This principle is the leading environment policy principle in the EU Environment policy (the Treaty on European Union and the Treaty on the Functioning of the European Union 2012/C 326/01 article 191). It was mentioned as a recommendation in EU policies as early as in the 1970s and has been in the Treaty since 1987. According to the waste framework directive the costs of waste management shall be borne by the original waste producer or by the current or previous waste holders (Directive 2008/98/EC on waste and repealing certain

directives article 14). Also the waste act (646/2011) is based on the polluter pays principle, the original producer or current or previous holder of the waste shall bear the costs of waste management.

The full responsibility is often referred to as extended producer responsibility EPR. The concept was originally introduced by Thomas Lindhqvist (Lindhqvist & Lidgren 1990 according to Lindhqvist 2000, ii). Later EPR was formally defined:

Extended Producer Responsibility is an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the take-back, recycling and final disposal of the product. The Extended Producer Responsibility is implemented through administrative, economic and informative instruments. The composition of these instruments determines the precise form of the Extended Producer Responsibility. (Lindhqvist 2000, ii)

According to Lindhqvist (2000, 38) there are five aspects of EPR:

- Liability is responsibility for environmental damages caused by the product and extended liability covers also the life cycle of the product, including use and disposal of the product.
- Economic responsibility means that the producer covers all or part of the expenses (i.e. collection, recycling or final disposal) of the product. Expenses can be paid directly or by a special fee.
- Physical responsibility refers to responsibility to organise waste management.
- Informative responsibility has several possibilities to extend responsibility by requiring to supply information on the environmental properties and manufacturing.
- Ownership means that the producer may retain the ownership of the product throughout the life cycle and be linked to the environmental problems of the product.

The extended producer responsibility is a shift from legislative command and control law to market-based instruments. The liability is channelled to the

producer, who has larger resources and capacity to manage the waste, but in the end, the consumer will pay the packaging waste management in the product price.

2.1.3 Producer responsibility and ownership of waste

The extended producer responsibility can be either partial or total responsibility for waste. When the waste act was prepared, different models of responsibility were considered. The full producer responsibility was chosen because the model has a clear division of responsibilities and costs, and to avoid of double charging of inhabitant's in municipal waste charges and by the producers (Background note of the waste act HE 199/2010 vp, 37)

At the moment, the packaging waste management is partially the responsibility of the municipalities and partially the responsibility of the producer. Municipalities have organised collection points for inhabitants, the cost of which is covered by the waste charge. Municipalities have also been able to regulate about separate collection of glass, metal and cardboard in the waste management regulations.

From the beginning of 2016 producers must organise a network of regional collection points for municipal packaging waste, and source separated municipal packaging waste is not the responsibility of municipalities anymore (The waste act 646/2011 section 152).

The network should (The government decree on packages and packaging waste 518/2014 section 9):

- cover the whole country;
- be balanced and take population density into account;
- consist of collection points, which are located near the daily retail shop or other usual services near commonly used routes;
- have 1850 collection points for glass, metal and fibre-based packaging waste so that every urban area with 500 inhabitants has at least one collection point and other regions have collection points corresponding to the number of market places (market place is an area with at least one daily retail shop or several not more than 500 m away) and

- have 500 collection points for plastic so that every urban area with 10 000 inhabitants has at least one collection point.

In addition to the collection points, the producers must organise 30 terminals for other than municipal packaging waste and for the municipal packaging waste collected in properties (The government decree on packages and packaging waste 518/2014 section 9). The terminals must be in use by the beginning of May 2015.

The producer responsibility has two sides: the producer responsibility for waste management and the ownership of the waste. Ownership of waste was strengthened in the new waste act in order to have a balance between responsibilities and rights. That was necessary to assure that other than the producers do not transport the waste with better market value to their own systems, i.e. to avoid cherry picking.

The producers have a right of precedence to organise waste management actual means to obtain the waste (The waste act 646/2011 section 47) (Figure 3). According to the waste act section 47, a municipality may supplement the transport of separately collected packaging waste and reception of the packaging waste insofar as the producer does not arrange it. The supplementary reception can be organised by regional collection points. The waste act 646/2011 section 35 allows the transport from the property if it is not organised by the producer. The waste must be delivered in all cases to the producer's terminals. The official Finnish version of the waste act (646/2011) section 35 uses the wording "the municipality may ensure for the transport of separately collected packaging waste", which is open for different interpretations. How a municipality should inform of it and what does it legally mean.

If a municipality ensures supplementary transport from properties or regulates about separate collection in the waste management regulations, it has to negotiate with the producer. The producer must also take into account separate collection from properties in the region if possible in positioning of the collection points.

If a municipality decides to ensure the transport of packaging waste from the properties it can be either mandatory in the waste management regulations or

voluntary in certain defined cases in the regulations. In both cases the actual waste transport system can be arranged either by the municipality or by the property holder. If the municipality does not ensure the organisation of the transport, then the property holder may organise the transport from the property (The waste act 646/2011 section 41).

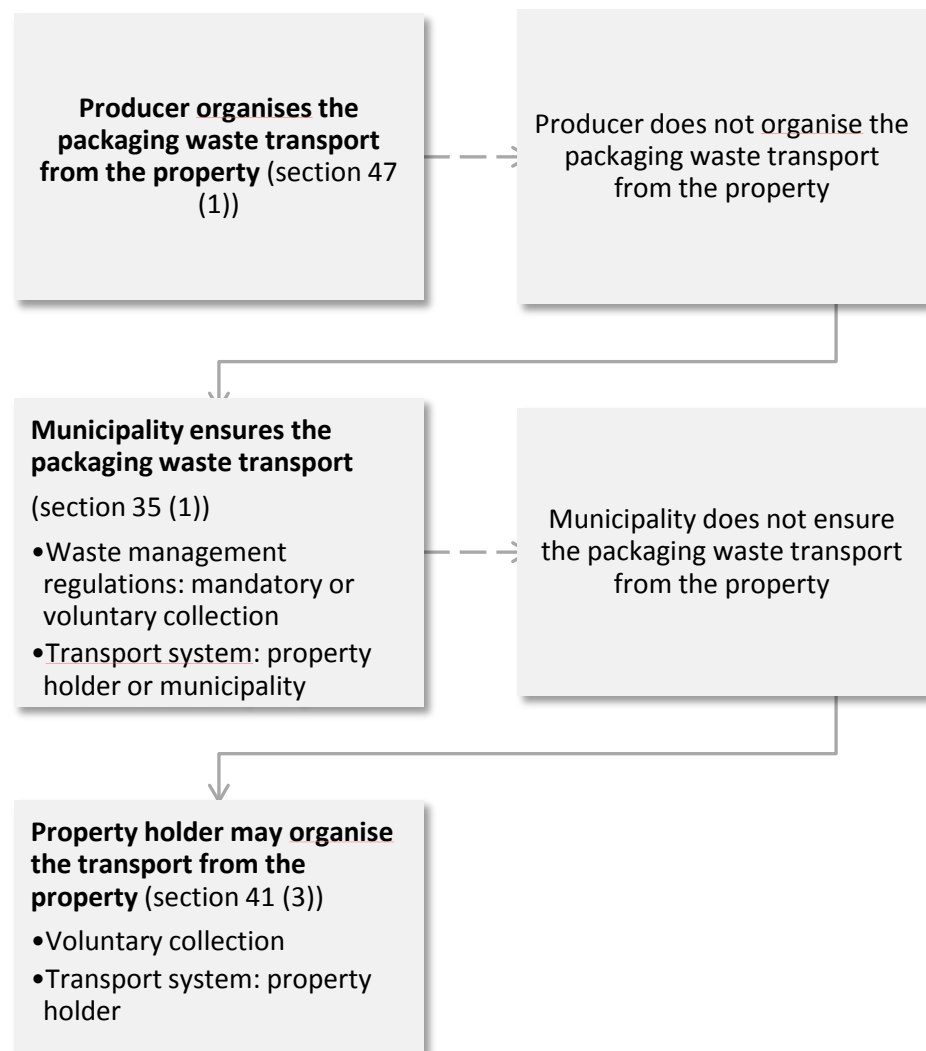


FIGURE 3. Packaging waste transport from the property.

It has to be noted that the producers with yearly turnovers over one million euros are jointly responsible for all the waste management of packaging waste, but recycling and reuse target levels are calculated from the number of packages, which they have placed on market itself. The municipality is still responsible for other similar waste generated in households. In practice that applies to small metal; plastic, glass and cardboard are mostly packaging waste.

The waste act (646/2011) and the government decree on packaging waste (518/2014) recognize only separate collection of packaging waste. The producer has the right to predefine the content of the waste received from the properties to terminals and refuse to accept the waste if it contains other than packaging waste (The government decree on packages and packaging waste 518/2014 section 10). In the background note of the packaging waste decree it is said that the responsibility for separate collection does not require collection of packaging metal and small metal separately if this is appropriate and the life cycle impacts are positive (Background note of the government decree on packages and packaging waste 2014, 35). Municipalities and producers should agree about the division of costs and responsibilities of the establishment and maintenance of the network, and guidance of inhabitants if for instance packaging metal and small metal are collected together.

2.1.4 Producer corporations

Producers can establish a legally competent producer corporation to manage the responsibilities (The waste act 646/2011 section 62). Producer corporations must register to a producer register (The waste act 646/2011 section 142). The producer corporations must have more than one member and they can only have producer members. The latter change was included in order to strengthen the producers' authority in waste management (Background note of the waste act HE 199/2010 vp, 101)

At the moment there are seven producer corporations: Mepak-Kierrätys Oy for metal, Puupakkausten Kierrätys PPK Oy for wood, Suomen Keräyslasiyhdistys ry for glass, Suomen Kuitukierrätys Oy for paper and cardboard, Suomen Palautuspakkaus Oy PALPA for deposit-based systems for beverage containers, Suomen Teollisuuskuitu Oy for industrial fibre-based materials and Suomen Uusiomuovi Oy for plastic (Environment 2014).

The collection of municipal packaging waste according to the packaging waste decree (518/2014) will be organised by PYR. Packaging waste producers transfer the producer responsibility obligation to PYR by making a contract.

2.2 Waste management in municipalities

2.2.1 Waste management and transport

Most of the municipalities have arranged their waste management by establishing municipal waste management companies and transferring the reception and treatment of waste as well as invoicing of waste charges and waste guidance to them (The waste act 646/2011 section 43).

According to the waste act (646/2011) section 32

(1) A municipality must organise waste management for the following non-hazardous waste:

1) waste generated in permanent dwellings, holiday homes, residential homes and other forms of dwellings, including sludge in cess pools and septic tanks;

2) municipal waste generated in health care and social welfare services, and educational activities;

3) waste generated by administrative and service activities of the state, municipalities, parishes and other corporations and associations subject to public law, other than the municipal waste referred to in paragraph 2;

4) municipal waste generated on business premises, collected at the property together with the waste referred to in paragraphs 1–3;

5) other municipal waste collected together with the waste referred to in paragraphs 1–4 in a regional automated pipe collection system for waste, or in another corresponding collection system.

(2) In addition, municipalities shall organise the reception and treatment of hazardous waste generated in dwellings. Municipalities are responsible for the reception and treatment of hazardous waste generated in agriculture and forestry, unless excessive quantities are involved.

(3) The obligation of municipalities pursuant to subsections 1 and 2 does not apply to waste delivered for waste management organised by the producer or distributor, in accordance with chapter 6 [producer responsibility] and or 7 [beverage containers].

