Reduction of Plastics Use in Housing Development project: Case Metsäkissa

Joonas Lyytikäinen, Anu Pousi, Moona Pohjola

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ara VERONA GROWTH PREMICO Kuntarahoitus Lujatalo Oy Ympäristöministeriö Miljöministeriet Ministry of the Environment

FOREWORD

The report for the “Reduction of Plastics Use in Housing Development — Case Metsäkissa” development initiative was completed by Verona Growth Oy (formerly Avanto Ventures Oy). The initiative was ordered by Premico Group Oy, Lujatalo Oy and the Housing Finance and Development Centre of Finland (ARA). The Ministry of the Environment, Municipality Finance Plc (MuniFin) and L&T participated in the development initiative’s steering group as specialists.

The Ministry of the Environment published a Plastics Roadmap for Finland in 2018. The Plastics Roadmap for Finland sets out a number of actions that help us reduce the harm caused by plastics, avoid unnecessary consumption, improve the recycling of plastics and find alternative solutions. The roadmap shows the first steps towards a new kind of sustainable circular economy for plastic.

As the roadmap was being prepared, the construction industry was identified as an important user of plastic products as a fifth of all plastics is used in construction. Most of the plastics used in new building construction consists of packaging plastics from construction materials and plastic film used for covering surfaces. According to Päivi Piispa, “we must recycle at least 50% of packaging plastic by 2025 and raise the recycling rate to 55% by 2030. The organisation of separate collection of packaging plastics from construction sites is accelerated with a green deal agreement.”

The Metsäkissa development initiative got its start when Premico Group Oy contacted ARA. According to CEO Janne Vaula, “almost all international institutional investors expect their property investments to fulfil certain norms of sustainable investing. These are no longer just wishes — they are prerequisites.”

The Plastics Roadmap’s perspectives “reduce, refuse, recycle and replace” function as the initiative’s starting point. These objectives were used as the basis when creating questions that are still awaiting answers while simultaneously noting that it is not possible to solve everything with one initiative. However, we can take the first, significant steps

towards low-plastic construction. We hope that the initiative's results raise discussion as well as the interest of the property and construction sector to start tangible construction initiatives along the lines of the low-plastic objective.

On behalf of everyone who participated in the initiative, I would like to thank Verona Growth Oy's Moona Pohjola and Joonas Lyytikäinen for their outstanding research and report.

Lahti 21 April 2021

Vesa Ijäs
Chief Architect
The Housing Finance and Development Centre of Finland (ARA)

SUMMARY

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Summary

In this project, the reduced use of plastics was examined in the construction site conditions of Premico and Lujatalo's building project Metsäkissa. In addition, several construction industry players were interviewed about the current state of plastics use in the industry. The goal was to answer the following questions:

- *How can financiers, clients and developers impact the use of plastics?*
- *What is the current state of sorting of plastics and how can it be improved?*
- *Based on the case study, what kind of matters and aspects should be brought forward in the whole property and construction sector?*

The construction sites tools to promote the reduced use of plastics: target sorting rate 70%, better training, extensive material flow chart, equipment for separate collection, documentation of amounts and types of plastic generated, and phase-specific planning including recycling. Both the sorting rate and recycling rate have increased significantly thanks to these measures. The amount of construction waste generated has been lower than at the control construction site. Enthusiastic recycling has increased the shipping and skip hire costs but decreased waste-related costs. The total costs of the construction site have not been not significantly high or low.

The interviewed construction industry players expressed clear needs related to the use of plastics and circular economy. Collection of data is essential to the development of concrete indicators. Plastics should be included in the concept of low carbon. Different operators must cooperate more closely in order to implement circular economy models successfully. Rules and regulations as well as incentives were expected to accelerate the move towards a circular economy. The use and reduction of plastics should be considered at the planning phase. The interviewees wished for more cooperation with material manufacturers and suppliers. The Land Use and Building Act reform might introduce concrete tools to find solutions to these needs.

TERMINOLOGY

Below are the definitions for the key terms used in this study.

Circular economy

A circular economy is an economic system aimed at eliminating the continuous production of new goods. Circular systems employ sharing, renting and reuse to preserve the value of materials as long as possible in society. In a circular economy, economic growth is independent of the use of natural resources. Circular systems aim to minimise the creation of waste through product and service design, sharing, renting, repair, reuse and recycling. (Sitra, 2018.)

Carbon footprint

A carbon footprint is the total greenhouse gas emissions caused by a product, action or service during its life cycle. A carbon footprint is usually expressed as carbon dioxide equivalent (CO_2-e). (Finnish Plastics Industries Federation, 2021.)

Low plastic

In this report, the concept ‘low plastic’ contains four objectives:

1. Avoid unnecessary use of plastics
2. Use plastics as a building material only when the its properties are exceed the properties of other materials and/or it is the best option in terms of total emissions.
3. Strive to replace plastic products with plastic products with a lower environmental load or other better alternatives.
4. Maximise plastics recycling.

Metsäkissa

‘Metsäkissa’, ‘project Metsäkissa’ and ‘pilot’ refer to the housing association Asunto Oy Vantaan Metsäkissa, which is Lujatalo Oy and Premico Group’s new building project in Asola, Vantaa. A plastics recycling and reduction scheme has been piloted at the building site.

Sorting rate

The sorting rate indicates how much waste is sorted at a construction site. It does not indicate whether the waste is recycled or reclaimed (generally, ‘reclamation of waste’ refers to the burning of waste to recover energy).

Recycling rate

The recycling rate indicates how much of the waste created is recovered and recirculated.

Plastic type

A generic term for material names referring to the polymer or polymers in plastic materials. The best-known plastic types are polythene (PE) and polypropylene (PP). According to estimates, there are hundreds of thousands of different plastic types in the world (Finnish Plastics Industries Federation, 2021).

Packaging plastics

Plastics make up approximately 18 per cent of all construction waste. These plastics are divided into packaging plastics and hard plastics (Liikanen et al., 2018). Packaging plastics include PE packaging and wrappers, stretch and shrink films, bubble wraps, empty raw material bags and wrappers and pallet wrappings. Packaging plastics are divided into clear and coloured plastics.

Separate collection

In this report, ‘separate collection’ refers to the collection and sorting of different waste components in their designated waste containers on the building site.

Material flow chart

‘Material flow chart’ refers to a chart provided by Lassila & Tikanoja. The chart explains which waste components should be recycled at construction sites and specifies the appropriate collection instruments and disposal sites.

Client

A client is the entity who commissions a building project, for example, a finance company or the future owner of the building.

Planning guidelines

In this report, ‘planning guidelines’ refer to the planning and implementation guidelines included in the construction instructions followed by Premico in the company’s housing production operations.

Planning guidance

In this report, ‘planning guidance’ refers to more general planning guidelines and consultation, for example, guidance provided by ARA to entities applying for funding.

Project planning

‘Project planning’ and ‘project design phase’ refer to the building project stage in which boundary conditions are determined for the implementation of the project. These conditions concern, for example, technical and functional solutions, architectural solutions as well as costs and schedules.

Project plan

A project plan is a plan that is part of the client’s process. The plan sets operational and technical goals for the project. The project plan lays the foundations for a more detailed proposal plan and the project master plan.

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1 INTRODUCTION

1.1 Report background

The packaging industry and construction industry are the two biggest users of plastics in Europe. The former makes up approximately 40 per cent of all use of plastics. Approximately 20 per cent of plastics are used directly in construction. Plastics are also used in building product packaging, weather guards at construction sites and many other applications in construction. (Häkkinen, Kuittinen & Vares, 2019.)

Financiers ARA and MuniFin and investor Premico decided to carry out a pilot project that surveys the reduction of plastics use at the construction site of Lujatalo's new building project in Vantaa. The objective of the pilot is to develop a better understanding of the possibilities of reducing and recycling plastics in construction site conditions and introduce new approaches and practices to the whole field and the project's value chain.

In addition to this document, a PowerPoint summarising the key points of the final report is available.

1.1.1 The Housing Finance and Development Centre of Finland (ARA)

The Housing Finance and Development Centre of Finland (ARA) is an agency implementing the state social housing policy. ARA operates under the supervision of the Ministry of the Environment. ARA grants subsidies, grants and guarantees for housing and construction and controls and supervises the use of the ARA housing stock. In addition, ARA participates in projects related to the development of housing and expertise in the housing market and produces information services for the industry.

1.1.2 Premico

Premico is a Finnish real estate fund manager and property development agency specializing in apartments. Premico manages over 6000 rental apartments and has built or renovated over 5000 rental apartments during the years of 2010 to 2020.

Premico Residential Funds I & II own over 1200 reasonably priced rental apartments and the aim is to grow their portfolio up to 2700 rental apartments by 2024. Premico also launched Finland's first carbon neutral residential fund called Premico Carbon Neutral Residential Fund I (PCNRF) in Q1/21. The fund focuses on sustainable buildings that are carbon neutral during the occupancy period and have significantly lower carbon footprint during construction period. The ESG goals of the fund are very ambitious as the buildings will be built as A-rated energy class buildings and thus will be the first buildings in Finland to receive BREEAM Excellent rating. PCNRF will be the first European property investment fund to be classified as a Dark Green Fund according to the Sustainable Finance Disclosure Regulation (SFDR) article 9. The Fund will also commit to the Paris Agreements long term goals related to global warming and EU taxonomy demands.

In addition to Premico's own real estate funds, they are also the local partner of Morgan Stanley in Finland and jointly own over 2000 rental apartments.

Case Metsäkissa

"Premico Group's responsibility policy guides also the activities and investments of the funds they manage. Finland has set the goal to be the first carbon neutral country in the world by 2035 and Premico wants to do their part in supporting this goal. The climate impacts of both construction and living are significant, and about 60% of a residential buildings carbon footprint is accumulated during the occupancy of the building. Our goal is to remove this share of the emission completely. However, this is not enough for us and we have set even higher goals for ourselves. For example, we will put an effort in selecting the best construction materials focusing on the recyclability of the materials.

Asunto Oy Vantaan Metsäkissa was an excellent fit for a pilot site, when we wanted to explore the possibilities of recycling plastics at construction sites and also the possibilities of replacing plastics with other more sustainable materials. Construction industry is the second largest use of plastics after packaging, and it is estimated that about

20% of all plastics in Finland is used in construction. We are very proud to be part of this project with Lujatalo, Ara, Ministry of Environment and MuniFin, to explore the possibilities of reducing plastics and increasing circularity of plastics in construction industry, and also to find cocncrete ways to achieve these goals.

1.1.3 MuniFin

Municipality Finance Plc, or MuniFin, is a financial institution owned by the Finnish public sector; the municipalities, the government of Finland and Keva, a public sector pension fund. It provides versatile financial services to the municipal sector and public housing production.

"Our mission is to build a better future in line with the principles of responsibility and in cooperation with our customers. Our customers use MuniFin's financial solutions to finance environmentally sustainable and socially responsible projects, such as public transport, sustainable building, hospitals and health centres, day-care centres and schools as well as housing for specific social groups and moderately priced rented flats. Although MuniFin's customers are Finnish, our institution operates globally. The company is the most active Finnish issuer of bonds operating on the international capital market and the first issuer of green bonds in Finland.

We are participating in project Metsäkissa, because we wanted to obtain new information and gain new perspectives for the assessment of our green financing projects. Furthermore, we are interested in the project's reference value and the benefits we can share with other entities applying for funding."
(Erkkilä, MuniFin)

1.1.4 Lujatalo

Lujatalo belongs to Luja-yhtiöt, which is one the largest construction groups in Finland. Lujatalo is a residential and non-residential construction company. The company also

has a wide range of project and property development services and strong experience in PPP projects. Lujatalo is a pioneer of utilising digital methods of construction. The company employs more than 800 specialists and its Lujakoti trademark is an indicator of high-quality housing.