Waste transport is organised either by the municipality (The waste act 646/2011 section 36) or by the property holder (The waste act 646/2011 section 37). The primary option is the waste transport organised by the municipality. The municipal waste management companies do not have waste transport services. In practice the municipal waste management company or municipality will put the transport services out to tender.

The most common model to organise waste transport by the municipality is that the municipal waste company is responsible for contracting the inhabitants, customer service, invoicing and routing of waste transport, and only the waste transport itself is put out to tender for waste carriers. If only small parts of the area are in the waste transport system organised by the municipality, the most cost efficient way of organising is to put the whole package of customer service, invoicing, routing and transport to a contractor.

The transport system organised by the property holder is possible only if it fulfils the following requirements (The waste act section 37):

- Waste transport is comprehensive, reliable, reasonable and non-discriminatory;
- waste transport promotes the overall functioning of the waste management of the municipality, supports the regional development of waste management and does not cause hazard or harm to human health or the environment and
- impacts are generally positive, paying particular attention to the circumstances of households and the operations of businesses and authorities.

2.2.2 Waste collection

The waste legislation knows only separate collection of waste. Different types of packaging waste are usually collected in separate containers.

A commingled collection means collection of different types of waste in a single waste container. For instance glass and metal can be collected in same container

and they can be easily separated in a material recycling facility, MRF. In the background work for the packaging legislation the possibility of commingled collection was considered only briefly as one solution for packaging waste collection in the regional collection points (Moliis, Dahlbo, Retkin & Myllymaa 2014, 52).

The possibility of commingled collection has been studied in Sweden (Stenmarck & Sundqvist 2008, 26). The biggest barrier for commingled collection in Sweden was the ability to invest in MRF. The study did not discover any technical obstacles for transport and sorting. According to the study the wording of the waste framework directive (Directive 2008/98/EC on Waste and repealing certain directives section 11) does not support the commingled collection. Also the Finnish waste act (646/2011) recognises only the separate collection of waste.

Waste can also be collected in a single container which consists of several compartments. In the Eastern Uusimaa area waste collection is organised by the municipality and Itä-Uudenmaan jätehuolto Oy offers inhabitants the possibility for waste collection with several compartments. The container is either 370 l or 660 l. The container is divided into four compartments: cardboard, paper, mixed waste and a joint compartment for glass and metal. Glass and metal is separated later in MRF. (Itä-Uudenmaan jätehuolto Oy 2014).

The collection in the Eastern Uusimaa area was started in 2012-2013. In the experiment, the 370 l container was divided into four sections: 180 l for mixed waste, 120 l for cardboard and 30 l for glass and metal each (Korhonen, Haverinen, Kaila & Heikkonen 2013, 8). The study showed that the recovery of the recyclable waste was about twofold compared to the recovery from regional collection points (Korhonen, Haverinen, Kaila & Heikkonen 2013, 40). The study also calculated the effects on greenhouse gas emission with LCA and the results showed 41 kg less CO₂ per household per year (Korhonen, Haverinen, Kaila & Heikkonen 2013, 42).

The majority of the inhabitants who took part in the collection experiment were satisfied and felt that service level has risen significantly (Korhonen, Haverinen, Kaila & Heikkonen 2013, 43). However, the willingness to pay rate does not

cover the costs of collection. The majority is willing to pay 0-2 euros more than collection of the only mixed waste (Korhonen, Haverinen, Kaila & Heikkonen 2013, 22). The customer price for the collection of a 240 l mixed waste container was at the study moment 6.5 euros/emptying (including VAT) and the estimated customer price for the 370 l container with several compartments was 14 euros/emptying (Korhonen, Haverinen, Kaila & Heikkonen 2013, 34).

Also Kymenlaakson jäte Oy is planning to offer containers with several compartments for customers living in detached houses and small rowhouses in Kouvola and Iitti. The container is either 360 l or 660 l. The collected waste types are mixed waste and three other types from paper, cardboard, glass and metal. (Kymenlaakson jäte Oy 2014)

Pirkanmaan Jätehuolto Oy is offering a service called Kotiporttikeräys in the Tampere region. The municipal waste management company gives a customer three 40 litre bags, one for paper, one for cardboard with a side pocket for energy saving light bulbs, fluorescent lamps and batteries, and one for glass and small metal. The emptying cost was 4.30 € in 2013 per emptying and the emptying interval was two weeks. (Pirkanmaan Jätehuolto Oy 2014)

2.2.3 Municipal steering instruments

The municipal level steering instruments for increasing the level of recycling of packaging waste produced in households can be divided into regulatory guidance, economical guidance, informative guidance and technical measures (Table 2).

The main instruments in steering the waste management of municipal household waste on the municipal level are the waste management regulations. The preparation of the municipal waste management regulations is based on section 91 in the waste act (646/2011). The municipality can issue general regulations concerning:

1. the reduction, sorting, storage, collection, transport, recovery and disposal of municipal waste which the municipality is responsible for and the technical requirements concerning these;

2. practical arrangements at properties or waste reception points for the collection, reception and transport of waste other the waste the municipality is responsible for (market-based waste), and the technical requirements concerning these;
3. measures to prevent littering and
4. the obligation to submit information to the municipal waste management authority or municipal environmental protection authority on waste

TABLE 2. Municipal level steering instruments and technical measures to improve reuse and recycling packaging waste.

	Municipal level steering instruments
Regulatory guidance: Normative framework and administration & planning	The waste management regulations
Economical guidance	Municipal waste tariff
Informative guidance: Advisory and RDI	Municipal advisory, information and education Pilot projects
Technical measures	Waste collection methods MRF

At the moment there is a wide range of provisions for separate collection of packaging waste in the waste management regulations in Finland (Table 3). Many waste management authorities are in the process of reviewing their waste management regulations. FSWA estimates that separate collection of packaging waste will increase in Finland (Moliis, Salmenperä & Rehunen 2014, 23). The reason for the tightening of the waste sorting regulations is the need to separate nonflammable material due to the increased waste recovery as energy.

The waste management authority decides on the waste tariff in the municipality. The tariff can support sorting and be smaller for instance for the bio waste than for the mixed waste. The municipality is authorized to collect the waste charges set in the municipal waste tariff from the property holder or other holder of waste for whose waste the municipality organises waste management (The waste act 646/2011 section 80). The producer always has responsibility for the waste management of the separately collected packaging waste even if it transported by

the municipality or by the private waste carrier. Therefore, the municipality can include in the tariff only transport charges of packaging waste and only in case that transport is organised by the municipality. Overall, municipal waste charges should cover the total costs of waste management.

TABLE 3. Example of provisions for separate collection of packaging waste in some waste management regions (The waste management regulations of Kymenlaakso and Lapinjärvi 2011 section 2; the waste management regulations of the Helsinki Metropolitan area and Kirkkonummi 2012 section 7; the waste management regulations of Hailuoto, Kempele, Liminka, Lumijoki, Oulu, Muhos and Tyrnävä 2013 section 14; the waste management regulations of Porvoo regional waste management board 2013 64; the waste management regulations of Lahti 2003 section 4).

Region	Households/property		
	Cardboard	Glass	Metal
Helsinki Metropolitan area 2012	10	20	20
Oulu region 2013	4	4	4
Porvoo region 2013	20	-	-
Kymenlaakso region 2011	10		10
Lahti and region	10	-	-

The municipality is obligated to organise advisory, information and education services in order to reduce the quantity and harmfulness of municipal waste and to ensure the appropriate implementation of waste management (The waste act 646/2011 section 93). The municipality can also use pilot projects in cooperation with waste management actors in order to develop best practices and new methods for sorting and collection.

The municipalities' power to influence the collection methods of packaging waste depends on the transport system. If the waste transport is organised by the municipality, it has the power to offer selected collection options to inhabitants. If the waste transport is organised by the property holder, collection methods, pricing and availability of collection will be provided according to the market situation.

3 THE PÄIJÄT-HÄME WASTE MANAGEMENT REGION

3.1 Description of the region

The Päijät-Häme waste management region consists of twelve municipalities: Asikkala, Heinola, Hollola, Hämeenkoski, Kärkölä, Lahti, Myrskylä, Nastola, Orimattila, Padasjoki, Pukkila and Sysmä. The Päijät-Häme waste management area has over 200 000 inhabitants. There were 103 073 permanent dwellings and 15 010 holiday homes in ecocharge register in 2014. Different actors and their role in waste management are described in Figure 4.

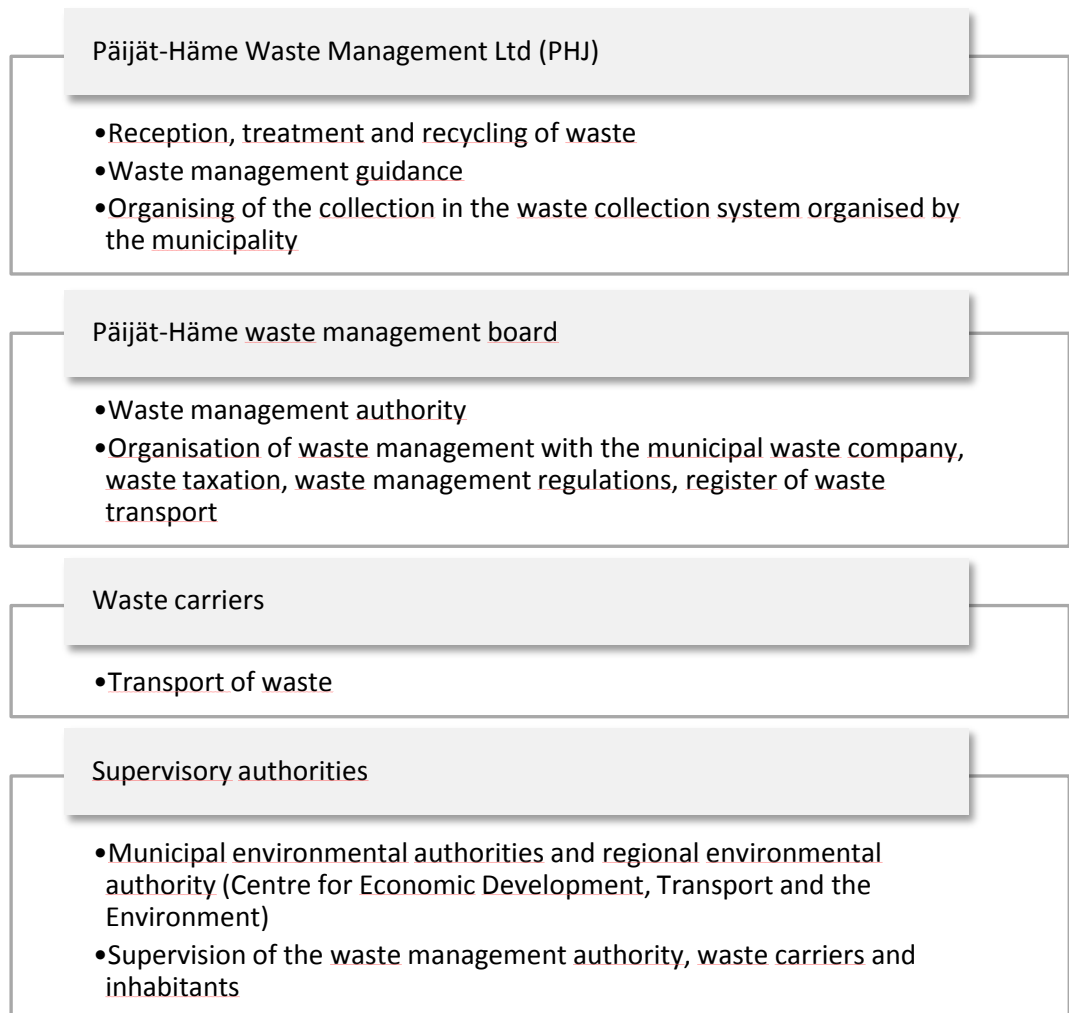


FIGURE 4. Actors in waste management.