The promotion of circular economy and reduction of the company's carbon footprint play a key role in Lujatalo's work towards low-carbon and ecological development. The Plastics Roadmap for Finland helps the developer understand and identify the amount and type of plastics used in construction and improve the sorting and recycling of plastics waste at construction sites.

1.1.5 Ministry of the Environment

The Ministry of the Environment coordinates the Plastics Roadmap for Finland. The Plastics Roadmap sets the following goal for the construction industry: "Improve the identification of plastics in buildings and sorting of plastics waste at construction sites". Construction is one of the most significant applications of plastics. Plastics are accumulated in buildings throughout their life cycle due to maintenance, additional installations and repairs and, naturally, during the actual construction process. Currently, separate collection of plastics is rare at construction sites. Successful separate collection would require a better identification of plastics at construction sites. The easiest plastics to recover and recycle are packaging plastics, which are used in building product packaging and for covering surfaces. In order to improve the separate collection and recycling of packaging plastics, a Green Deal agreement on the reduction of packaging plastics in the construction sector (2020–2027) was concluded. Industries that produce packaging plastics have committed to ensuring that recovered packaging plastics will make up 40 per cent of all the plastics used in their production by 2027. This is a significant improvement.

The Plastics Roadmap also sets the industry another goal: "Prepare a plan and carry out experiments". In other words, together with ARA and Senate Properties, a plan is prepared on reducing of plastics and increasing the recycling rate of plastics waste as well as on the use of recycled plastics in construction. The building project at hand – Asunto Oy Metsäkissa – will increase the impact of sustainable use of plastics in

construction. In the future, building project financiers, such as ARA and MuniFin, will require developers to optimise their use of plastics, boost separate collection at construction sites and improve the conditions for the recycling of plastics.

1.2 Research problem and questions

This report strives to provide solutions to the following problem: how and by what means can the parties involved in the building project promote reduced plastics use and the low plastic principle in building projects?

The purpose of the study is to find answers to these questions:

- How should the client indicate its objective of reducing the use of plastics in its call for tenders while ensuring that its requirements are also fulfilled at the planning and execution stage of the building project?

- What aspects should the project's main contractor take into account in keeping the project as low-plastic as possible?

- What kinds of obstacles/bottlenecks might the contractor encounter that prevent it from meeting the targets?

- What kind of matters should financiers pay attention to when deciding on granting funding to a project?

- What is the current state of sorting of plastics and how can it be improved?

- Based on the case study, what kind of matters and aspects should be brought forward in the whole property and construction sector?

1.3 Research objectives

This report strives to depict how the low plastic principle is currently taken into account in the construction industry by reviewing Premico and Lujatalo's building project Asunto

Oy Vantaan Metsäkissa. In addition, interviews were conducted to discover measures and practices that would help the parties involved in the project promote the low plastic principle. The parties discussed in this report are the client (Premico), main contractor (Lujatalo) and project financiers (ARA and MuniFin). The Ministry of the Environment is part of the project's steering group.

1.4 Subject definition

This report examines the low plastic principle and recycling of plastics in the context of new building projects with special focus on how the low plastic principle is realised in construction site conditions. The report raises some points regarding the recycling of plastics outside construction site conditions and the building's whole life cycle, but it does not discuss these topics in detail. The use of plastics at construction sites is examined through a single pilot site. Therefore, the results cannot be generalised and applied to other construction sites.

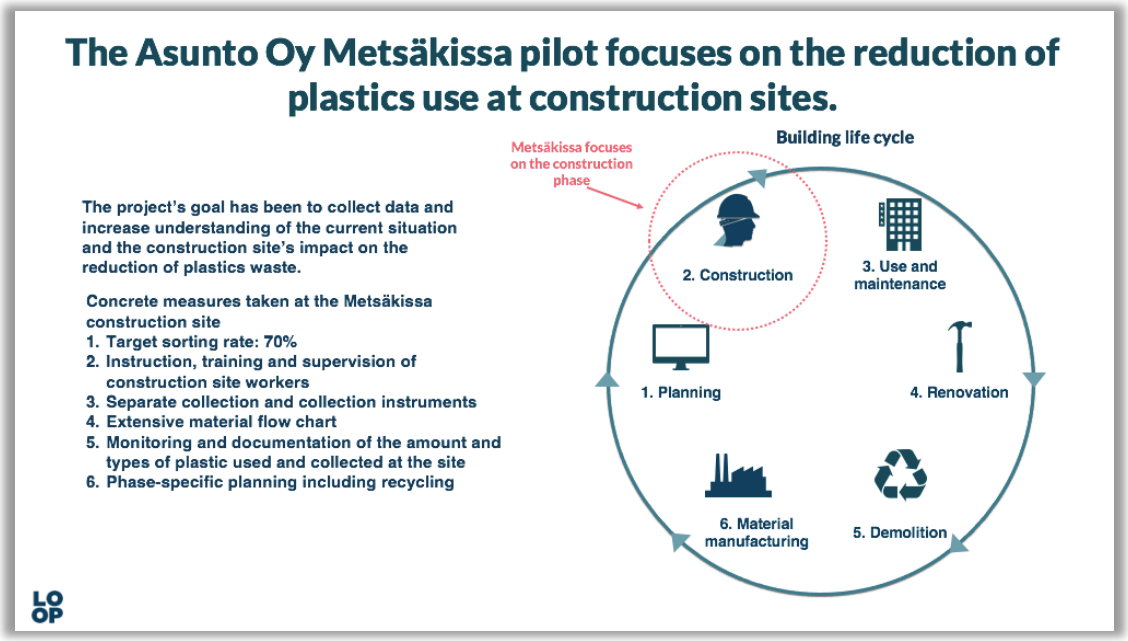

Image 1: The Asunto Oy Metsäkissa pilot focuses on the reduction of plastics use at construction sites. (Lyytikäinen & Pohjola, Verona Growth, 2021.)

2 RELEVANT POLICY INSTRUMENTS AND PREVIOUS REPORTS

2.1 Laws, statutes and policy instruments governing building projects

The construction industry is governed by many national laws and obligations and EU directives and regulations that regulate the recycling of waste and use of packaging and other materials. Such policy instruments include the Finnish Land Use and Building Act and Waste Act and the EU Waste Framework Directive, Packaging Waste Directive and Construction Products Regulation.

2.1.1 EU directives and regulations

A key objective of the **EU Waste Framework Directive** is to increase waste recycling by enhancing source separation and separate collection. According to the valid Waste Framework Directive, separate collection should always be organised. Deviations from this rule are allowed under special circumstances. The Waste Framework Directive obliges the member states to ensure the establishment of sorting systems for construction and demolition waste at least for wood, mineral fractions (concrete, bricks, tiles and ceramics, stones), metal, glass, plastic and plaster. (EU 2018/851 Article 11.)

The objective is that at least 70 per cent of construction and demolition waste, with the exception of soil and stones and hazardous waste, is used for applications other than the production of energy or fuel. The EU Commission has also declared that all plastic packaging should be recyclable or suitable for reuse by 2030. (Ministry of the Environment, 2020e.)

The **EU Packaging Waste Directive** (EC/94/62) has set material-specific recycling targets for packaging. These targets apply to all member states of the EU. The Packaging Waste Directive declares that all packaging shall fall under the extended producer responsibility scheme by 31 December 2024. The member states shall promote the use of materials recovered from recycled packaging in the production of packaging and

other products by improving the market conditions of the materials in question and reviewing the current regulations that might prevent the reuse of such materials. (Ministry of the Environment, 2020e.) The amendment to the EU Packaging Waste Directive (EU 2018/852) lays down recycling requirements for various packaging materials which producers must meet by employing separate collection and recycling.

The **EU Construction Products Regulation** regulates construction products in the EU. The objective of construction product legislation is to ensure that construction product information acquired from assessing construction products' suitability is reliable and comparable (Ministry of the Environment, 2020e.)

The EU Construction Products Regulation applies to construction products for which product standards exist or the European Technical Assessment (ETA) has been issued. Construction products must be safe and in line with the sustainable development principles. They must pose no health risks. The objective of the Construction Products Regulation is to produce accurate and reliable information about the performance and properties of construction products uniformly in Europe. (Ministry of the Environment, 2020e.)

The **SUP Directive** (EU 2019/904), i.e. the directive on single-use plastics, strives to promote circular economies and the use of reusable products. The measures laid down in the directive aim to impact consumption, product design, extended producer responsibility and separate collection. The SUP Directive will enter into force in the EU in July 2021. (Ministry of the Environment, 2019.) The SUP Directive introduces requirements for a mandatory minimum content of recycled plastics in certain products. (Ministry of the Environment, 2020e.)

Furthermore, the SUP Directive includes requirements concerning product markings. Certain kinds of packaging and products must bear a marking that informs the consumer of the product's plastic type, its appropriate disposal method and the adverse environmental effects caused by inappropriate disposal of the product. (Ministry of the Environment, 2019.) This is significant for the construction industry, where the identification of plastics has been found challenging.

2.1.2 National laws and obligations

At the national level, land use and construction are governed by the Finnish Land Use and Building Act, which defines the general requirements for construction. (Ministry of the Environment, 2020a.)

The purpose of the Land Use and Building Act:

- Organising the use of land areas and building activities conducted on them in such a way that creates the preconditions for a favourable living environment
- Promoting ecologically, socially and culturally sustainable development
- Ensuring that everyone has the right to participate in the preparation of related matters
- Ensuring the high quality and interactivity of planning, the diversity of expertise, and the openness of communications.

A reform of the Land Use and Building Act is underway. The government bill is expected to be finished by the end of 2021. The key objectives of this reform include the establishment of carbon-neutral society, reinforcement of biodiversity, improvement of the quality of construction and promotion of digitalisation. (Ministry of the Environment, 2020b.)

The purpose of the Finnish **Waste Act** (646/2011) is to prevent the hazard and harm to human health and the environment posed by waste and waste management, to reduce the amount of waste and to promote the sustainable use of natural resources, among other goals. According to the Waste Act, waste of different types and quality shall be collected and kept separate to the extent necessary to prevent hazard or harm being posed to human health or the environment, to facilitate the appropriate arrangement of waste management, and to the extent technically and economically feasible.

The provisions on construction waste laid down in section 15 of the Waste Act (646/2011) have been specified further: construction and demolition waste should be reduced and usable substances and objects should be reused. Arrangements should be made to minimise waste generation at construction sites. Construction sites must have separate collection for the following waste types:

- Soil and stones
- Paper and cardboard
- Plastic
- Glass
- Metal
- Impregnated wood waste
- Gypsum-based waste
- Concrete, brick, mineral slab and ceramic waste

(Government Decree on Waste 179/2012.)

The Waste Act sets monitoring and reporting obligations related to the treatment of construction waste. The objective of these obligations is to increase information about the amount, origin and quality of construction waste.

The Government Decree on Waste (179/2012) demands separate collection of plastics at construction and demolition sites. Separate collection must be organised for at least eight waste types. However, the obligation to sort waste is watered down by the phrasing: “to the extent technically and economically feasible”. In practice, this means that the supervisory authority rarely demands construction sites to organise separate waste containers for every waste type. (Ministry of the Environment, 2020e.)

The Waste Act is currently under reform. The objective is to submit the government bill to the Finnish Parliament in early 2021. The reform would allow Finland to implement several changes imposed by the relevant EU directives. For example, the EU Waste Framework Directive obliges the member states to increase the recycling of residential waste significantly. The new act imposes on municipalities, holders of waste and producers of packaging much stricter obligations of separate collection of waste. (Government, 2020a.)

The reporting obligation impacts the collection of waste substantially at construction sites. If waste generated at a construction site is transported to waste processing without sorting, it is impossible to identify the shares of different waste type afterwards. The new Waste Act will also include an obligation to prioritise recovering waste for reuse.

The holder of waste shall strive to reduce the amount and harmfulness of waste and process waste generated at the site for reuse first and recycling second. Recovering waste for energy generation and waste disposal should be the final option. (Lassila & Tikanoja, 2020.)

The **National Waste Plan** is a strategic plan that sets out the objectives for waste management and waste prevention and the measures to reach these objectives. The National Waste Plan is valid until 2023. Detailed targets are set and measures presented for four key areas: construction and demolition waste, biodegradable waste, municipal waste, and electrical and electronic waste equipment. (Ministry of the Environment, 2020f.)

Construction waste is one of the key areas of the National Waste Plan. The targets set for construction waste:

- Reducing the volume of construction waste
- Raising the material recovery rate of construction and demolition waste to 70%
- Increasing the material recovery of construction waste while managing related risks
- Achieving greater accuracy and correctness in statistics on construction and demolition waste.

The National Waste Plan is a document that binds authorities. The Plan proposes measures to be taken by other operators. (Ministry of the Environment, 2020e.) The National Waste Plan is currently being updated. The reformed Waste Framework Directive as well as the directive on the reduction of the impact of certain plastic products on the environment demand new content to be included in the National Waste Plan. (Ministry of the Environment, 2020f.)

The implementation of the Waste Act provisions and the Government rules issued under the Waste Act may be expanded by **municipal waste management provisions**. Municipal provisions may concern, for example, incineration, composting or burying of waste or the placement and loading of waste containers on a company's property. (Ministry of the Environment, 2020e.)

2.1.3 European Green Deal

The European Green Deal is the European Commission's comprehensive and ambitious set of measures to make Europe climate neutral by 2050. The goal of the programme is to reduce emissions, invest in cutting-edge research and innovations and preserve the natural European environment. The purpose of the Green Deal is to make the EU's economy more sustainable in a way that makes the move towards the green economy beneficial to both citizens and companies. (European Commission, 2020.)

The regulations proposed in the Green Deal also impact Finland in multiple ways. Finland prioritises the Green Deal initiatives on climate neutrality, circular economy, the industry policy strategy and the new forestry strategy. (European Commission, 2020.)

On the topic of plastics, the programme's circular economy action plan states that single-use products should be substituted with sustainable materials and products whenever possible. Other goals include the reduction of microplastics and increased recovery of microplastics throughout a product's life cycle. (European Commission, 2020.)

In late 2020, Finland was the first country in the world to release a voluntary agreement that stated the common goals for moving the entire construction supply chain towards a closed loop model for packaging plastics. This agreement pursues a situation where packaging plastics are sorted and collected at construction sites so carefully that the plastics waste can be processed into recycled plastic. Companies' commitment to the agreement begins in 2021. The goal is that in 2027 40 per cent of the raw material for packaging plastics will consist of recycled materials. (Government, 2020b.)

2.1.4 National Plastics Roadmap

The Plastics Roadmap for Finland was prepared by a broad-based working group appointed by the Ministry of the Environment. The Plastics Roadmap sets out a number of actions by which we can reduce the harm caused by plastics, avoid unnecessary consumption, improve the recycling of plastics, and find alternative solutions to replace plastics. The Roadmap points out the first steps towards a new, sustainable plastics economy. The aim was to discover concrete practical measures to get started as quickly as possible. (Ministry of the Environment, 2019.)

In the preparation of the Plastics Roadmap, special attention was paid to the construction sector. The construction sector is in fact one of the most significant users of plastics, and various types of plastics are used in both construction products and their packaging. One of the Plastics Roadmap's objectives is improved identification of plastics in buildings and sorting of plastics waste at construction sites. (Ministry of the Environment, 2019.)

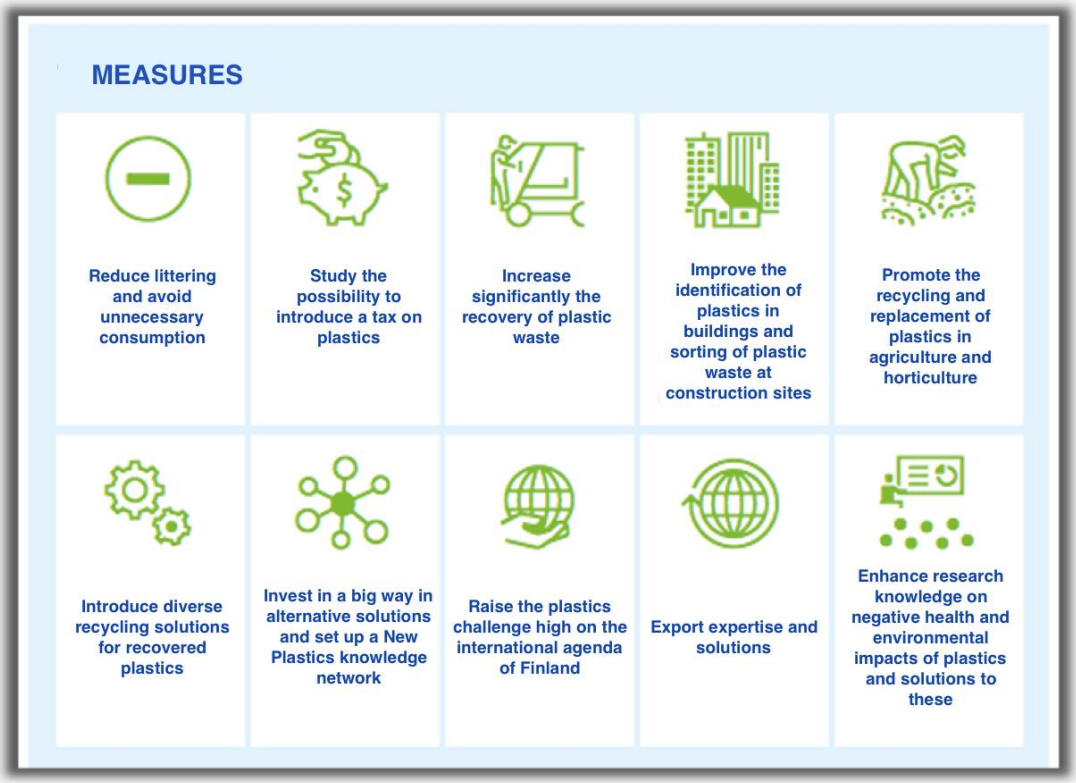

Image 2: Measures proposed in the Plastics Roadmap for Finland. (Ministry of the Environment, 2020c.)

2.1.5 Other voluntary agreements

The European Plastics Pact is a European voluntary agreement initiated by industries. A substantial number of European countries, companies and organisations have signed the Pact and voluntarily committed to take measures in order to reduce the environmental impact of plastics. Finland signed the Pact in March 2020. (European Plastics Pact, 2020.)

The Pact covers all three steps towards a circular plastics economy: planning and production, use and reuse and recycling. The Pact applies to plastic packaging and single-use plastics. Its goals concern the recycling and consumption of plastic packaging and single-use plastics as well as the use of recycled plastics. However, it is significant that the objectives of the Pact are not legally binding. (European Plastics Pact, 2020.)

2.2 Recycling of plastics in the construction industry

In Finland, a number of studies have been conducted on the generation and recycling of plastics waste in the construction industry. In their thesis for the Karelia University of Applied Sciences, Riikka Kinnunen and Riina Kupiainen examined plastic waste streams at a construction site and the environmental impacts of sorting. Tarja Häkkinen, Matti Kuittinen and Sirje Vares have studied the use of plastics in different building types. They published a report on the subject as part of the Plastics Roadmap in 2019. In addition to these two studies, Ramboll Finland Oy launched an extensive survey on the use of plastics in construction in 2020. The purpose of this survey was to support the preparation of the Ministry of the Environment's *Rakentamisen muovit Green Deal* agreement.

Approximately 20 per cent of all plastics is used by the construction industry. The most common applications are packaging, insulation, waterproofing, floors, pipes and cables. The use of plastics is prominent in the construction industry, because the material has excellent technical and functional properties that are important in modern construction. (Häkkinen, Kuittinen & Vares, 2019.)

Currently, construction waste is rarely sorted and most of the plastics waste generated by the industry are recovered as an energy source. Impurities are one of the key factors hindering the sorting of plastics. Dirty materials are very difficult to recycle and reuse. Using plastics as an energy source should not be the only application of recycled plastics. More research should be carried out on the potential uses of recycled plastics. One alternative could be using recycled plastics as a filling material in different products. (Häkkinen, Kuittinen & Vares, 2019.)

In addition to waste separation, the lack of monitoring of plastics waste generated at construction sites poses a challenge. In practical terms, this means that there is not enough data on how much of each waste type is generated at construction sites or

where the waste is transported to. The majority of waste shipment documents are either in paper format or saved as PDF files. These documents are hardly used for tracing waste shipments or reporting purposes. The construction industry should introduce electronic shipment documents in their everyday processing of waste. This would allow construction waste to be traced digitally via waste monitoring systems, such as Materiaalitori. (Kinnunen & Kupiainen, 2019.)

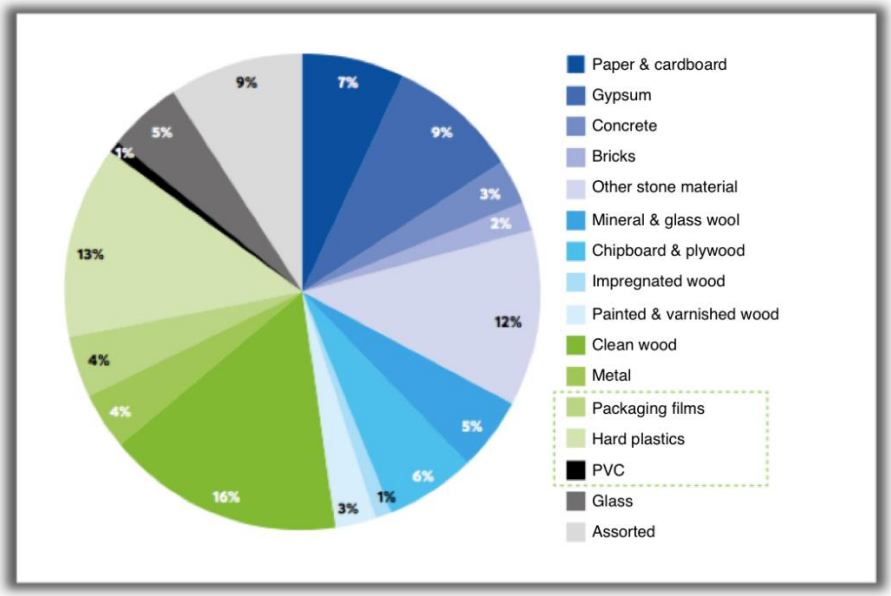

Image 3: Approximately 18% of all construction waste is comprised of plastics. (Liikanen et al., 2018.)

Plastics make up approximately 18 per cent of all construction waste. These plastics are divided into packaging plastics and hard plastics (Liikanen et al., 2018). The most common plastic type in Finland is PE-LD, which is low-density polythene. It is primarily used in packaging films by industries and in consumer goods. In construction materials, PE-LD is present in film materials. Consumer goods that contain PE-LD include plastic bags. The second-most widely used plastic type is PP, i.e. polypropylene, which can be found in more rigid packaging bags and wrappers. In addition, PP is used in industrial bags, sewer pipes and ropes. The third significant plastic type used in construction is PE-HD, i.e. high-density polythene. The most common applications of PE-HD include pipes, films, injection-moulded products and blow-moulded products. PE-HD is also used to manufacture watering cans, plastic canisters, detergent bottles and water pipes. (Järvinen, 2016.)