PHJ was founded in 1993, and it is jointly owned by the municipalities of the Päijät-Häme waste management region. It is responsible for the reception, treatment and recycling of municipal solid waste, MSW, which the municipality has responsibility for. The members have also delegated some other tasks to the municipal waste management company such as waste management guidance to inhabitants of the region. All the property holders of the region pay a basic waste charge (ecocharge) to cover part of the costs of the municipal waste management, for instance recycling points and guidance. MSW treatment is covered by the waste treatment charges approved in the waste tariff.

The Päijät-Häme waste management board was established in 2012 by the municipalities of the Päijät-Häme waste management region (The city council of Lahti section 2012). The board is the municipal waste management authority (The waste act 646/2011 section 23) and responsible for the administrative functions of waste management in the region. The board has 13 members from the member municipalities and it is an independent authority with its own employees and financing.

The Centres for Economic Development, Transport and the Environment and the municipal environmental authorities supervise the waste carriers, the waste management authority and whether inhabitants have joined into the organised waste management (The waste act 646/2011 section 24).

In the majority of the municipalities of the Päijät-Häme region the MSW transport is organised by the property holder. Transport of the waste in scattered settlements in Sysmä and Heinola, and Artjärvi in Orimattila, and transport of bio waste in Heinola and Orimattila is organised by the municipality. Altogether six waste carriers operate in the region and five of them in the waste transportation organised by the property holder. One carrier operates only in one contract area in the transport system organised by the municipality.

The Päijät-Häme region has a long tradition of separate collection of waste. Separate collection of energy waste was started in 1998 and extended to all properties in 2000. Bio waste has been separately collected in Lahti since 1994 and in other urban areas of the region since 1998. All municipal waste from

households has to be delivered to the PHJ's Kujala waste treatment centre. 43 % of the all MSW received by PHJ was mixed waste in 2013 (Figure 5). The total amount of MSW consists of the waste collected in households and companies and was 100 000 tonnes, i.e. 500 kg/inhabitant. Altogether PHJ received a little over 209 000 tonnes of waste in 2013. About 38 % of the MSW goes to material reuse, 57 % to energy and 5 % to the landfill (Päijät-Häme Waste Management Ltd 2014a, 3).

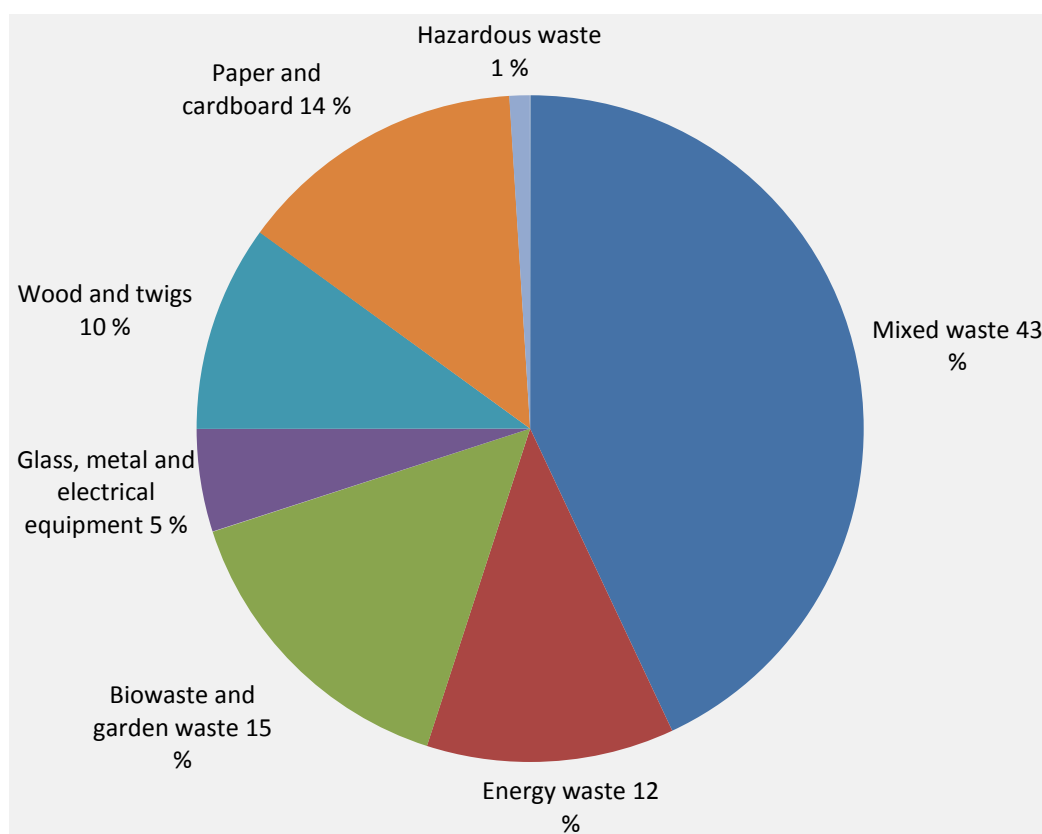


FIGURE 5. Separately collected MSW in 2013 (Päijät-Häme Waste Management Ltd 2014a, 3).

Recyclable waste goes to material reuse; bio waste and garden waste are composted in Labio Oy (Figure 6). Mixed waste is transloaded in the LATE sorting terminal and used in energy production in incineration plants. The MURRE plant transforms energy waste into SRF fuel for gasification plants. (Päijät-Häme Waste Management Ltd 2014b, 8-9)

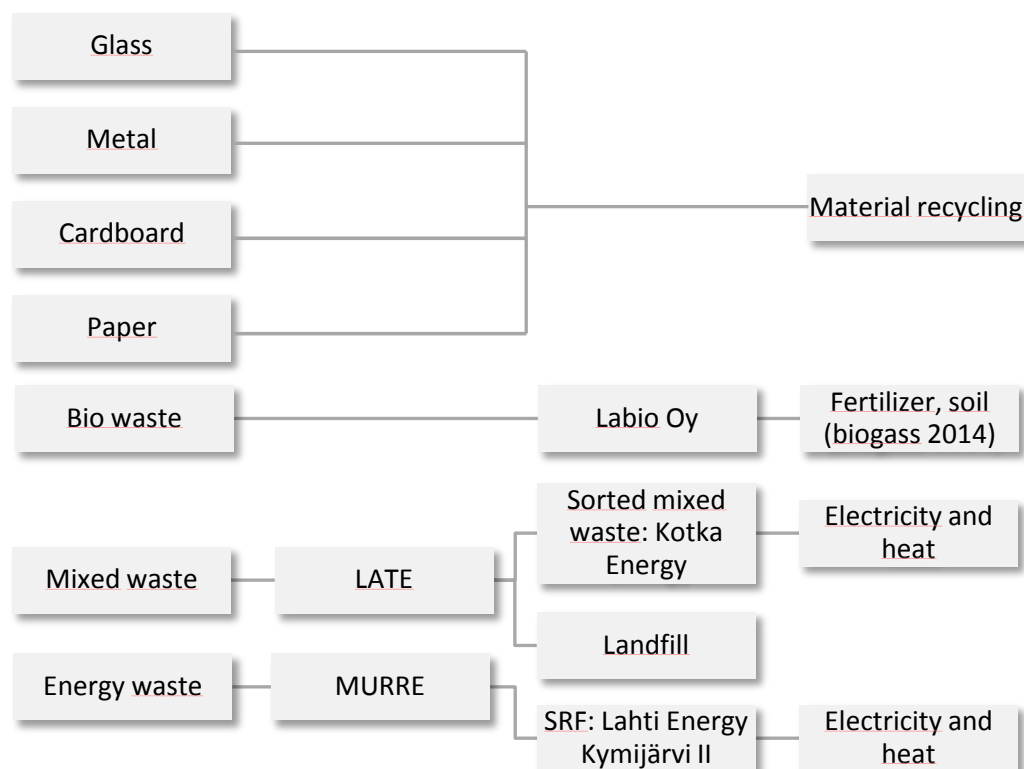


FIGURE 6. Waste collection and treatment in Kujala waste treatment centre.

3.2 Future challenges

The preparation of the municipal waste management regulations is based on section 91 in the waste act (646/2011). The key need for the revision is the target to increase material reuse according to the municipal waste recycling and reuse goal of 50 % by 2016 (The government decree on Waste 179/2012 section 14). According to a study performed in the Päijät-Häme region, 6 % of the municipal mixed waste is cardboard, 3 % glass, 5 % metal and 10 % plastic (Autio 2006, 8). In that study only 48 % of mixed waste delivered to the waste management centre was actually mixed waste and other waste was recyclable or reusable. According to another study, the energy waste from the households of the region includes 20 % cardboard, 0.3 glass, 0.5 metal and 29 % plastic (Forssell 2010, 17).

Another challenge is that the energy use of mixed waste is expensive compared to energy waste and sorting of recyclable waste would decrease the amount of mixed waste. The government decree on landfills (331/2013 section 27 and 28) bans the disposal of organic waste into landfills from the beginning of the 2016. PHJ has

the capacity to recycle all organic waste for energy, but this increases the amount of mixed waste. PHJ will pilot a few bio waste collection systems.

Decisive for the waste management options in the future are the revenues from recyclable waste and how they can be used for the increasing of sorting in the place of origin or funding of possible MRF. PHJ has put to tender a MRF in autumn 2014. The planned MRF would be able to sort different packaging materials and other materials similar to packaging materials. The decision whether PHJ is going to continue to plan the facility will be made in 2015.

4 INTERPRETATIONS OF THE WASTE LEGISLATION

4.1 Sorting and reception to terminals

The producer corporation is responsible for the sorting instructions. PYR prepares the sorting instructions during the autumn 2014 (Tanskanen & Koivunen 2014). At the time of writing preliminary instructions for glass and cardboard were completed. Cardboard includes packages made of cardboard and corrugated cardboard. Glass includes both colourless and coloured glass bottles and jars (Tanskanen 2014).

According to the packaging waste decree (518/2014) section 10 it is possible to combine other waste to the separately collected packaging waste only if the producer allows it. Background note of the decree (Background note of the government decree on packages and packaging waste 2014, 35) recommends the joint collection for instance for small metal and packaging metal. All the interviewees, MoE, FSWA and AFLRA agreed that it is highly recommendable and should be negotiated before the collection (Eränkö 2014; Innala 2014; Blauberg 2014).

However, it is stated in the background note (Background note of the government decree on packages and packaging waste 2014, 38) that if the packaging waste that has been delivered to the producers' terminal from the collection of the properties includes objects or substance which are not the producers' responsibility and substantially hinder the reuse, recycling or utilization, the producer has the right to decline to receive that waste or charge compensation cost for the management. FSWA and AFLRA find that contradictive with the waste act, and see that the background note of the packaging waste decree cannot narrow the producer's responsibility that covers also the disposal of the packaging waste (The waste act 646/2011 section 6, 46, 48 and 48). MoE clarified that the background note is not intended to be interpreted in contradiction to the waste act (Blauberg 2014). If the municipality has guided the sorting according to the producers' instructions, it should be able to deliver the packaging wastes collected

to the producers' terminals without cost even if it contains impurities. (Eränkö 2014; Innala 2014)

The way of collection (separate, commingled, collection with several compartments) is not an acceptable reason either to decline to receive the waste to the terminal (Eränkö 2014; Innala 2014). At the same time FSWA, AFLRA and MoE agreed that, regardless of the way of collection, all the packaging waste collected in the households has to be delivered to the terminal and the producer is not obligated to pay any compensation for the storage in transit or sorting carried out by the organiser of the transportation before the delivery to the terminal (Eränkö 2014; Innala 2014; Blauberg 2014). The waste act does not state anything about the compensation of the delivery of the waste. PYR informed that it will not compensate for the delivery of municipal packaging waste (Tanskanen & Koivunen 2014).

PYR interprets that the packaging waste decree (518/2014 section 10) does not allow the commingled collection of packaging waste without producers' permission (Tanskanen & Koivunen 2014). The background note of the packaging waste decree (2014, 38) states that section 10 is intended to secure the producer the right to decline to receive other than packaging waste. MoE and AFLRA interpreted that it does not mean that the producers can forbid the commingled collection if the quality of packaging waste meets the producers' requirements and it is delivered to the producers (Levinen & Innala 2014).

If the producer declines to receive the waste to the terminal without a valid reason, the municipality or other organiser of the transportation can initiate coercive measure in the supervising authority (Eränkö 2014; Innala 2014).

4.2 Supplementary transport from the property and reception points

The municipality's right to supplement the packaging waste transport from the property is restricted to the transport (The waste act 646/2011 section 35). The strict interpretation of transport does not include storage in transit and transloading. FSWA and AFLRA see that in order to efficiently transport packaging waste that should be possible (Eränkö 2014; Innala 2014). MoE sees

that inclusion of storage in transit and transloading to the transport would be in accordance with the spirit of the waste act (646/2011) (Blauberg 2014).

The producer has to organise 30 terminals for other than municipal packaging waste and for the packaging waste which is collected from properties. Those terminals will be arranged by the individual producer corporations, not by PYR, except for glass where PYR negotiates the terminals for the producer corporations (Tanskanen & Koivunen 2014). As a result of that there could be 30 terminals for each type of packaging waste. In that case also MoE sees that storage in transit could be part of the municipal packaging waste transport for practical reasons (Blauberg 2014).

In the background note of the waste act it is stated that the right to give waste management regulations concerning the reduction, sorting, storage, collection, transport, recovery and disposal of municipal waste also includes packaging waste generated in households, only excluding the reduction of the waste (The waste act section 91; Background note of the waste act HE 199/2010 vp, 116). The municipality may regulate about the reception and the treatment point of the packaging waste if the organisation of the transport is ensured by the municipality (Innala 2014; Blauberg 2014). If the transport is organised by the property holder according to section 41, reception and treatment point cannot be regulated by the municipality. In both cases packaging waste has to be delivered to the producers' terminal even if it was first stored in transit elsewhere.

The municipality may also sort packaging materials from the mixed waste and the energy waste. That is not transport of packaging waste according to the waste act section 47 and therefore separated cardboard, plastic, metal or glass is not ordered to be delivered to the producer (Innala 2014; Blauberg 2014).

4.3 Decision making on the supplementing of the regional network

The municipality may supplement the regional network of collection points organised by the producer. All the interviewees agreed that the packaging waste should be delivered to the producers' terminals from supplementary points (Eränkö 2014; Innala 2014; Blauberg 2014).

FSWA and AFLRA had different views than MoE on determining the service level. The first ones saw that the decision maker is the municipal waste management company with the municipalities' guidance although cooperation between the municipal company and the waste management authority is very important (Eränkö 2014; Innala 2014). The latter saw that the decision on the service level of the regional network of recycling points should be made by in the waste management authority (Blauberg 2014). FSWA and AFLRA interpreted that the waste management authority can examine if the requirements of the waste act (646/2011) section 34 are fulfilled.

4.4 Decision making on the supplementary transport from the properties

If the municipality decides to ensure the packaging waste transport from the properties according to the waste act (646/2011) section 35, it is carried out by giving sorting instructions in the waste management regulations. The municipality can have a separate section in the waste management regulations stating that it will ensure the transport of packaging waste (Luukkonen, Innala & Nurmikolu 2014, 52-53). According to AFLRA, sorting has to be regulated mandatory or voluntary in specific regions in certain grounds in order to be ensured by municipality and organised under section 35 (Innala 2014). In other cases packaging waste transport in properties not regulated in the waste management regulations may be organised by the property holder.

According to the waste act (646/2011) section 39 the waste carrier should provide the municipal waste management authority information on properties from which waste has been transported, and the number of times waste containers have been emptied, by property and type of waste. In the background note of the waste act (HE 199/2010 vp, 92) it is stated that if the property holder organises the collection of packaging waste according to the waste act (646/2011) section 41, the section 39 right to obtain transport information from the companies applies.

FSWA and AFLRA interpret that this right for information includes all transport of packaging waste from the households (Eränkö 2014; Innala 2014). In order to develop regional waste management and oversee the overall functioning of waste

management it is important to be able to have the information. MoE interprets that it includes only the waste that the municipality ensures i.e. it does not include the packaging waste transport organised by the property holder according to the waste act (646/2011) section 41 (Blauberg 2014).

4.5 Transport system

The Päijät-Häme waste management board decided in January 2014 that in the most parts of the region the property holder will organise the waste transport (Päijät-Häme waste management board 2014b). The wording was “municipal waste for which the municipality is responsible”. At the time of the decision packaging waste was the municipality’s responsibility and therefore the transport decision also covers packaging waste (Eränkö 2014; Innala 2014; Blauberg 2014).

The January 2014 decision was adopted according to the waste act section 149. Section 149 decisions can be executed earliest 3 years after the decision. That is based on the constitution (731/1999) section 15 protection of the property to protect the legitimate expectations (The constitutional law committee 2011) (Blauberg 2014). The constitutional law committee saw it important to guarantee sufficient transition period for waste carriers if the waste management authority changes the transport system.

If the municipality ensures the transport of packaging waste, packaging waste transport has to fulfil the waste act section 37 requirements for the waste transport from the properties in the waste transport organised by the property holder. The requirements of the section 37 are presented in Chapter 2.2.1. In the Päijät-Häme waste management region, the Päijät-Häme waste management authority may ask for the waste charges of packaging waste collection of the individual properties of the region according to the waste act section 122 right to obtain information (Eränkö 2014; Innala 2014; Blauberg 2014).

The waste management authority is required to follow the fulfilling of the requirements of the waste act (646/2011) section 37 for waste transport organised by the property holder. If they are not fulfilled, the follow-up decision could be made according to the waste act (646/2011) section 37, which does not have a

three year transition period. However, it could be argued that the protection of the legitimate expectations should be applied.

4.6 Cooperation with the producer corporations

FSWA and AFLRA do not see that it would be necessary to have an official negotiation about supplementing the transport of packaging waste from the properties, since the right to supplement is given in the law. Both interviewees see it important, however, to have a discussion with the producer organisations (Eränkö 2014; Innala 2014). In the background note of the waste act (HE 199/2010, 116) it is stated that the municipality should negotiate with the producer or producer corporation about the waste management guidelines.

According to the packaging waste decree (518/2014) section 12, public information about separate collection and guidance about sorting instructions and systems in in the producers' responsibility. In the background note of the decree (Background note of the government decree on packages and packaging waste 2014, 39) it is, however, stated that the waste act (646/2011) section 93 obligation to municipalities to guide inhabitants would apply to the packaging waste produced in households.

PYR's position to guidance is that guidance about packaging waste management to inhabitants is the producers' responsibility. If the municipalities ensure collection of packaging waste from the properties, municipality is responsible for the guidance of inhabitants concerning the collection from properties (Tanskanen & Koivunen 2014). PYR prepares nationwide material on common vocabulary for the guidance. Since PYR estimates that most of the municipal waste management companies will most likely supplement the regional network of recycling points, PYR is suggesting that both PYR and municipal waste management companies will answer to customer calls. PYR might also establish a call centre for inhabitant calls (Tanskanen & Koivunen 2014).

4.7 Packaging waste from the private sector

If the packaging waste is market-based waste from companies, it does not have to be delivered to the producers' terminal or to the producer. MoE notes that only the packaging waste delivered to producers is included in the reuse and recycling levels (Blauberg 2014). However, that is not the situation at the moment either. Producers have made contracts with transport companies, who deliver the information of the amount of packaging waste collected yearly straight to PYR. The amount is included in reuse and recycling levels. If there will be significant side flow of packaging waste from market-based waste it may later hamper reaching of the recycling and reuse targets. Only 30 % of the packaging waste is from households (Background note of the government decree on packages and packaging waste 2014, 8).

In the interviews of the waste carriers, was predicted that the market-based packaging waste market will affect also the transport prices of municipal packaging waste transport from the property (Halttunen 2014; Hämäläinen & Puranen 2014; Koivisto 2014; Kukkurainen & Stång 2014; Virtanen 2014). That will lead to the assumption that packaging waste from households would not necessarily be delivered to producers without compensation or it would not be delivered to producers as household waste.

If the market-based waste and municipal waste were sorted in a same MRF, it would create a difficulty to interpret when the packaging waste is collected under mandatory collection and at what cost the reusable and recycle metal, glass and cardboard are to be delivered to producer. For instance metal fraction from a sorting plant can contain small metal under the municipality's responsibility (household and the waste act section 35 small metal), market-based small metal and market-based packaging metal.

5 PRODUCER RESPONSIBILITY AND SERVICE LEVEL

5.1 Current service level in packaging waste management

PHJ has a network of 80 ecopoints for the collection of glass and metal (Table 4). The collection possibility for glass and metal is better, 80 and 58 points, than for cardboard, which has 26 points. The municipality of Sysmä has 17 collection points for glass and metal in the scattered areas arranged in connection with regional points for the mixed and energy waste, which are not listed in the table. There is also private collection. The number of private collection points in Table 4 is from Kierrätys.info, which lists all recycling points in Finland.

TABLE 4. Number of PHJ ecopoints and number of types of waste collected in PHJ ecopoints and private collection points (Helenius 2014a, Kierrätys.info 2014).

	Ecopoints	Card-board	Glass	Metal
Lahti	20	6	20	15
Hollola	9	3	9	6
Heinola	8	4	8	5
Orimattila	11	2	11	3
Nastola	7	7	7	6
Asikkala	7		7	7
Kärkölä	3		3	1
Sysmä	3		3	3
Padasjoki	9	1	9	9
Hämeenkoski	1	1	1	1
Pukkila	1	1	1	1
Myrskylä	1	1	1	1
Number of ecopoints	80	26	80	58
Number of private collection points	8	8	7	7
Total number of collection points	88	34	87	65

The current municipal waste management regulations (Asikkala 2005 section 4; Heinola 2006 section 4; Hollola 2000 section 4; Nastola 2004 section 4; Orimattila 2006 section 4; Lahti 2003 section 4) decree that residential properties

with at least ten households residing in the urban areas in Lahti, Nastola, Hollola, Orimattila, Asikkala and Heinola should have separate collection of cardboard in the property. All the properties should have a mixed waste container and an energy waste container. Bigger properties also have voluntary glass and metal collection (Table 5).