Plastic is a common construction material because it is very functional, advanced and light. Plastic has many great properties which cannot necessarily be replaced by other materials. Instead of avoiding plastics altogether, the recycling and reuse of plastics should be invested in. This would prolong the life cycle of plastic products. The potential of bioplastic is also worth considering. In fact, the development of some bioplastic products is rather advanced. It is particularly important to consider how the recycling of the most common plastic type, PE-LD, could be improved. (Ministry of the Environment, 2020e.)

Plastics waste other than packaging plastics are often sorted into combustible or mixed waste at construction sites and, thus, used as an energy source. This plastics waste usually includes hard plastics, pipes and PVC. It is often mixed and dirty or difficult to identify. Furthermore, the chemical properties of such plastics can prevent recycling. As things currently stand, reusing these plastics is challenging. Comprehensive data collection of plastics waste generated at construction sites is also lacking. (Ministry of the Environment, 2020e.)

2.3 Summary of previous reports

In Finland, a number of studies have been conducted on the generation and recycling of plastics waste in the construction industry. These studies have brought forward both issues and possibilities as well as proposals for promoting the recycling of plastics. In their thesis, Kinnunen and Kupiainen (2019) state that recycling plastics at construction sites is worthwhile, especially from the perspective of the environment, and should be promoted on a larger scale. The potential uses of plastics should be developed more in order to make recycling as beneficial and economically reasonable as possible.

The construction industry is governed by many laws, directives and decrees. Legislative reforms are considered to be some of the most important policy instruments. Examples of such reforms include the manufacturer's obligation to use recycled materials added to the Waste Act and the more detailed provisions on the sorting of construction waste (Ministry of the Environment, 2020e).

The recycling of plastics at construction sites is likely hindered by the lack of awareness of plastics' potential. In order to raise awareness of the subject and introduce new practices, it should be ensured that operators in the construction sector know how to

collect and start recycling plastics and where the waste should be transported. (Kinnunen & Kupiainen, 2019.) It is proposed that the practices of collecting packaging plastics should be included in developers' and contractors' ERPs and workers' induction training. To achieve this, it is important to distribute user-friendly training material on waste sorting and collection at construction sites. A standard waste tracing form and an electronic form would make compiling statistics of packaging plastics easier. That way it would be easier to utilise the data acquired for business purposes. (Ministry of the Environment, 2020e.)

One challenge is that the price paid for recycled plastics does not make recycling very appealing to businesses. The recycling of construction plastics is not necessarily economically viable. Construction plastics are usually light and affordable packaging plastics, and high transport and reuse costs might make recycling a more expensive option than the production of virgin plastics. From an environmental point of view, recycling of plastics is a more reasonable option than incineration. To combat this dilemma and make recycling more profitable, new ways to keep recycling-related costs low must be discovered. (Kinnunen & Kupiainen, 2019.)

One solution to increase the appeal of recycling is imposing fees on packaging producers. The incineration of plastics waste could be taxed in order to mitigate the competition between energy recovery and recycling. The tax rate should be optimised in a way that does not compromise the business of waste incineration plants, but encourages waste sorting plants to invest in separation and recycling. (Ministry of the Environment, 2020e.)

However, the studies referenced here mention that plastic is a very advanced, practical and light construction material and, instead of avoiding plastics altogether, the recycling and reuse of plastics should be invested in. This would also prolong the life cycle of plastic products, which is important. The potential of bioplastic should also continue to be considered in the context of construction. The studies specify packaging plastics as the most important type of plastics to be recycled and encourage further studies to be carried out on the issue. (Kinnunen & Kupiainen, 2019 & Ministry of the Environment, 2020e.)

3 MATERIAL AND METHODS

The material examined for this report is comprised of qualitative interviews and the data collected on the project Asunto Oy Vantaan Metsäkissa. A wide range of operators were interviewed, including representatives of the Ministry of the Environment, MuniFin, Premico, Lujatalo and ARA. The interviewees have been listed in Appendix 1.

The interviews were conducted as qualitative interviews. The purpose was to acquire information about the current state of recycling in the construction industry, value chain members' means of influencing the recycling of plastics and measures to be taken in order to promote the low plastic principle.

The survey was conducted in autumn 2020 and spring 2021. The pilot site, Asunto Oy Metsäkissa, will be completed by the end of 2021.

4 INTERVIEWS: THE STATE OF THE RECYCLING OF PLASTICS IN THE CONSTRUCTION INDUSTRY

This chapter presents the key observations and discoveries that emerged during the interviews regarding the current state of the recycling of plastics in the construction industry, project stakeholders' means of influencing the recycling of plastics and the measures to be taken in order to promote the low plastic principle.

4.1 Low plastic principle and awareness of plastics recycling

The term 'low plastic' aroused diverging opinions among the interviewees. Several interviewees thought that the term is not necessarily ideal or descriptive of the desired result. Some of the interviewees understood that the term referred to the minimisation of plastics use in building projects and saw the reduction of plastics use as a priority. The majority of the interviewees felt that 'low plastic' is a bad term, because plastic is determined to be the most reasonable option for many applications when the aggregated environmental impacts are considered. The interviewees also mentioned that the general discussion on plastics tends to ignore the fact that there exists a wide variety of plastics with different properties. Plastic products with a short life cycle, such as single-use plastics, and products with a long life cycle should be discussed separately. A plastic construction product that retains its useful properties for 50 years is not comparable to packaging plastics. Alternative objectives suggested by the interviewees included the maximisation of plastics recycling and optimisation of carbon footprints.

> *"We are approaching optimisation from the perspective of the carbon footprint. Abandoning all plastics altogether is not necessarily the best option in this sense." (ARA, Ijäs)*

Most of the interviewees agreed that the recycling rate of plastics should be higher and that products' recyclability should be improved and optimised in relation to consumption and use. These opinions concerned packaging waste generated at construction sites in

particular. However, many of the interviewees felt that plastics should only be replaced with other materials with smaller environmental impacts. They argued that plastics have important technical properties which make them the best solution for certain applications.

> *"If the use of a certain material is reduced, the use of some other material must be increased. Unless the goal is to reduce the volume of construction itself. I believe this issue should not be discussed on the basis of material types. Instead, we should focus on different materials' environmental load. This way we could actually approach the matter from an environmental point of view and make decisions based on it." (Uponor, Aho)*

Several interviewees thought that plastic is the best material for many applications and it will continue to be the most reasonable option in the future. They said that the issue should be approached from the point of view of optimisation: is it best to reduce, refuse, recycle or replace plastics? The interviewees also believed it a good idea to pay more attention to the types of plastics used and their recycling methods.

> *"On the one hand, we should strive for minimal use of virgin materials. On the other hand, plastics play a key role in the construction industry. In any case, the most costly option is to handle the issue poorly. We do not want to make bad decisions and then be forced to fix things in a few years. I think that careful and good use of materials could be set as a goal alongside the low plastic goal." (Research organisation expert)*

Many of the interviewees thought that increasing the recycling rate of plastics should be a priority. The current situation, in which the majority of plastics waste is incinerated or disposed of, serves nobody's interests and generates unnecessary emissions. Plastic was considered to be a good and sturdy material that lasts reuse better than many other materials.

> *"At the moment, less than ten per cent of construction plastics end up in circulation. This rate will increase significantly and the life cycle of plastic products will become longer in the future, thanks to both*

mechanical and chemical recycling." (Ministry of the Environment, Piispa)

The interviewees felt that successful reduction of the use of plastics and the maximisation of plastics recycling depend on the right mind-set. This mind-set should be visible at all stages of construction and guide the construction industry's actions. Some thought that the term 'low plastic' also refers to the selection of products and producers throughout the value chain. Some answers raised the need to include the entire path of plastics in the value chain and make more accurate assessments of the amount of plastics consumed in that cycle. This way a price could be set for the consumption of plastics, similar to the consumption of metal.

"This approach should be visible throughout the construction process, starting from project planning. It should not be just a technical issue. All operators should share this mind-set and pursue the same objectives at all stages of construction, like with occupational safety or moisture control." (Lujatalo, Pehkonen)

Many of the interviewees felt that the reduction of plastics and increased recyclability should mainly concern packaging plastics protecting more expensive products transported to a construction site. Although the importance of protecting more expensive products and moisture control was emphasised, almost all the interviewees agreed on the point that the industry is ready to reduce the amount of packaging plastics used and increase plastics' recyclability significantly.

4.2 Views on the state of the low plastic principle and recycling of plastics in building projects

Almost all the interviewees felt that there is still much to be done about the recycling of construction waste. The majority of the interviewees even described the situation as poor. Many of the interviewees approached the subject from the point of view of construction sites and said that the most-recycled materials are wood waste, gypsums and metals. According to their experience or understanding, the rest of the waste is usually sorted as mixed or combustible waste.

“The situation is bad. I am sorry to say that a great amount of waste is sorted into combustible waste or mixed construction waste. Naturally, some – but not very much – of the waste is recovered.” (Lassila & Tikanoja, Turunen)

Practically all the interviewees emphasised that they do not have accurate statistics on the recycling of plastics in the context of building projects and that their understanding of the situation relies on their experiences from construction sites.

“We do not have accurate statistical information that would help us determine the actual current situation. Nevertheless, the recovery rate of construction plastics is somewhere below ten per cent. This includes both plastics that remain in the buildings and are removed later and packaging plastics. Unfortunately, most of the plastics waste is incinerated and recovered as energy. This practice cannot be economically sound in the long run, because plastic is an oil-based material.” (Ministry of the Environment, Piispa)

The lack of statistics was explained by the fact that issue has not been actively monitored. The majority of the interviewees had not encountered any kind of criteria or concrete goals for promoting or monitoring the reduced use of plastics in their own projects nor in the value chain. Several interviewees felt that there has been progress and the matter is being discussed more and more by operators in the value chain. They believed that people are becoming more aware of the situation and paying more attention to the use of plastics. However, common practices have yet to be established. There was a general conviction that the industry has the capacity to promote the low plastic principle and the majority of construction materials could already be separated and recovered, especially at construction sites.

The interviews highlighted that construction sites have the capacity to collect and recycle most of the packaging plastics, but fail to do so. The experts representing the plastics industry stated that significant amounts of good raw material are wasted when packaging plastics are not recovered and recycled at construction sites. One of the reasons behind the lack of recycling is that the standards set for packaging materials used by the construction industry are not as strict as, for example, the standards set for the food industry. Some interviewees pointed out that the construction industry has a great

offset for recycling because construction materials are usually made of only one material.

> *"Technically, the value chain has good prospects for utilising recycled plastics. However, our field is hindered by certain standards and regulations. But not all plastic types used in construction have these obstacles."*
>
> *(Uponor, Aho)*

The interviews also raised a more difficult issue: the recovery of materials that are part of a building and which should be recycled when the building is renovated or demolished. Strict regulations and standards have been set for these materials in order to ensure their quality. In this context, the interviewees emphasised how the use of plastics should be assessed in relation to the purpose of the material as well as in comparison to the carbon footprint of alternative materials. In that case, there should be a more recycling-friendly material that provides the same quality and durability as plastics and, thus, has a smaller carbon footprint. The interviewees mentioned that developers and contractors tend to order an abundance of materials that remain in a building after its construction. According to the interviewees, this should be avoided and the spare materials should be put into circulation.

Many of the interviewees declared that the state of the low plastic principle and plastics recycling is likely to improve in the near future. This is because it is increasingly common that building project clients want the industry to be more transparent about the environmental impact of the construction products used. Some of the interviewees believed that this would benefit the operators who are pioneering transparency. The demand for products bearing a smaller environmental load would gradually increase.