TABLE 5. The number of properties which have packaging waste collection from properties (Päijät-Häme Waste management board 2014a).

Municipality	Collection from property 2013, number of properties		
	Glass	Metal	Cardboard
Lahti	470	476	1437
Hollola	36	47	198
Heinola	35	24	338
Orimattila			142
Nastola	19	18	119
Asikkala	15	20	86
Kärkölä			
Sysmä			
Padasjoki			
Hämeenkoski			
Pukkila			
Myrskylä			
Total	575	585	2320

Other than residential properties should have separate collection for cardboard, glass and metal, if at least 50 kg of each type of waste is generated per week (Asikkala 2005 section 4; Hämeenkoski 2000 section 4; Heinola 2006 section 4; Hollola 2000 section 4; Kärkölä 2000 section 4; Myrskylä 2006 section 4; Nastola 2004 section 4; Orimattila 2006 section 4; Padasjoki 2006 section 4; Pukkila 2006 section 4; Sysmä 2000 section 4; Lahti 2003 section 4).

The accumulation of the packaging waste from inhabitants in the Päijät-Häme waste management region can be only estimated (Table 6). Waste carriers are regulated to provide summaries of annual packaging waste transported from the properties (The waste act 646/2011 section 39). The amount of packaging waste collected to ecopoints is recorded by the PHJ. Some of the packaging waste might

be mixed with the commercial packaging waste in transport and some of the waste carriers have not provided all the information to the Päijät-Häme waste management board.

TABLE 6. Amount (t) of packaging waste collected in properties and ecopoints in Päijät-Häme region in 2013 (Helenius 2014b, Päijät-Häme Waste management board 2014a).

	Collection from properties and private recycling points (t)	PHJ Ecopoints (t)
Metal	177	322
Glass	84	344
Paperboard	582	-
Cardboard	3 331	527

5.2 Effects of producer responsibility at service level

The second research question dealt with the effects of producer responsibility for the regional network of collection points and the service level. The number of current PHJ ecopoints is 80 (Table 4). There are 16 population centres with over 500 inhabitants in the Päijät-Häme region according to the Statistics Finland (2014) and 13 according to PYR (Koivunen 2014) (Table 7). According to the packaging waste decree, each of these population centres must have at least one collection point for glass, metal and fibre-based package waste and Lahti, Heinola and Nastola should have recycling points for plastic.

The waste act (646/2011) section 49 secures the recycling points also in the regions where collection is not economically sound (Background note of the waste act 199/2010 vp, 96-97). The minimum service level has to be provided to inhabitants despite that the target levels for recycling and reuse set in the packaging decree would be reached with less reception points (The environmental committee 2011). PYR has calculated that nationwide there are 482 centres with at least 500 inhabitants, and 406 retail areas in scattered areas. There should be an equal amount of collection points in scattered areas than there are retail areas in scattered areas. Those 406 recycling points should be located in scattered areas.

The rest of the points 962 out of the total 1850 can be located freely (Koivunen 2014).

TABLE 7. Population in November 2014 and population centres with over 500 and 10 000 persons in the region (Population Register Centre 2014; Statistics Finland 2014; Koivunen 2014).

Municipality	Population	Population centre, over	
		> 500 person	> 10 000 person
Lahti	103 716	1	1
Hollola	21 955	3	
Heinola	19 731	2	1
Orimattila	16 276	2	
Nastola	14 896	1	1
Asikkala	12 110	1	
Kärkölä	4 664	1	
Sysmä	4 108	1	
Padasjoki	3 221	1	
Hämeenkoski	2 105	1	
Myrskylä	2 003	1	
Pukkila	2 017	1	
Total Statistics Finland	206 802	16	3
Total PYR		13	3

The number of recycling points will also depend on the decisions taken in other regions about supplementary transport from properties. If the Helsinki metropolitan area will have extensive packaging waste collection in the properties, a large number of recycling points will be available to be located elsewhere in Finland. PYR also informed that it will not be transporting packaging waste from the properties (Tanskanen & Koivunen 2014). PYR has evaluated the possible number of the recycling points in different waste management regions taking into account the number of inhabitants of the region and the current waste management regulations in all the regions (Table 8). Those estimations of the points vary between 57-104 for cardboard, metal and glass (Koivunen 2014).

TABLE 8. The number of the current ecopoints according to PHJ and PYR as well as estimation of the number of producers' recycling points when number of inhabitants is taken into account and when current sorting regulations are taken into account (Helenius 2014b; Koivunen 2014)

	Cardboard	Glass	Metal	Plastic
The number of the current ecopoints according to PHJ	26	80	58	
The number of the current ecopoints according to PYR	31	88	64	
The number of recycling points, number of inhabitants	73	73	73	19
The number of recycling points, current sorting regulations	57	102	104	19

Producer corporation PYR told in the interview that the number of regional recycling points in the Päijät-Häme region is estimated to be between 50-60 points taking into account the number of inhabitants and current mandatory separate collection of packaging waste from properties (Tanskanen & Koivunen 2014). All the producers' points will have glass, metal and cardboard recycling. Therefore the points will increase for cardboard, decrease for glass and be about the same for metal compared to the current PHJ ecopoints. All the current PHJ's ecopoints were visited by PYR and use of the points that fulfil the criteria set in the packaging waste decree will be negotiated with PHJ. Other types of waste, such as clothing and paper are negotiated by PYR to be located at the same recycling points. (Tanskanen & Koivunen 2014)

PHJ can supplement the regional network of recycling points, but the estimation during the study was that it will not be supplementing. According to discussions that PYR has had with the municipal waste management companies, many of them will most likely supplement the regional network (Tanskanen & Koivunen 2014). PYR will have first negotiations with the FSWA about the framework agreement of cooperation, and the individual producer organisations and municipal waste management companies will make agreements (Tanskanen & Koivunen 2014).

The decreed regional network will in principle guarantee a sufficient number of points located. The reasons for supplementing the network of regional reception points vary in waste management regions. Reasons can be economical; the recycling points can be in the beginning of their lifecycle or collection solutions might be harder to remove, as is the case with deep collection systems. There is also risk that decreasing a network may result in more glass and metal in mixed MSW. In the end, the decision to supplement the network is political.

PYR is willing to buy or rent the waste containers from the municipal companies, if they are suitable for their use. The waste transportation will be put to tender in spring 2015 and the collection will begin in the beginning of 2016. It is challenging to have the network operational by 1 January as stipulated, due to the strict timetable (Tanskanen & Koivunen 2014).

Most of the interviewed waste carriers thought the producers' network of recycling points should be the primary way of collection. Some of the waste carriers thought it might be inevitable to supplement the producers' network with municipal collection points because of the environmental protection reasons and to prevent littering. (Halttunen 2014; Hämäläinen & Puranen 2014; Koivisto 2014; Kukkurainen & Stång 2014; Virtanen 2014)

6 VIEWS ON MEASURES IN INCREASING THE MATERIAL REUSE AND RECYCLING

6.1 Evaluation of waste management options by actors

Employees of PHJ and the Päijät-Häme waste management board and the waste carriers were asked to evaluate different waste management options in a questionnaire (Honkanen 2014). First they were asked to rank the factors from 1 to 4. The author's answers are treated as a part of PHJ's answers. Both PHJ and the waste carriers agreed that sorting should be real and the quality of recyclable waste materials should be reassured. Sorting should also be easy for inhabitants and inhabitants should receive equal service. For waste carriers it was more important that the system would be easy to execute whereas the municipal waste management company prioritised the recycling targets set by legislation (Figure 7). Altogether, the views were quite similar on top priorities.

The same types of questions were asked in a joint seminar of the PHJ board and the Päijät-Häme waste management board and the same type of priorities were found there as well (Honkanen 2014). That questionnaire did not distinguish if the respondent was from the Päijät-Häme waste management board, the PHJ board or employees of them.

After prioritisation, the first five priorities were chosen and a few different options were evaluated:

- Option 1 Current regulations: voluntary sorting and current waste management regulations.
- Option 2 Extended sorting with regulations: extended mandatory sorting to all households without specific method of collection in regulations for inhabitants.
- Option 3 Extended sorting & mandatory container with several compartments: extended sorting to all households and mandatory waste container with several compartments for smaller properties.

- Option 4 Two-container system: two-container system accompanied with treatment in MRF. One container would be for mixed waste and energy waste and the other container for all packaging waste.

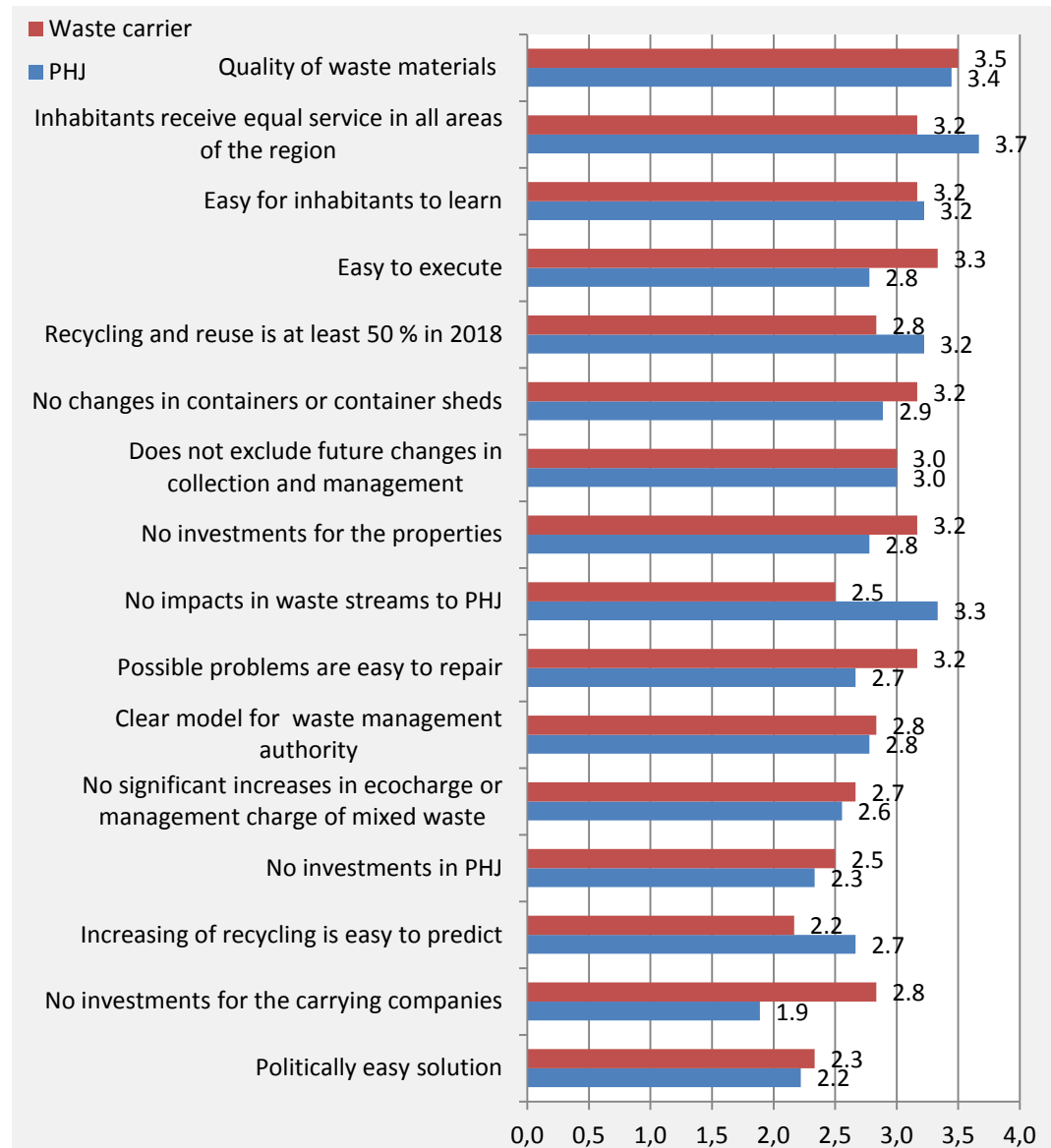


FIGURE 7. Evaluation of significance (after Honkanen 2014).

Waste carriers and PHJ had very different views on how the current system would work regarding the equality of service and recycling level. (Figure 8 and Figure 9) (Honkanen 2014). Waste carriers thought that the current system is best in all chosen priorities. PHJ had did not believe in the equality of the current systems in all areas and in achieving recycling targets. However, PHJ was more sceptical on how the other options would function than the waste carriers.

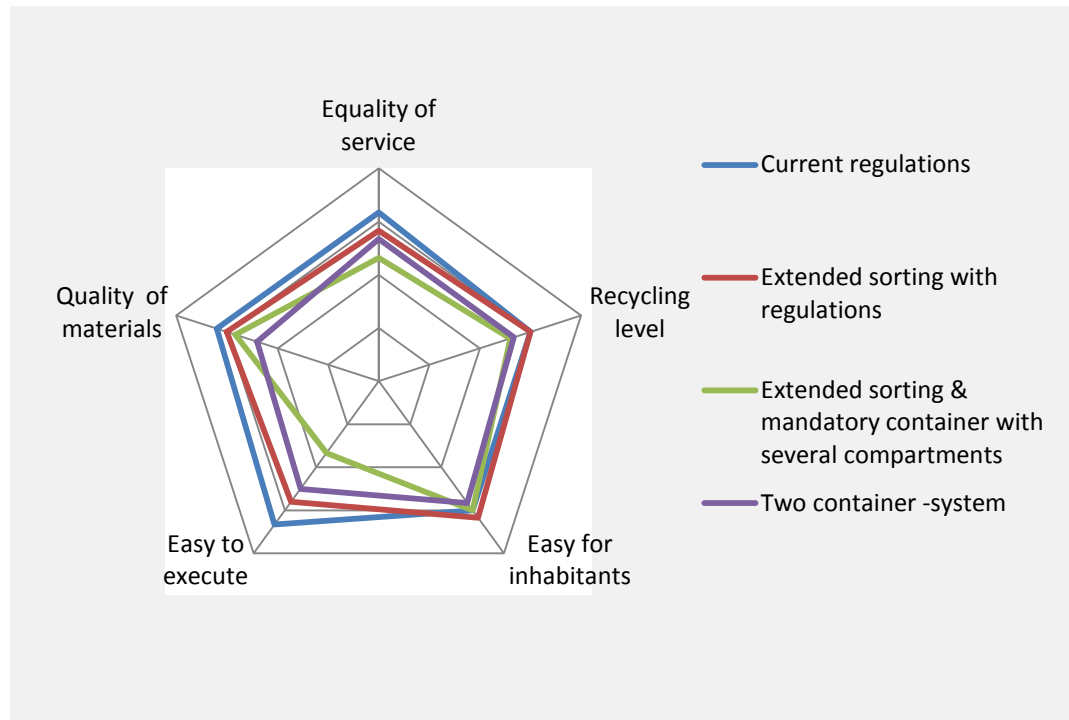


FIGURE 8. Waste carriers' evaluation of waste sorting and collection options (After Honkanen 2014).

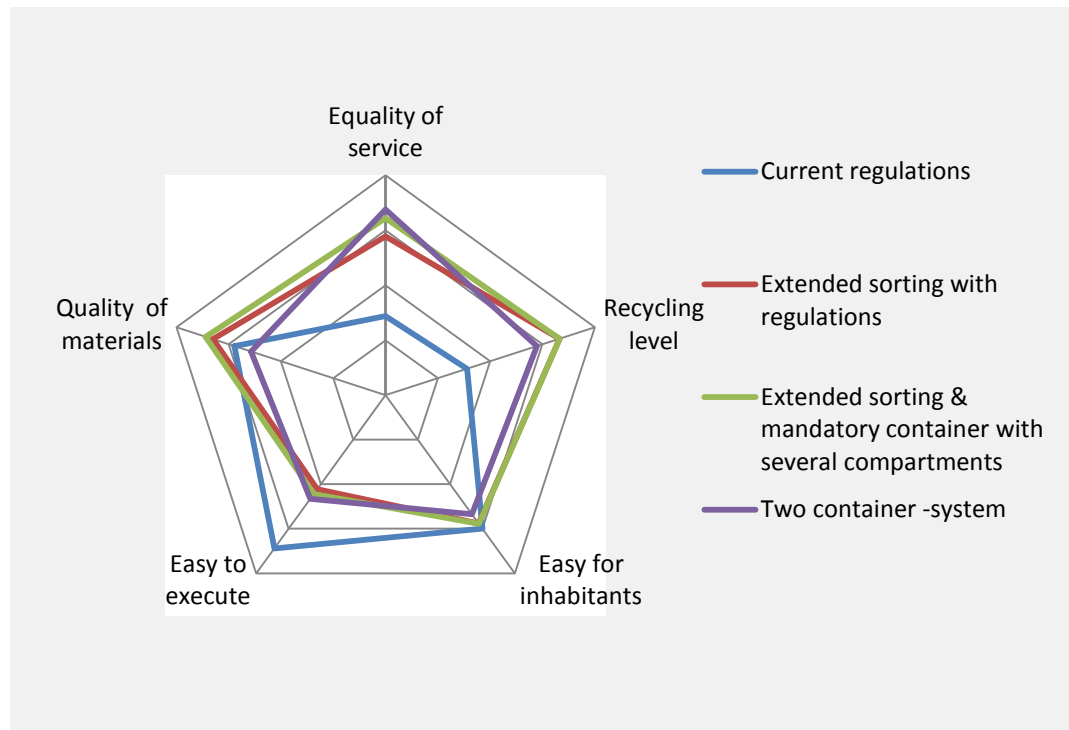


FIGURE 9. PHJ's evaluation of waste sorting and collection options (After Honkanen 2014).

6.2 Municipal steering instruments

6.2.1 Regulatory guidance

The municipality can issue provisions concerning packaging waste generated in households if the municipality ensures the packaging waste transport, and the technical requirements concerning these (The waste act 646/2011 section 91).

70 % of the packaging waste is market-based. The municipality has a supplementary obligation to organise waste management to companies which do not have market-based service available (The waste act 646/2011 section 33). However, the municipality cannot regulate about the sorting. If PHJ receives the waste according to municipality's supplementary obligation it can agree about the content of the waste in the agreements with the waste carrier. Normative measures cannot be used to sorting of market-based waste.

Properties with at least 10 households must collect cardboard separately. At the moment there are a little less than 2000 properties which belong to the extended sorting in municipalities of Asikkala, Hollola, Heinola, Lahti, Nastola and Orimattila (Table 9.) If extended sorting of cardboard were expanded to properties with at least 7 households in the municipalities mentioned above, less than 300 properties more would be reached. If expansion were to properties with at least 3 households, the increase in properties would still be less than 1000 properties. To reach a substantial increase, the extended sorting would have to be expanded to all properties.

TABLE 9. Number of properties in the Päijät-Häme region according to PHJ's ecocharge register (Makkonen 2014).

	Number of households/property (number)			
	≥10	7-9	3-6	1-2
Asikkala	61	21	76	2 261
Hollola	173	25	45	4 164
Heinola	247	51	74	3 356
Hämeenkoski	7	14	8	615
Kärkölä	34	22	18	1 368
Lahti	1 164	108	301	9 592
Myrskylä	3	6	15	632
Nastola	106	35	81	3 176
Orimattila	115	39	142	4 652
Padasjoki	29	3	10	950
Pukkila	5	3	9	806
Sysmä	41	15	0	1 078
Total	1 985	342	779	32 650

The amount of voluntary glass and metal collection in properties vary between municipalities. Lahti has the highest rates of voluntary collection; 40 % for glass and 41 % for metal out of properties with at least ten households (Table 10). Some of the collection data might be missing from the calculations and some carriers might have informed market-based collection too. It has to be evaluated when voluntary collection has reached the level that it cannot be increased any more with guiding and voluntary measures.

If sorting of glass and metal were extended to properties with at least ten households in the biggest municipalities of the region (Asikkala, Hollola, Heinola, Lahti, Nastola and Orimattila), the potential of metal revenue from mixed waste would be 650 tonnes yearly, which is twofold the amount collected in PHJ ecopoints in 2013 (Table 11) (Helenius 2014b; Makkonen 2014). For glass the potential is about the same as from ecopoints. The acceptability and viability of extension of sorting for inhabitants of the region also depends on the practical solutions, which are discussed in Chapter 6.3.

TABLE 10. Approximate levels of separate collection in properties in 2013.

Percentage depicts the number of properties with separate collection in relation to properties with at least ten households (The Päijät-Häme waste management board 2014a). Waste carriers may have reported other MSW properties other than dwellings.

	Population	10 households / property (number)	Collection from property, %		
			Glass	Metal	Card- board
Asikkala	8441	61	25	33	141
Hollola	22065	173	21	27	114
Heinola	20025	247	14	10	137
Lahti	103167	1 164	40	41	123
Nastola	15090	106	18	17	112
Orimattila	16365	115	0	0	123

TABLE 11. Metal and glass collection in properties and private recycling points and PHJ ecopoints in 2013 and the potential amount of glass and metal in mixed waste in sorting efficiency of 60 % in properties with at least ten households in six of the biggest municipalities in the Päijät-Häme waste management region (The Päijät-Häme waste management board 2014a; Helenus 2014; Makkonen 2014).

	Collection in properties and private recycling points (t)	PHJ Ecopoints (t)	Potential (t)
Metal	177	322	652
Glass	84	344	391

6.2.2 Informative guidance: guidance and RDI

Guidance is an effective tool in improving the recovery of packaging waste and other reusable materials in support of the municipal waste management regulations. The municipality is obligated to give guidance on waste management, but the obligation is restricted to inhabitants and other waste producers, which are the municipalities' responsibility. The municipality cannot give regulations about

sorting of the market-based waste and cannot use the municipal waste charge to fund guidance for it. Therefore, also the effectiveness of guidance is restricted to MSW. If sorting instructions are changed, there will be a need for extra guidance at least for a couple of years.

PHJ used 240 000 € for guidance in 2013, which equals 2.03 € per household in the region (Päijät-Häme waste management board 2014c, section 25). Guiding has focused on the user groups with the biggest effects such as high-rise buildings. At the moment PHJ has for instance a campaign called Luukuta oikein (Päijät-Häme Waste Management Ltd. 2014c). The campaign concentrates on improving sorting in high-rise buildings owned by Lahden Talot, a municipal apartment house rental company, in the form of inhabitant competition. The other special target group are children in day care centres and schools.