4.3 Current measures taken by the interviewed value chain operators and stakeholders to promote the low plastic principle

4.3.1 Lujatalo

"We are not pursuing reduced use of plastics, but our sorting rate target is more than 70%. We monitor the amount of waste generated and the sorting rate."
(Lujatalo, Pehkonen)

When asked about concrete means to impact the use and recycling of plastics, the contractor highlighted equipment, waste presses and containers provided by waste management operators for the separate collection of different materials at construction sites. Other measures included employing building cleaners who know how different plastic types should be recycled.

In fact, influencing workers' attitudes towards and awareness of recycling was deemed to be the most important measure to be taken at construction sites. Regarding separate collection, implementing recycling as an everyday practice was seen as the biggest challenge. Finally, the contractor mentioned that influencing procurements and subcontractors would be an effective measure. It would help minimise the amount of waste, including plastics, generated by a construction site and prioritise the use of recycled plastics.

4.3.2 Lassila & Tikanoja

"We want to make recycling of plastics possible. We have been collecting packaging plastics from construction sites for years and strive to make it easier by providing collection instruments, training and instructions. We also have our own plastics processing plant and partners who can utilise the recovered raw material."
(Lassila & Tikanoja Turunen)

The interviewee brought forward the fact that L&T strives to recycle all the clear packaging plastics, but the recycling of coloured plastics is still very much at the

developmental stage. In addition to packaging plastics, L&T collects expandable polystyrene and flexible intermediate bulk containers for recycling. Multilayer films pose a challenge because they are difficult to recycle.

In order to promote the recycling of plastics at construction sites, L&T continues to develop the aforementioned collection instruments. Construction sites are often cramped, and L&T's goal is to make recycling easy by developing instruments that do not take much space. They believe that tools like multi-collection instruments will help them reach this goal. In addition to collection instruments, L&T highlighted the training programmes organised by the company. L&T also prepares phase-specific sorting instructions for construction sites. These instructions help raise awareness about the recycling of different materials at construction sites. The aim of these measures is to make the separate collection of different materials as efficient as possible.

Finally, L&T mentioned that they are actively promoting assessing the potential of a closed loop model.

4.3.3 Premico

> *"Here at Premico, we have acknowledged our environmental liabilities and want to be progressive and reduce the use of plastics in the whole construction industry. We strive to reduce the amount of unnecessary construction plastics by establishing clear policies and setting requirements for our contractors."*
> *(Premico, Kainulainen)*

Premico views the low plastic principle as a model of thinking that will be implemented concretely in all future projects. In practice, reduced use of plastics is one of the company's priorities alongside their general target of pursuing as energy-efficient construction projects as possible.

The most concrete measure mentioned were the company's planning guidelines. The guidelines urge contractors' to pay attention to recycling and recyclability. The planning guidelines include best practices and rules regarding construction. According to the interviewees, provisions on plastics will be added to the guidelines in the future. The guidelines force potential contractors to comply with the principles of plastics recycling.

4.3.4 MuniFin

According to MuniFin, green financing is their most important tool in impacting the use of plastics. They emphasised that MuniFin is a national operator that influences the industry through its financing operations.

> *"The low plastic principle falls under green financing. We channel funds into projects with positive environmental impacts. We strive to identify pioneer projects and learn from them. We promote the benefits of such projects to our customers. Otherwise, the issue is outside our sphere of operations."*
> *(MuniFin, Erkkilä)*

MuniFin stated that the inclusion of recycling principles in green financing is still at a rather abstract level. Their objective is to produce concrete references and results that would make the issue easier to discuss.

> *"In general, the process of green financing differs from the normal process by having an external three-member team analyse and assess a project's environmental impacts. When a project is presented by our customer manager, the plan is first reviewed and then we make a proposal and recommend the project. After that, a financing offer is made." (MuniFin, Erkkilä)*

Reduced use of plastics is not yet a market convention, so it cannot be set as a requirement for receiving funding. From MuniFin's point of view, the most important environment-related condition for funding is energy efficiency. The use of plastics falls under this category. However, a project may also be included in the green financing scheme if it has other positive environmental factors. In practice, operators applying for green financing can include application documents on the use of plastics under sustainable development.

4.3.5 The Housing Finance and Development Centre of Finland (ARA)

According to the interviewees, the issue is related to ARA's more extensive objective of increasing the recycling rate of building project materials up to 70 per cent. The

assessment of plastics use is included in the project preparation process and reservation period. However, it is not yet taken into account in the assessment of the carbon footprint. ARA has not established specific criteria for the implementation of the low plastic principle. Instead, they promote the matter through development projects. The results of these projects are reported:

> *"Right now, through development projects. The low plastic principle will be more relevant in future, but currently we are establishing models through development projects. When these models are ready, we will report the results. After that, the simplest way is to include it in ARA's planning guidelines. We can give strong recommendations, but not orders." (ARA, Ijäs)*

In general, the objectives of ARA's operations are determined by the Ministry of the Environment's guidelines on, for example, the promotion of a circular economy and low carbon.

4.3.6 Ministry of the Environment

According to the Ministry of the Environment, the issue is tangent to two clearly-defined matters.

> *"It is related to two matters: the promotion of low-carbon construction and the circular economy of construction. The goal is to minimise emissions, which involves both the circular economy and low carbon." (Ministry of the Environment, Piispa)*

The objectives of the Ministry of the Environment are determined by the government programme. The low plastic principle is visible in the Ministry's Plastics Roadmap for Finland project. The familiar principles are also at the core of the programme: reduce, refuse, recycle and replace.

The interviewees stated that one of the Ministry and the value chain operators' key duties is to promote awareness of plastics. This target is promoted through various pilot and development projects that have surveyed, for example, the movement of different plastic types within the value chain and strived to determine the means to make the

cycle of plastics more efficient in the industry. The data acquired from these projects is shared through, for example, guidelines and training.

In addition to the aforementioned measures, the interviewees highlighted the voluntary Green Deal pact on the use and recycling of packaging plastics in the construction industry (*Rakentamisen muovit Green Deal 2020–2021):*

> *"I would compare the Green Deal to when we negotiated energy efficiency with the industrial sector. We are at the same stage now. We are developing a voluntary agreement system in cooperation with industrial and trade unions as well as municipalities. We strive to achieve circulation through cooperation."*
> *(Ministry of the Environment, Piispa)*

The interviews also emphasised the Ministry's role as a legislator. The Land Use and Building Act is associated with the recycling of plastics in building projects. The act is currently being reformed. New provisions and specifications will be added to the act regarding, for example, mandatory climate reports. The reform is also expected to impose stricter regulations and promote the recycling of packaging and construction plastics. According to the interviewees, the Ministry also has other policy instruments at its disposal, such as raising awareness of the issue and voluntary agreements. The interviewees mentioned taxes as a potential policy instrument, however, tax matters do not fall under the authority of the Ministry of the Environment.

4.3.6.1 ***Construction supervision***

Observance with the Land Use and Building Act is, ultimately, monitored by construction supervision authorities. They promote the recycling and reduced use of plastics through permit conditions and consultation. According to the interviewees, the permit conditions cover almost everything from waste management to recycling. However, in practice, the authorities do not have enough resources to monitor these issues at construction sites.

The principal objective of consultation and guidance is to promote the reduced use of plastics. The interviewees stated that they have not prepared separate and clear

instructions for the recycling of plastics. It is likely that their clients are not provided sufficient information about the recycling of plastics. The construction supervision authorities believe that increased information and knowledge would have a great impact on the situation.

4.3.7 Research and development organisations

4.3.7.1 *Finnish Environment Institute SYKE*

According to a representative of the Finnish Environment Institute SYKE, the most important ways organisations like SYKE can impact the circular economy of plastics include cooperation with the construction industry and expert services, such as low-carbon assessments and calculations. SYKE experts' role is to collect and analyse data, conduct surveys and make calculations. At the moment, SYKE is helping the Ministry of the Environment with tasks related to the Plastics Roadmap. Although the Institute does not currently have any projects concerning construction plastics in progress, SYKE is developing a circular economy ecosystem with other research institutes (VTT, Luke, Aalto University) and construction is one of the industries included in the ecosystem.

4.3.7.2 *Muovipoli*

Muovipoli's key tools to promote the recycling of plastics are related to the activation, initiation and implementation of development projects that aim to reform the plastics industry. The expert interviewed for the study also highlighted plastic testing services. In the context of plastics recycling, plastic testing services refer to the analysis of plastic flows and material characterisation.

"First, we identify the plastic streams on the site. After that, we conduct a stream analysis. In other words, we find out what kind of material is flowing to the site and determine the amount, nature and impurities of the material discovered. Then, we carry out a processing study and characterise the material. We determine how it should be recycled and try to find potential applications for the recovered material. We also have to find partners who would use the material or industrial recyclers for it." (Muovipoli, Eerola)

Muovipoli has also initiated a network called 'New Plastics Center NPC'. The goal of this initiative is to reform the plastics industry by promoting bioplastics and other plastics produced from renewable sources. In addition, NPC endorses the use of recycled plastics.

"We are cooperating with LAB University of Applied Sciences in this project. The University has acquired a compounder in order to study recycled plastics. We realised that Finland is lacking a line of research that could produce enough material for industrial pilot projects."
(Muovipoli, Eerola)

4.3.8 Manufacturing industry and materials industry

A materials industry expert interviewed for the study revealed that their industry's key tools to promote the recycling of plastics include the industry's own capacity to recycle materials and find applications and a market for recycled materials. According to the interviewee, many of the materials produced by them are already recyclable.
In addition to recycling, the interviewee mentioned the development of technology. The aim is to achieve a higher level of performance from the same or a smaller amount of material.

"We are not trying to maximise the tonnage sold, but the value generated by the amount. Both we and our customers benefit from using less material to achieve the same or better results."
(Materials industry expert)

Another industry expert stated that the use of recycled materials in some plastic products is restricted by strict mechanical, pressure resistance and hygiene standards. However, the restrictions do not apply to all areas of application, so producers can use recycled materials in certain products. According to an expert interviewed, industrial players have the opportunity to influence product standards in the long term and make the use of recycled plastics less restricted.

The interviewee also brought up prefabrication, which is becoming increasingly common in the manufacturing industry. Manufacturers strive to make their products as ready for use as possible in order to cut the amount of work at construction sites. This would also affect the amount of construction waste.

4.4 The most significant obstacles preventing the implementation of the low plastic principle

The interviewees were nearly unanimous on the most substantial obstacle preventing the implementation of the low plastic principle: the lack of information and awareness at all project stages from decision-making to procurement and construction work. They felt that the issue concerned the planning and procurement stages in particular. The lack of commitment and funding were also brought up. Although the solutions are already available, people are not committed to or do not care about separate collection at construction sites. Developers and contractors may feel that recycling is costly and bothersome, which is why recycling should be made as effortless as possible at construction sites.

> *"In the context of construction sites, the biggest obstacles are attitude and money. If recycling is included in the budget from the start, the work is already half done."*
> *(Lujatalo, Pehkonen)*

"The lack of knowledge among people working in procurements and clients is a clear problem. Clients do not have any requirements for recycling. Recycling should be considered more at that stage. And then regarding the actual construction work, contractors do not know which plastic products are recyclable and tend to prioritise the price of materials."

(Lassila & Tikanoja, Turunen)

In terms of attitudes and money, the interviewees brought up the lack of economic incentives that would encourage operators to collect waste at a construction site, when there are several subcontractors working at the same site. They also mentioned that recycling is rather costly. Collecting and sorting different types of plastics and keeping them clean as well as shipping the collected waste to a processing plant can raise the costs significantly. The interviewees raised the problem of arranging cost-effective logistics.