Before making drastic changes in the waste management regulations, new ideas can be tested with the pilot projects. Due to the waste transport system in the region, all collection pilots are carried out in consensus with the waste carriers. This restricts the pilots to ones that do not generate too high costs for the carriers. For instance the collection with waste containers with several compartments cannot be piloted in a waste transport system organised by the property holder.

6.2.3 Economical guidance

In the areas with the waste transport organised by the property holder a municipality's only economical steering method for increasing sorting is the waste tariff. The Päijät-Häme waste tariff encourages sorting; handling charges for 2015 without VAT are 111 €/t for mixed waste, 79 €/t for bio waste and 45 €/t for energy waste (Päijät-Häme waste management board 2014d). However, it is up to waste carriers how the tariff steering affects consumer prices.

Innovative procurements can also be used in smaller contract areas with waste transport organised by the municipality. Contract areas are traditionally put to tender with detailed contract descriptions. Contracts could be put to tender with conciliation procedure without detailed descriptions, including only the aimed recycling level (Workshop on extension of sorting 2014).

In the municipal transport system the municipality also can affect the transport price and compensate for instance for collection of containers with several compartments in the early stages of the collection to obtain a big enough clientele. In both transport systems direct support to customers can be offered for instance in the form of free waste containers for sorting, but it cannot be guaranteed whether they are used in sorting or to replace other waste containers (Workshop on extension of sorting 2014).

6.3 Technical measures: collection and treatment

6.3.1 Separate collection

Household waste has to be sorted at the place of origin i.e. homes. The major technical obstacles of sorting are the waste sorting and storage facilities in the households. Even new buildings have an insufficient number of waste bins and there might not be enough space to store recycled waste to be carried to recycling points (Halttunen 2014; Hämäläinen & Puranen 2014; Koivisto 2014; Kukkurainen & Stång 2014; Virtanen 2014).

The consumer price for emptying a waste container consists of a waste management charge and transport charge. The average regional transport charge is 8.0-14.1 €/240 l container for glass, 6.1-10.1 €/240 l container for metal and 3.1-3.3 €/600 l container for cardboard/paperboard (VAT 0 %) (Table 12). Producers or waste carriers are not allowed to charge of the management of packaging waste. Inhabitants pay the transport charge to the waste carrier. If the households per property limit is too low, costs of the transport may become too high to be acceptable to inhabitants. The practical challenges of the separate collection to small properties are often limited space in the waste shelter or in the property (Halttunen 2014; Hämäläinen & Puranen 2014; Koivisto 2014; Kukkurainen & Stång 2014; Virtanen 2014).

Advantages of separate collection are that waste containers can be emptied with any waste truck. It does not create limitations to equipment and has neutral market effects on private waste carriers in the waste transport system organised by the

property holder. The smallest basic single container is 120 l. Regardless of the emptying interval, containers of for instance glass or metal are never full, if packaging waste is collected in small properties, since the waste volumes there are so low.

TABLE 12. Transport charges of metal, glass and cardboard/paperboard and energy and mixed waste in 2012 Prices are the range between average transport charges in all municipalities (Päijät-Häme waste management board 2014a; Päijät-Häme waste management board 2014e, 13).

Type of waste	Average transport charge €, VAT 0 %
Metal 240 l	6.1-10.1
Glass 240 l	8.0-14.1
Cardboard / paperboard 600 l	3.1-3.3
Energy waste 240 l	6.5-7.5
Mixed waste 240 l	4-8

6.3.2 Use of waste containers with several compartments

The containers with several compartments are more expensive for customers and they require waste truck with a separate compartment for each type of waste. The compactor structure of the car costs 2-3 times more than in the basic compress waste truck (Korhonen, Haverinen, Kaila & Heikkonen 2013, 34). At the moment there is no collection with containers with several compartments in the Päijät-Häme waste management region. In the interviews some of the waste carriers expressed an interest to bring containers with several compartments into the market in the Päijät-Häme waste management area (Halttunen 2014; Hämäläinen & Puranen 2014; Koivisto 2014; Kukkurainen & Stång 2014; Virtanen 2014). However, it was estimated that payback of the investment requires 5 years of a stable market situation in the area. When this study was performed, there were appeals taken to administrative court about overruling the waste transport decision to stay in transport organised by property holder. It raises questions if the market situation is stable enough at the moment.

Waste carriers argued in the questionnaire answers that if the waste management regulations support extended sorting also to smaller properties, the markets would

work and there would be enough competition also in the system with containers with several compartments in the region (Honkanen 2014). Some waste carriers however told they are not able to invest to the system (Halttunen 2014; Hämäläinen & Puranen 2014; Koivisto 2014; Kukkurainen & Stång 2014; Virtanen 2014).

6.3.3 Commingled collection and MRF treatment

If the packaging waste is collected commingled, it has to be ensured that the separated waste fractions meet the producers' requirements. Both PHJ and waste carriers agreed on that. Glass and metal are relatively easy to separate, and the biggest concern is if the recyclability of plastic and cardboard declines.

The advantage of commingled collection is that the number of waste containers needed in the property is smaller and the transport charges are lower than in the system with a container with several compartments. If the waste carrier collects commingled packaging waste, it cannot charge of the management and disposal. Also, as discussed earlier, the waste carriers cannot sell the packaging without negotiating with producers. The interviews gave indication that there would be a market for municipal packaging waste since they were prepared to compensate transport costs with the value of the material (Halttunen 2014; Hämäläinen & Puranen 2014; Koivisto 2014; Kukkurainen & Stång 2014; Virtanen 2014, Honkanen 2014).

As in all waste collection systems, the waste carriers with a market share in the region preferred waste transport organised by the property holder also in commingled collection. Waste carriers saw that there are enough material recycling facilities in the market and also the packaging waste should be allowed to transport to private MRFs (Honkanen 2014). It was suggested that the waste carrier should be responsible for the waste management of packaging waste (Honkanen 2014). According to the waste act (646/2011), it is not possible. However, companies can sell their services to the producers.

7 DISCUSSION AND CONCLUSIONS

The first research question dealt with how different stakeholders interpret the waste act and the government decree on packages and packaging waste especially in relation to organising the supplementary transport of packaging waste from properties. The interpretations of the waste act (646/2011) and the packaging waste decree (518/2014) did not give clear answers to all open questions. Many of the questions are implementation questions, which were not discussed when producer responsibility was decreed.

If the municipality decides to ensure the packaging waste transport from the properties according to the waste act (646/2011) section 35, it gives sorting instructions in the waste management regulations. The municipality can have a separate section in the waste management regulations stating that it will ensure the collection of packaging waste. Collection has to be regulated mandatory in waste management regulations in order to be ensured by the municipality. The other option for the municipality to ensure collection is to regulate it to be voluntary in specific regions in certain grounds. In that case packaging waste transport in other properties may be organised by the property holder.

The municipality's right to supplement the packaging waste transport from a property is restricted to transport (The waste act 646/2011 section 35). The strict interpretation of transport does not include storage in transit and transloading, but in order to efficiently transport packaging waste that should be possible.

The municipality may regulate about the reception and the treatment point of the packaging waste if the organisation of the transport is ensured by the municipality. If the transport is organised by the property holder according to section 41, reception and treatment points cannot be regulated. In both cases packaging waste has to be delivered to producers' terminal even if it was first stored in transit elsewhere.

If the municipality has guided the sorting according to the producers' instructions the packaging waste should be possible to deliver to the producers' terminal without cost even if it contains impurities. Also the way of collection (separate,

commingled, collection with several compartments) is not an acceptable reason to decline to receive the waste to the terminal. The producers cannot forbid the commingled collection, if the quality of packaging waste meets the producers' requirements and it is delivered to the producers. At the same time, regardless of the way of collection, all packaging waste collected in the households has to be delivered to the terminal.

The municipality may also sort packaging materials from mixed waste and energy waste. That is not transport of packaging waste according to the waste act section 47 and therefore separated cardboard, plastic, metal or glass is not ordered to be delivered to the producer.

The second research question explored how the producer responsibility affects the service level of collection of municipal packaging waste. Effects of the forthcoming producer responsibility on the service level of the waste management depend on the decision made on the waste management regulations on sorting. It seems that the service level of regional collection points would increase for cardboard and decrease for glass and metal in the Päijät-Häme waste management region in view of the number of the collection points. The collection points may, however, centralise to urban areas and the number of collection points will most likely be smaller in scattered areas than it is today. At the time of writing of this thesis the exact number of future recycling points was not known.

The third research question looked for an answer to what kind of preferences different stakeholders have to the municipal steering instruments and technical solutions for collection from properties in order to increase recycling. The measures to increase recycling of packaging waste were evaluated by different actors of waste management from different point of views. Waste carriers were satisfied with the current sorting regulations, as well as the waste transport organised by the property holder and are looking out for new business opportunities in packaging waste transport and treatment. PHJ did not rely as much on the current system and functionality of the market in ensuring the service for inhabitants of the region and reaching the recycling and reuse targets.

The decision on the appeals concerning the waste transport system decision of the region has not yet come even from the lower court level, which makes the market situation unstable. It is not likely that waste containers with separate compartments for different packaging waste types would be a significant feature in the near future in the area.

Other options than just lowering the limit of households per property in sorting instructions should be looked for. The uncertainty with interpretations of legislation and how different actors will work when the producer responsibility begins will complicate the municipalities' decision making on packaging waste sorting and waste management guidelines. PHJ's bio waste collection pilots may also affect the future decisions on packaging waste sorting.

From the inhabitants' point of view an MRF could provide cost-efficient way to increase the collection of packaging waste from properties if it is used for sorting of commingled waste. From the legislative point of view this study concluded that the packaging waste reception and treatment point can be designated for instance to municipal MRF if sorting is regulated in the waste management regulations. The other option would be for the municipality to have contract treatment facilities.

The overall objective of this study was to explore what kind of options there are for sorting instructions in the revision of the waste management regulations in order to support the increase of recycling of packaging waste in the Päijät-Häme waste management region. The packaging waste decree (518/2014) was given in July 2014, a year later than expected. Both producers and municipalities have had very little time to prepare for producer responsibility. At the time of writing, in November 2014, the negotiations between PHJ and producers were still open and PYR had delivered preliminary sorting instructions only for glass and cardboard and the locations of terminals were still open. New waste management regulations are planned to be in force by 1 May 2015 when the producer responsibility begins. Given that timetable, it is not possible to make drastic changes to current sorting instructions in the waste management regulations in this revision.

At the moment the realistic options would be to continue with the current sorting instructions in the waste management regulations, meaning separate collection of cardboard in properties with at least ten households in the urban areas of Asikkala, Hollola, Heinola, Lahti, Nastola and Orimattila or to include, besides cardboard, also glass and metal to those same areas and properties. Both would leave options open for future changes. The potential amount of glass and metal collected from mixed waste of the larger properties' with sorting efficiency of 60 % would be more than the amount collected nowadays in the PHJ ecopoints. The mandatory collection from properties would decrease the number of producers' recycling points in the Päijät-Häme area since collection from properties has to be regarded when locating the producers' recycling points.

In the latter option the municipality would also have the responsibility for waste transport of glass and metal. In practice it means that the reception site could be designated for them in waste management regulations and the waste management authority would have better control to oversee the functionality of the waste transport of packaging waste. In both options there could be a specific region designated in the waste management regulations, where collection would be voluntary but the organising of the transport would be ensured by the municipality (The waste act 646/2011 section 35). In either option, transport of voluntarily collected cardboard, glass and metal waste outside those specific regions is arranged by the property holder (The waste act 646/2011 section 41).

The findings of this thesis are directed as much at the next revision of the waste management guidelines as the current one. The main new findings were the interpretations of the legislation concerning packaging waste. They are useful in planning of the future sorting instructions and packaging waste treatment. Thesis work brought them also up in national level to be considered and resolved.

Future studies could follow implementation of the packaging waste decree and the revenues of packaging waste in the different regions. The most urgent topic would be the interpretation of the waste act and the packaging waste decree about producer responsibility.

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APPENDICES

APPENDIX 1. QUESTIONNAIRE FOR THE MINISTRY OF THE ENVIRONMENT, FINNISH SOLID WASTE ASSOCIATION (FSWA) AND ASSOCIATION OF FINNISH LOCAL AND REGIONAL AUTHORITIES (AFLRA)

Translated from the Finnish original

Interviewees:

- Ministerial adviser Tarja-Riitta Blauberg, The Ministry of the Environment (1-18)
- Senior legal adviser Leena Eränkö, Finnish Solid Waste Association, FSWA (questions 3-17)
- Development engineer, M.Sc. (Tech) Tuulia Innala, Association of Finnish Local and Regional Authorities, AFLRA (questions 3-17)

The revision of the waste management regulations has been started in Päijät-Häme waste management region (Asikkala, Heinola, Hollola, Hämeenkoski, Kärkölä, Lahti, Myrskylä, Nastola, Orimattila, Padasjoki, Pukkila and Sysmä). Preparation of the municipal the waste management regulations is based on section 91 in the waste act (646/2011). The key need for revision is the need to increase material reuse. The goal is 50 % material reuse in 2016, when the reuse percentage in the management area of Päijät-Häme Waste Management Ltd. (PHJ) is circa 38. With respect to that PHJ examines alternative means to increase the reuse of waste in waste transport system organised by the property holder.

PHJ has Ecopoint network for collection of glass, metal (about 80 collecting points) and cardboard (about 30 points). Current municipal the waste management regulations decree that properties with at least ten households residing in the urban areas (Lahti, Nastola, Hollola, Orimattila, Asikkala and Heinola) should collect cardboard separately at the property. Bigger properties also have voluntary glass and metal collection. Other than residential properties shall have separate collection for cardboard, glass and metal, if at least 50 kg of each type of waste is generated per week.

Preparation of the producer responsibility

1. What kind of different possibilities for producer responsibility to organise waste management were considered during the preparation of the waste law?
2. What were the reasons for choosing of this model?

Supplementary transport of the packaging waste

3. What is the actual difference between that municipality ensures of the packaging waste transport and the transport is organised by the property holder (35 section (1)) versus property holder organises the packaging
4. If municipality decides to ensure of the packaging waste transport according to 35 section (1), is the decision adopted by 149 section (4) and analysis according to 37 section has to be studied?
5. If the decision is not 149 section (4) decision, what kind of decision has to adopted?

Information on the packaging waste

6. Does 39 section information delivery apply to packaging waste transport from properties carried out in accordance with 41 section (3) and 35 section (1)

Separate collection of packaging waste and sorting

7. Is it possible to deviate from separate collection of packaging waste?
8. Who can deviate from separate collection? Does the producer have the sole preserve to deviate or can also municipality decide of the commingled collection of packaging waste?
9. If producer declines to accept waste that has been separated in MRF, can the actor who ensured the organisation of the transport take the packaging waste elsewhere?
10. Can the producer demand the carrier to participate to waste management charges if the waste consists of other waste fractions (for instance packaging metal contains small metal)?

11. Can the producer demand the municipality to participate to waste transport charges if the waste consists of other waste fractions (for instance packaging metal contains small metal)?
12. If the packaging waste transport is ensured by the municipality (The waste act 35 section (1)) and the producer does not accepted commingled collected packaging waste, can municipality order the reception point for sorting of packaging waste?
13. Is municipality obligated to deliver the sorted waste to the producers' terminal?

Ownership of waste and rights and responsibilities of producers

14. Is it mandatory to deliver the packaging waste collected in the property to the producers without remuneration or should the producer participate to the costs of collection?
15. Is it mandatory to deliver the packaging waste collected in private companies to the producers' terminals or to the producers?
16. Is it likely that there will be the same kind of compensation arrangement as WEEE (waste electrical and electronic equipment) in packaging waste in time?
17. If the producers pay of the collected packaging waste, what kind of responsibilities do they have? Are they considered to be public organisations and to have bigger responsibility and transparent pricing?

Supervision of decisions making in waste management authorities

18. Do the Centres for Economic Development, Transport and the Environment supervise the legality of the waste transport decisions adopted by the waste management authorities?

APPENDIX 2. QUESTIONNAIRE FOR THE ENVIRONMENTAL REGISTER OF PACKAGING PYR LTD

Translated from the Finnish original

Interviewees:

- Managing director Juha-Heikki Tanskanen, Environmental Register of Packaging PYR Ltd
- Regional director Jari Koivunen, Environmental Register of Packaging PYR Ltd

The revision of the waste management regulations has been started in Päijät-Häme waste management region (Asikkala, Heinola, Hollola, Hämeenkoski, Kärkölä, Lahti, Myrskylä, Nastola, Orimattila, Padasjoki, Pukkila and Sysmä). Preparation of the municipal the waste management regulations is based on section 91 in the waste act (646/2011). The key need for revision is the need to increase material reuse. The goal is 50 % material reuse in 2016, when the reuse percentage in the Päijät-Häme Waste Management area is circa 38. With respect to that PHJ examines alternative means to increase the reuse of waste in waste transport system organised by the property holder and interviews also the Environmental Register of Packaging PYR Ltd.

PHJ has Ecopoint network for collection of glass, metal (about 80 collecting points) and cardboard (about 30 points). Current municipal the waste management regulations decree that properties with at least ten households residing in the urban areas (Lahti, Nastola, Hollola, Orimattila, Asikkala and Heinola) should collect cardboard separately at the property. Bigger properties also have voluntary glass and metal collection. Other than residential properties shall have separate collection for cardboard, glass and metal, if at least 50 kg of each type of waste is generated per week.

Background information

1. Name of the company and person interviewed

Collection and treatment of packaging waste

2. What kind of regional network of recycling points PYR is planning to organise in the Päijät-Häme waste management region? What is the planned number of collection points per municipality and per the type of waste?
3. How are the points located in relation to PHJ Ecopoint network?
4. Do the producers organise transport from the properties?
5. What is the primary way of collection of municipal packaging waste, collection from properties or regional network of recycling points?
6. What is PYR's position on supplementary transport of separately collected packaging waste in properties in the Päijät-Häme waste management region?
7. If municipality or property holder organises supplementary collection of packaging waste from properties, how does it affect the density and positioning of the regional network of recycling points?
8. What types of plastic would it be useful to collect from residential properties?
9. Could PHJ's waste reception station (7) be regional reception points for municipal plastic waste in the producer's regional network of recycling points?
10. Do the producers receive packaging waste which contains other waste (for instance packaging metal which contain other metal waste)?

Ownership of waste

11. If municipality or property holder organises supplementary transport of packaging waste from properties as commingled collection (for instance glass-metal or glass-metal-cardboard or glass-metal- cardboard-certain types of plastic, waste is collected in one waste container and separated in MRF),
 - a. is it separate collection (The waste act 35 section 1)?
 - b. who owns the waste (organiser of the transport or producer)?

- c. do the producers receive above mentioned waste that contains several types of packaging waste?
 - d. must the packaging waste which is separated in MRF after commingled collection be delivered to producers?
 - e. if it has to be delivered to producers, free of charge or does the producer compensate the costs of separation?
12. If packaging waste is collected to multiple compartment waste containers (waste container which has different compartments for different types of waste), is it separate collection (The waste act 35 section 1)?

Information on packaging waste

13. Producers are obligated to submit the information of the amounts of collected waste to Pirkanmaa centre for economic development, transport and the environment. Do the producers monitor amounts of waste regionally (Päijät-Häme waste management area) and does it provide the information to waste management authority is asked (according to The waste act section 122 right to obtain information)? Information is used in planning of regional waste management and service level?

APPENDIX 3. QUESTIONNAIRE FOR WASTE CARRIERS

Translated from the Finnish original

Interviewees:

- Unit manager Ari Kukkurainen, Lassila & Tikanoja Oyj
- Customer manager Kari Stång, Lassila & Tikanoja Oyj
- Managing director Jarkko Hämäläinen, Hämeen kuljetuspiste
- Transportation manager Reijo Puranen, Hämeen kuljetuspiste Oy
- CEO Jukka Koivisto, HFT Network Oy
- Unit manager Pasi Halttunen, SITA Suomi Oyj
- Service unit manager Markku Virtanen, RTK-Palvelu Oy

The revision of the waste management regulations has been started in Päijät-Häme waste management region (Asikkala, Heinola, Hollola, Hämeenkoski, Kärkölä, Lahti, Myrskylä, Nastola, Orimattila, Padasjoki, Pukkila and Sysmä). Preparation of the municipal the waste management regulations is based on section 91 in the waste act (646/2011). The key need for revision is the need to increase material reuse. The goal is 50 % material reuse in 2016, when the reuse percentage in the management area of Päijät-Häme Waste Management Ltd. (PHJ) is circa 38. With respect to that PHJ examines alternative means to increase the reuse of waste in waste transport system organised by the property holder. The waste carriers in the area are invited to workshop to compose different alternatives for waste collection and treatment in autumn 2014. The waste carriers are interviewed for the preparation of the workshop.

Background information

1. Name of the company and person interviewed
2. In which municipalities does your company carry municipal household waste and other waste for which municipalities are responsible in PHJ area?
 - a. What types of waste?

3. Does your company have waste treatment in PHJ area or elsewhere in Finland?
 - a. What kind of treatment activity and for which types of waste?

Collection and treatment of packaging waste

PHJ has Ecopoint network for collection of glass, metal (about 80 collecting points) and cardboard (about 30 points). Current municipal the waste management regulations decree that properties with at least ten households residing in the urban areas (Lahti, Nastola, Hollola, Orimattila, Asikkala and Heinola) should collect cardboard separately at the property. Bigger properties also have voluntary glass and metal collection. Other than residential properties shall have separate collection for cardboard, glass and metal, if at least 50 kg of each type of waste is generated per week.

4. Is it necessary to supplement the current Ecopoint network / the network that producers have by January 1 2016 in the PHJ area with packaging waste collection in properties?
 - a. If yes, for what types of waste?
 - b. Should the supplementary collection be organised by municipality or property holder?
5. Should the sorting of packaging in properties waste be included mandatory in the waste management regulations?
 - a. For what size of properties (households/property) should it be mandatory and for what types of waste?
 - b. Should the same rules apply to urban areas and scattered settlements?
6. What kind of solutions does your company have for increasing the collection of packaging waste in
 - a. apartment buildings and row houses?
 - b. detached buildings?
 - c. other than residential properties that generate packaging waste?

- d. What types of waste should be collected separately and what kind of properties (households/property) could be included? Is collection of plastic cost-effective?
- e. What types of waste could be collected in commingled system and what kind of properties (households/property) would be reasonable to include? Commingled collection requires separation in MRF.
- f. Does your company have or are you willing to take for use waste cars for multiple compartment waste containers? If yes, what kind of cars?
- g. Are you interested in the treatment of municipal packaging waste or are you negotiating about it with The Environmental Register of Packaging PYR Ltd?

(Questions 7-13: Collection of bio waste from residential properties and other than residential properties)

General

14. Other views