Some of the interviewees stated that virgin plastics procured from Europe are cheaper than Finnish recycled plastics. This hinders the progress of establishing closed loop systems in Finland. In building projects, the recycling rate of plastics should be defined as a procurement criterion alongside price.

In any case, the interviewees felt that the lack of information and awareness is a bigger issue than money.

"I think it would be important to acquire more information about the use of plastics in the construction industry. Some studies do exist, but we still need more data about plastics in construction materials. We would also like to learn what alternatives there are for the materials currently in use. All the construction industry processes need this information in order to make decisions that would impact the use of plastics."

(Premico, Pelander)

There is enormous demand for reliable and scientific data. Many of the interviewees felt that the matter cannot progress until there is an adequate amount of information and evidence of economic impacts available. The interviewed research organisations noted that they need data in order to carry out research work. The number of plastic

types is very high, and plastics are not always identified before delivery to construction sites. One way to solve this problem is to introduce material identification codes.

The Ministry of the Environment discussed institutional obstacles preventing the implementation of policy instruments. The interviewees wondered whether the Ministries and industrial players can reach an understanding on tax matters and how to ensure their solution guides operators to the right direction.

Some of the interviewees also acknowledged the lack of resources as an obstacle. Organisations have not included targets concerning the circular economy of plastics in their general objectives, which is directly reflected in the resources allocated to the promotion of the matter. Official rules and regulations also have an impact on resourcing, since some targets are directly or indirectly linked to rules and regulations.

One significant obstacle mentioned by several interviewees was the issue of finding substitute materials for plastics. They were unsure whether plastics should be replaced by recycled plastics, more recyclable plastics or an altogether different material. The interviewees stated that they need more information about alternative materials and their price, quality and applications. More detailed specifications should be provided for recycled plastics in order to raise awareness of their properties, quality and impurities.

The strict regulations and construction product standards laid down for many applications were also seen as an obstacle. Several standards prevent the use of recycled materials. This applies to many products that remain in buildings after construction, such as pipes. The use of recycled plastics is also complicated by the traceability requirement set for raw materials used for many applications. In practice, it is easier to use products made of single virgin raw material than hard-to-trace recycled materials. According to an expert interviewed for the study, traceability is positive for the consumer but hinders the use of recycled plastics in many areas. The problem should be solved when it comes to the more challenging plastics applications.

> *“The Green Deal and other similar pacts include initiatives to establish a functional and traceable recycled plastics market. This is very important but also rather challenging. The field is quite fragmented at the moment.” (Uponor, Aho)*

Some interviewees also raised the issue of how the properties of recycled plastics compare to those of virgin material. Virgin material is usually flawless in terms of colour

and clarity. Although recycled plastics might meet the more technical requirements, they can be viewed as inferior to virgin plastics.

4.5 Targets for development identified in own measures and measures under development

When the interviewees were asked about any future measures of promoting the low plastic principle or any targets for development, most of them mentioned the development of indicators for monitoring and measuring the use and recycling of plastics. Some of the interviewees also proposed incentives to reward operators who reach the set threshold values and, thus, change people's attitudes.

The client recognised the planning guidelines as a concrete document that will set low plastic requirements in future. These requirements will help introduce concrete threshold values and criteria. However, the client needs more data about the subject before it can establish them. Other interviewees recognised the need for more detailed requirements and definitions as well. In practice, even though it is encouraged, the establishment of more detailed requirements is at a very abstract level. No clear criteria or definitions have been set.

The ARA representatives suggested that instead of project costs, we should be assessing life-cycle costs. A project could be rated based on its life-cycle costs, including those of plastics. This rating would determine the construction budget. There is demand for a calculation system similar to the carbon footprint as well as for common threshold values for plastics like in the energy certification. These indicators would help monitor the observance of certain threshold values. Operators could be demanded to prepare a plan for promoting the low plastic principle insofar as legally possible. Some interviewees also mentioned that they test various solutions to plastic-related and other environmental challenges in their pilot projects. Unfortunately, if a solution is deemed unprofitable, its results are usually forgotten. On the subject of pilots, points were raised about the concrete use of test results. According to one interviewee, lessons learnt from pilot projects are usually not applied to other projects.

Potential legislative measures include economic policy instruments, such as taxes imposed on plastics by the government programme. Furthermore, the reform of the Land

Use and Building Act will introduce low-carbon provisions. In practice, this indicates that climate emission reporting will become mandatory and binding. Carbon footprints and carbon handprints will be determined more accurately in future. In addition, it is likely that developers will have to provide a material content declaration for their buildings that specifies the building materials used and their impact on the environment. The voluntary agreement system Green Deal is expected to be implemented at national level in the future. Based on the interviews, the Green Deal will include a plastics procurement module whose aim is to discover substitutes for plastics. In addition to national legislation and policy instruments, the interviewees highlighted EU-level regulations and projects. They mentioned the potential EU directives on, for example, the mandatory requirements on recycled plastic content for construction products. Some of the interviewees stated that in order to achieve the greatest impact possible, laws and regulations should be aimed at the manufacturing industry.

Regarding research and the manufacturing industry, some interviewees brought up the opportunity to conduct more research on the combination of recycled plastics and virgin plastics in products and assess the properties of final products.

They emphasised that recycled plastics are often used in less demanding applications. In order to use recycled plastics also in applications with stricter standards, more tools should be developed for the monitoring of recycled plastics' traceability and properties. They believe recycled plastics should be certifiable and traceable. Furthermore, manufacturers should be able to verify that the products made of recycled plastics are as suitable for their application as virgin plastic products. To reach this goal, both virgin and recycled plastics require further development. Naturally, the interviewees also brought up the need to influence product standards. This would enable the use of recycled plastics in all applications. Costs and demand are also important factors. The cost of recycled material should be competitive with the cost of virgin material. The representatives of a plastics industry raw material supplier declared that they are happy to use recycled materials and intend to increase this line of business in future as they discover new business opportunities with other value chain operators.

The representatives of the manufacturing industry wishes for better and more long-term cooperation with building developers. They proposed operational models in which the supplier is included in the early stages of project planning in order to optimise the amount of material needed and, thus, reduce waste. One expert suggested that the

goods could be delivered directly to larger construction sites by the supplier and not via a wholesale dealer. This way the developer could avoid unnecessary packaging and order larger units of material. Several interviewees recognised the opportunity to improve value chain planning in order to reduce packaging plastics.

In addition to the aforementioned measures, the manufacturing industry experts brought up chemical recycling, which is still under development. Several experts regarded chemical recycling as a promising alternative to the processing and recycling of more demanding plastic components. However, they emphasised that the concept of chemical recycling involves still numerous uncertainties and the plans for a large-scale chemical recycling scheme are yet to be finished.

4.5.1 Policy instruments introduced by the Land Use and Building Act reform

The Ministry of the Environment is currently working on a Land Use and Building Act reform, which shall enter into force in 2022 and 2023. According to special adviser Matti Kuittinen, who is involved in the preparation of the reform, the reform will oblige building project operators to conduct a climate report for projects that are subject to authorisation. They must use a national evaluation method and utilise data obtained from a national emission database or a manufacturer-specific environmental declaration to do this. The evaluation method would cover the carbon footprint and the carbon handprint. The former indicates the negative environmental impacts and the latter the positive environmental impacts of the building. If a building produces more energy than it consumes, it is considered to be a positive effect. Kuittinen says that the carbon footprint and carbon handprint figures should always be kept separate.

As part of the reform, the Ministry is planning on establishing a national emission database that contains data about construction products, energy, and energy waste calculation, transport, processing equipment, recycling and waste management. This database would set standards for the calculation of carbon footprints. According to Kuittinen, the database will include carbon footprint data about construction products' construction processes. Instead of manufacturer-specific data, the database will provide data on the average carbon footprint for each product type. Manufacturer-specific data is given in a product's environmental declaration.

"In future, when buildings' carbon footprint is calculated in Finland, operators can use either manufacturer-specific data, if available, or the generic average values provided by the Ministry of the Environment's emission database. It depends on whether or not the manufacturer of the material used is known."
(Ministry of the Environment, Kuittinen)

Kuittinen mentions that, in future, applications for planning permission must include a data model of the building. The data model would provide wholesale data for carbon footprint calculation. Regardless of the data used for the carbon footprint calculation (manufacturer-specific or emission database), the climate report must be updated after the project is finished. This ensures that the building's carbon footprint is reported accurately. The data model is also updated from a planning model to a so-called 'realisation model'. According to Kuittinen, the Ministry is currently planning on imposing a material content declaration requirement. A material content declaration lists all the materials used in a building.

The representatives of the Ministry of the Environment stated that the new Land Use and Building Act will not include material-specific provisions, but threshold values will be set for new buildings in the statutes on the overall carbon footprint. Therefore, decisions and choices made regarding individual materials, such as plastics, will be visible in the overall carbon footprint of a building.

4.6 Targets for development identified in other value chain and decision-making processes

4.6.1 Construction site and waste management

The contractor emphasised that the low plastic principle should be considered in the design process of a building project. If the use of plastics is taken into account early on, the pressure to reach the low plastic goal would not rest on the separate collection of plastics at construction sites. The interviewees also suggested that the recycling process at construction sites should be planned and arranged better with waste management operators. Better planning would ensure more accurate cost and value estimates

for collection instruments used and amount of waste generated as well as more precise budgeting.

> *"The desired recycling rate should be included in the client's invitation to tender, for example, in the awarding criteria. The client should request information about the plastics in use or the recycling rate of plastics or ask how the contractor would organise separate collection of plastics at the construction site."*
> *(Lassila & Tikanoja, Turunen)*

Several interviewees stated that product design should use and favour recyclable materials. The representative of a waste management operator thought that products made of recycled plastics should be favoured whenever possible. Regarding the establishment of a circular economy, they said that the development of closed loop systems requires operators to use products made in Finland. Points were also raised about the influence developers and contractors have on the packaging decisions made by subcontractors. For example, if a material supplier prints the company logo all over its packaging plastics, the otherwise perfectly good and recyclable material can no longer be recycled or reused. According to an interviewee, the decisions made by suppliers should be challenged more. Some suppliers tend to use black packaging plastics instead of clear plastics, even though it is in no way justified.

The waste management and recycling expert also found it important to make waste management and collection arrangements with the contractor as early as possible. Early arrangement ensures that the waste management operator knows which plastics are used at each work phase and helps the operator make plans regarding the equipment, training and instructions needed for the project. The interviewee noted that some form of separate collection is arranged at most construction sites, but the lack of knowledge and poor attitude among the workers has resulted in low recycling rates. Contractors should organise comprehensive recycling training for all workers in order to change their attitudes and raise awareness about the topic. Concrete examples help people understand the importance of recycling. In addition to separate collection, the interviewee stated that construction sites should pay more attention to wasted materials. Raw materials should be used more efficiently.

4.6.2 Client and financier

When contemplating building project processes, the interviewees mentioned the importance of the project planning phase. Before a contractor is selected, the developer finalises the cost of the project. After the planning phase, there are no further negotiations about the execution of the project. Some interviewees said that a project's monetary benefits should be communicated better to potential financiers and, if a certain material or process is more expensive due to the reduced use of plastics, the higher cost should be explained. The budget of a building project should take into account that workers need time to learn, test and practise recycling at the construction site. The monetary benefits of recycling cannot be entirely ascertained before recycling is tested in practice.

The interviewees hoped that rules and regulations would help make some progress. Although some operators can reduce the use of plastics by their own behaviour, a comprehensive industry reform requires larger-scale commitment to the cause. Stricter taxation and processing fees issued on failing to sort different materials could be potential legislative measures. According to the interviewees, the construction industry needs to be encouraged to commit to recycling. Even though there are a few exemplary operators in the field, the number of ignorant operators is high.

The representatives of the construction industry and the plastics industry brought up the demand for closer cooperation and more information.

> *"Naturally, one important thing is to obtain more information about the use of plastics from the construction industry. There have been a couple of good studies, but we still need more data about the use of plastics and other materials in construction. Building-specific data about plastics. All the processes of the industry would need this information in order to make better decisions on the efficient and reduced use of plastics."*
>
> *(Premico, Pelander)*

Concrete examples included guidelines on the use and recycling of specific products and substitute products. Some interviewees expressed their wish for better material markings in the materials industry. In addition, they wanted the materials industry to be bolder in its investments in recycled plastics, packaging and manufacturing. If the

materials industry does not choose to use recycled plastics, the other value chain operators cannot promote the cause.

The interviewees believed that standardisation of waste reporting would help developers compare projects and monitor the achievement of set objectives. Adequate waste reports could also be used to guide decision-making. The establishment of some kind of low-plastic criteria would help assess projects before the actual construction process begins.

From the financier's point of view, the best – and only – way to improve the situation is to ask the other value chain operators to provide more results and references. Concrete results and references would indicate the progress being made and help create indicators to support financiers in their decisions to finance projects. According to an interviewee, concepts become concrete general practices when it is required by decision-making bodies and authorities.

The representatives of ARA stated repeatedly that the Ministry of the Environment should provide clearer and more detailed guidelines and instructions on the subject. Currently, they are too abstract. The interviewees also found it challenging to promote the cause in practice because there are no specific requirements or legislative instruments. ARA could be more active in promoting the reduction of plastics use if there were rules and regulations demanding it. The interviewees mentioned information request forms, the revision of which would require more extensive preparation. In addition to simply calculating the impacts of the construction industry, clear and ambitious criteria should be set for building projects in order to improve the results.

When discussing an individual building project, the ARA representatives emphasised the need to raise the issue at the early stages of project planning and decision-making. If the use and recycling of plastics is side-lined at the early stages of a project, it is difficult to implement these aspects later on.

4.6.3 Legislation

One of the key issues raised by the representatives of the Ministry of the Environment was how to increase awareness of plastics at all value chain levels from production and consumption to recycling. More accurate statistics and data are needed in order to establish a system for assessing and comparing the emission impacts and environmental

impacts of plastic materials. This system could introduce product design tools to push the manufacturing industry towards developing better materials. An interviewee mentioned that VTT Technical Research Centre of Finland has already conducted and continues to conduct plastic type assessments at all value chain stages, but the amount of data obtained on the movement of material streams has been minimal. This data is incredibly valuable for raising awareness about the movement of material streams in the construction industry and for promoting the cause and identifying targets for development as concretely as possible.

> *"This data should be available to all companies. The competitive nature of the market should not prevent the sharing of important information. In that sense, reference and pilot projects are very important." (Ministry of the Environment, Piispa)*

In the context of an individual building project, the Ministry representatives agreed with the other experts interviewed and said that the recycling and reduction of plastics should be discussed at the planning phase of a project. During the planning phase, parties involved have the opportunity to influence which materials will be used in the project and bring up potential substitutes or structural engineering conceptions that would reduce the use of plastics. According to an interviewee, the project planning phase determines the future measures to be taken and how plastics will be identified throughout the construction process.

Regarding construction supervision, an interviewee brought up the need for tools introduced by legislation. However, the interviewee pointed out that although they are not an expert in the subject, they are hopeful that the Land Use and Building Act reform will introduce new tools and provisions to promote the recycling of plastics. They also mentioned the demand for more resources and guidelines to put the new rules and regulations into practice.

4.6.4 Research and development organisations

The representatives of research organisations also brought up the demand for reliable data that would enable various calculations to be made. In addition to the lack of data, one interviewee pointed out an issue in the overall plastics debate: the nature of the debate is very general and it fails to consider the extremely high number of existing

plastic types. At the general level, plastics are divided into single-use plastics and thermoplastics.

> *"Single-use plastics cannot be melted and reused. I do not know about studies on the use of single-use plastics in the construction industry. Single-use plastics can be crushed but not burned. We need different recycling methods for those plastics."*
> *(Research organisation expert)*

One interviewee was under the impression that the construction industry uses a lot of polyurethanes and PVC plastics, which are not recycled in Finland and, thus, cause trouble. The interviewee stated that alternatives should be developed for these kinds of plastics.

They also found the potential introduction of data banks very important. Data banks reveal what kind of materials have been used in certain products and promote long-term recycling. For example, the demolition of a 50s block of flats could involve plastics-related risks.

The representatives of research and development organisations also brought up the ongoing debate about mandatory requirements on recycled plastic content for construction products. One of the interviewees said that this subject should not necessarily be approached from the point of view of such requirements. Regional rules and regulations that are not applicable in all European countries could entail problems for the market. The interviewee believed that it would be a better option to set voluntary requirements that operators would be encouraged to follow through incentives. For example, R&D funding could be increased and granted to both companies and research institutes.

> *"The discussion circulates too much around finding new applications for recycled products and developing new products. It is more reasonable to use small amounts of recycled materials in existing products. That way we can avoid quality-related risks. The quality does not have to be as high as in 100% recycled products." (Research organisation expert)*

The interviewees emphasised that the development of a circular economy requires investments and new businesses. Monetary support and incentives should be allocated

to companies that are taking concrete measures to promote the use of recycled plastics. The development and introduction of new materials are big and very expensive steps. One interviewee also highlighted the importance of company networks. Cooperation enables the development of a recycling chain and engages workers, companies and experts to work around the same ecosystem.

In the context of an individual building project, the research and development experts emphasised the inclusion of criteria concerning the recycling and use of plastics in tendering. One expert proposed that developers should favour companies that use recycled plastics. Another suggestion was the preparation of a recycling path for waste components that should be recycled at construction sites. For example, the recycling of films and pipes would be a great place to start, because recycling paths have yet to be laid down for these segments.

4.6.5 Manufacturing industry and materials industry

The representatives of the manufacturing industry interviewed for the study discussed the quality criteria set for plastics by material standards. These criteria prevent the use of recycled materials in many applications. Naturally, they also stressed that standards form a system that helps regulate and monitor the quality of plastic products. The interviewees stated that plastics standards should be revised and developed in a way that allows the use of recycled materials without compromising the quality of plastic products. They noted the demand for legal provisions on recycled materials that would drive the matter towards the right direction. According to the interviewees, it is usually more costly to use recycled materials than virgin materials for more demanding applications. Cost should not be the only deciding factor, which is why more regulations and standards are needed. Concrete policy instruments proposed by the interviewees included the granting of waste fee reliefs to companies that use more recycled materials.

In the context of individual building projects, the interviewees wanted bolder targets for the use of recycled plastics. Operators should strive to use recycled plastics as much as possible if it is permitted by law, standards and technical requirements. When discussing plastic materials collected for recycling, the interviewees reminded that labels, prints and adhesives can make otherwise good materials less recyclable or even ruin a whole batch of recycled materials. According to the experts, operators could effortlessly avoid this or use more recyclable solutions. All the experts representing the

manufacturing industry stressed that the easiest step towards better recycling is to improve sorting at construction sites and keep the sorted material clean. Careful sorting ensures that all the waste sent for recycling is actually recyclable.

In addition to the aforementioned points, the interviewees said that products with a longer life cycle should be compared to other products from the perspective of their overall environmental load.

"When considering products with a long life cycle, we should:

1. *Choose materials that are best from the viewpoint of the project's aggregated environmental load*
2. *Strive to use waste materials from plastic products with a short life cycle as raw materials for plastic products with a long life cycle."*

(Uponor, Aho)

The interviewees also wished for more active involvement from the customers' side. Customers could require operators to make carbon footprint calculations. According to one interviewee, the percentage of recovered secondary raw materials in products with a long life cycle is a better indicator than a product's recyclability.

The interviewees also mentioned the demand for transparent and independent research on the environmental impacts of products with a long life cycle and the long-term impacts of recovered secondary raw materials on the aggregated environmental impacts. This kind of research would allow operators to compare the useful life and environmental impacts of different products throughout their life cycle. Information like this would be beneficial to both clients and manufacturers.

5 PROJECT METSÄKISSA

The key observations concerning project Metsäkissa in relation to the reduced use of plastics are presented in this chapter. Experts involved in the building project were interviewed for this part of the study. This chapter also discusses important discoveries and results regarding measures taken during the project.

5.1 Project Metsäkissa and the low plastic principle

According to the experts interviewed, the low plastic principle was not particularly emphasised in the planning phase of project Metsäkissa. The developers decided to make Metsäkissa a pilot project after the planning phase. This explains why the measures taken to promote the reduced use of plastics were limited to the collection, sorting and recycling of plastics waste at the construction site. However, the principle has been present in decision-making processes. Premico has been an active promoter of the low plastic principle and set the project targets tackling the issue.

The interviewees declared that project Metsäkissa differs significantly from average building projects in terms of waste sorting and collection.

> *"The sorting rate should be higher than 70%, which is an intense target. For normal projects, the rate is around 50%. It would be good if only 30% was sorted as mixed waste. Currently, the figure is around 50%." (Lujatalo, Pehkonen)*

Some of the interviewees pointed out that such comprehensive separate collection for different materials could be organised at other construction sites as well if the developers and contractors wished to do so. Most construction sites have decided to skip this opportunity made possible by waste management operators. The separate collection of coloured and clear plastics were deemed a very rare but brilliant solution. According to the interviewees, expandable polystyrene waste, P-pipes and canisters, which are great industrial materials, are also collected at the Metsäkissa construction site. All the interviewees believed that, in comparison to other building projects, the number of different materials collected at this construction site is significantly high.

When discussing the separate collection of plastics, the interviewees mentioned the usefulness of innovative collection instruments, such as double-chamber presses. Project Metsäkissa has invested in collection instruments, equipment and skips in order to sort and collect as many waste components as possible. The interviewees brought up repeatedly the importance of providing the workers with regular training and instructions on the collection and sorting of plastics. Training and guidance help influence the workers' attitude towards recycling. The workers were given phase-specific instructions in order to raise awareness of the types of waste generated and collected at each work phase. Cleaners were also instructed to collect and sort all materials correctly.

The amount and types of plastics waste generated and collected at the construction site is monitored and recorded throughout the project. Furthermore, the amount and cost of waste is monitored in general. This data reveals how project Metsäkissa differs from previous building projects that did not invest in the sorting and collection of plastics waste.

5.2 Project objectives

The contractor's most concrete short-term goal was to raise the sorting rate up to at least 70 per cent. In general, the project aimed to raise awareness of the reduced use of plastics on a larger scale in terms of project planning and material life cycles. The contractor wanted to discover new practices that could be applied to the conclusion of subcontractor contracts. Furthermore, the contractor saw the pilot project as an opportunity to increase awareness about the amount of waste recycled and the economic impacts of recycling.

The representatives of Premico stated that their objective was to make building project documentation more specific in regard to the use of plastics. In this context, 'documentation' refers to planning guidelines and invitations to tender. The interviewees emphasised that Premico intends to set new concrete criteria for the use of plastics in its planning guidelines and invitations to tender, if the project generates enough data to establish useful indicators.

"One of our goals is to prepare planning guidelines on the use of plastics in construction. These guidelines would help us reduce the amount of plastics waste generated at our construction sites." (Premico, Pelander)

The representatives of Premico also mentioned that their goal is to obtain as much data as possible about the use and recycling of plastics at the pilot construction site. This data will be used in future projects at the planning phase. The data also increases understanding of how decisions made at the planning phase affect the construction site. The interviewees stressed that Premico's long-term goal is to make better and more informed decisions in project planning in the future.

MuniFin's objectives were linked to pursuing large-scale and positive environmental impacts, which MuniFin could share with other operators when the project is complete. All calculatory and legitimate benefits – economic impacts in particular – were deemed important targets.

The representatives of ARA stated that their key objectives include the communication of project results and models to other operators in order to develop low plastic indicators. Based on the data obtained, ARA would introduce measures in its proactive training and planning guidelines. The interviewees also mentioned that the term 'low plastic' should be given a clearer definition and more information is needed about the types of plastic used in building projects and how their use and processing can be influenced at each project phase:

"I think we need a more specific definition for the concept 'low plastic'. We need to know what types of plastic we are talking about here. That would help us understand the scale and significance of each segment. We have to establish what are the biggest issues that we can easily tackle. Not everything can be solved at once. We need to determine the first steps on this journey." (ARA, Ijäs)

The representatives of the Ministry of the Environment deemed it important that the pilot and the project were investor-oriented. They believed that financing criteria play a key role in the promotion of the low plastic principle on the market. Another important aspect mentioned was the great demand for information about materials and their use. It is important to know how much plastics waste is generated at each work stage as

well as how the use of plastics used could be reduced or replaced and how this would impact the decisions and contracts made between different value chain members. According to one interviewee, this information is essential in the development of a material data acquisition system.

5.3 Impacts and results of measures taken in the Metsäkissa pilot

According to a representative of Lujatalo, packaging plastics are by far the largest segment of plastic material accumulated at the Metsäkissa construction site, if materials remaining in the building are not taken into account. This is not unusual for a building projects of this scale and nature. A general opinion among the interviewees was that the total amount of waste generated in the pilot project does not differ significantly from other construction sites. The reason behind this is the fact that the low plastic objective was not discussed at the planning phase of the project. This will change in future projects as data obtained from the Metsäkissa pilot helps the developer make more sustainable decisions. An interviewee pointed out that one way to reduce construction waste is to procure a more accurate amount of construction materials. This would require better planning. Otherwise, the amount of waste generated at construction sites cannot be reduced.

The measures piloted in project Metsäkissa tackled the sorting and separate collection of waste in order to maximise the amount of recovered material and pass the sorting rate target of 70 per cent. In average projects, the sorting rate is usually around 60 per cent. Project Metsäkissa is currently at the interior finish stage, which means the work phases that generate the most waste are long behind. The current sorting rate at the construction site is 75 per cent. According to the site supervisor, the contractor will likely reach the sorting rate of 80 per cent. In other words, the project will exceed its original sorting and recycling rate target.

> *"We will see whether we will reach the target of 6.5 kilograms of waste per cubic metre. The current sorting rate is 75%. Last time the rate was a little over 60%. We have reached our sorting rate goal."*
> *(Lujatalo, Pehkonen)*

According to an interviewee, the most important measures taken have been the training and instructions given to the staff and the collection instruments and skips

organised in cooperation with the waste management operator. These measures have ensured that as many waste components as possible have been recovered. The interviewee highlighted the useful guidelines for cleaners prepared by the waste management operator. Other instructions, such as the guidelines distributed in the staff facilities and phase-specific instructions, have also been beneficial, but cultural differences and language barriers have caused some problems. According to a site foreman, the problem is mainly cultural, since many of the workers had no previous experience in recycling. The site foreman thought the instructions and training programmes are already adequate, but there is more work to be done regarding site practices and practical execution. An interviewee representing the construction site stated that there is still room for improvement in terms of waste collection and sorting as well as collection instruments. For example, positive steps should be taken towards better sorting practices in the planning of different work stages. Work-stage-specific sorting instructions have worked increasingly well in project Metsäkissa. Repeated instructions have not raised objections at the construction site.

From the construction site's viewpoint, it is essential to obtain data on the measures' impact on the cost of project Metsäkissa. Data helps develop the measures further and prepare a more accurate project budget. The answers concerning project Metsäkissa highlighted that the share of funds spent on waste management increased significantly. This was a result of the number of collection instruments arranged at the construction site, i.e. the higher hire and shipping charges. The shipping and skip hire charges accounted for the largest share in the total waste-related costs. In comparison to standard projects, the shipping and skip hire charges were increased nearly by a third due to the higher number of collection instruments in use and the separate collection of multiple waste components. It would be more affordable to collect plastics as combustible waste. In other words, sorting of plastics does not have direct economic advantages. More comprehensive separate collection is the primary factor behind the raised shipping costs. The collection of several small bags or batches of waste is more costly than the collection of one large batch of waste. Separate collection of plastics means a decrease in the fees paid on mixed waste, however, at the pilot construction site, the increased hire and shipping charges exceeded the money saved on fees. An interviewee proposed monetary incentives for recycling. Incentives would make recycling more economically justified.

In terms of concrete targets for development, the construction representatives said that the separate collection of expanded polystyrene in flexible intermediate bulk containers had not worked in practice. The containers were not collected often enough and it was costly. Hence, large amounts of expanded polystyrene were sorted as mixed waste. In addition to expanded polystyrene, another issue was the sorting of clear and coloured plastics. Many of the workers did not adopt the principle of sorting clear and coloured plastics. According to an interviewee, construction sites need cleaners and workers who understand the situation. Another solution would be to develop more straightforward and fast collection instruments for the sorting and collection of clear and coloured plastics.

6 SUMMARY

6.1 Summary of results obtained through project Metsäkissa

6.1.1 What is the current state of sorting of plastics and how can it be improved?

The majority of the interviewees agreed that the construction industry invests very little in recycling, with the exception of project Metsäkissa. Many of them stated that construction sites could increase their recovery and recycling rate significantly by adopting already existing solutions. In terms of recycling, the most significant issues raised were poor attitude towards recycling, high logistics costs and keeping recovered material clean.

The attitude problem concerns construction site workers and the lack of separate collection of materials in average building projects. Money and the lack of economic incentives were seen factoring in the poor attitude, especially when it came to subcontractors. The interviewees thought that more resources should be allocated to separate collection. Separate collection is time-consuming and increases the shipping and skip hire costs. Naturally, the increased shipping and skip hire costs are compensated by the decrease in the fees paid on mixed waste.

Project Metsäkissa reached a sorting rate of 75 per cent, which exceeded the original target (70 per cent) set for the pilot. It also exceeded the general sorting rate targets set by authorities. According to the interviewees, this was a result of the good instructions and training provided at the site as well as the use of appropriate collection instruments.

Project Metsäkissa proves that it is possible to reach the target sorting rate of 70 per cent by investing in recycling instructions, guidelines and training as well as waste collection containers and equipment at the construction site. Construction sites could reach even higher sorting rates by making more careful phase-specific plans that promote recycling and by arranging appropriate collection instruments with waste management operators. The next step in improving sorting is employing logistics solutions that

correspond better with the progress made at construction sites. Waste containers must be emptied at the right time, at a reasonable cost.

6.1.2 What aspects should the project's main contractor take into account in keeping the project as low-plastic as possible?

In order to understand the exact environmental load of different materials at the planning phase and, ultimately, the procurement phase, conducting recyclability assessments does not suffice. Contractors' should make carbon footprint calculations regarding products' entire life cycles. This would generate more data about product-specific environmental loads, which would, in turn, improve planning. Some interviewees wanted the materials industry to introduce more specific and higher quality recycled plastics markings. This would make monitoring and promoting recycled plastics easier. In general, more active involvement in the reduction and replacement of packaging plastics was requested of suppliers. Naturally, the same applies to other operators involved in building projects. The discovery and introduction of substitute materials requires more cooperation within the value chain. Regarding the recovery of waste streams and reuse of materials, the value chain operators hoped that subcontractors would be prevented from adding prints, labels and logos to their packaging materials in order to preserve the materials' recyclability.

Several interviewees mentioned waste reporting standards as a measure that would enable project comparison and monitoring of low-plastic objectives. In addition to waste reporting standards, some interviewees brought forward the demand for closer cooperation with waste management operators. Good cooperation would solve logistical challenges and make sorting more cost-effective. It would also improve separate collection of different materials.

6.1.3 What kinds of obstacles/bottlenecks might the contractor encounter that prevent it from meeting the targets?

In the context of project Metsäkissa, one challenge was to influence some construction workers' cultural habits. Workers who were not familiar with recycling ended up sorting waste incorrectly. The interviewees stated that cooperation with waste management operators has room for improvement. Sorting and collection should be as cost-effective

and timely as possible. Even though the fees paid on mixed waste were lower, the construction site's cost level increased due to the higher skip hire and shipping charges. In comparison to average projects, the total costs of the construction site were not significantly high or low.

The data obtained from the pilot as well as the interviewees' statements indicate that poor attitude and money are the most significant obstacles encountered by contractors. Substantial positive effects can be achieved simply by providing construction site workers with training and guidance. At the moment, investing in sorting causes additional costs to contractors due to the increased shipping and skip hire costs as well as the time it takes to recycle everything. In addition to the aforementioned obstacles, the study revealed that organising large-scale separate collection is not feasible at all construction sites. If a construction site is not located in a waste management operator's sphere of operations, the waste management operator is unable to provide collection instruments and collect the waste in a cost-effective manner.

Some interviewees believed that the lack of economic incentives impacts contractors' motivation to sort and collect waste. This statement applied to subcontractors in particular. Nearly all the stakeholders interviewed for the study felt that economic recycling and sorting incentives play a key role in the promotion of the cause.

6.2 Inclusion of low-plastic objectives in documentation

Regarding documentation and instructions, several stakeholders and value chain members felt that preparing clearer guidelines is challenging due to the lack of shared understanding and standard indicators. Hence, many of the interviewees thought that the calculation of carbon footprints is the easiest way to approach the situation. New indicators, that would also cover plastics, are needed for the measuring of building projects' overall carbon footprints. However, no threshold values are currently set for carbon footprint calculation in construction by financiers, clients or legislation. A legislative reform concerning the issue is underway, which means that threshold values will likely be introduced in future by other operators as well.

6.2.1 How should the client indicate its objective of reducing the use of plastics in its call for tenders while ensuring that its requirements are also fulfilled at the planning and execution stage of the building project?

In the context of an individual building project, the interviewees stated that developers should include high recycling rate in their tender criteria. They also hoped for more requirements and criteria concerning carbon footprints. Many of the interviewees mentioned that contract planning guidelines should include more rules and requirements regarding the low plastic principle. These guidelines could demand or recommend the use of recycled plastics in certain applications or some products to be replaced with products bearing a smaller environmental load.

Documents prepared before a contract agreement is signed impact how recycling is organised at a construction site. Such documents include an environmental protection plan and a waste management plan. According to the experts interviewed for the study, these documents do not have enough provisions on the separate collection of materials at construction sites. Furthermore, developers should plan and budget the arrangement of recycling and waste management better with waste management operators. This would help them assess the costs and prepare a more accurate budget for their projects.

6.2.2 What kind of matters should financiers pay attention to when deciding on granting funding to a project?

The standardised carbon footprint calculation practices and the mandatory requirements on recycled plastic content for construction products introduced by the Land Use and Building Act reform may provide financiers with new tools and benchmarks in future. If, in order to receive a planning permission, a developer is expected to meet specific carbon footprint threshold values and provide a material content declaration and a carbon footprint report for the materials used in building projects, a financier could set strict threshold values for green financing, similar to energy certifications.

The representatives of ARA suggested that instead of project costs, financiers could be assessing life-cycle costs. The use of plastics would be included in this assessment. A project could be rated based on its life-cycle costs, including those of plastics. This

rating would determine the construction budget. Another solution is to use the benchmark data obtained from the national emission database (under development) or material content declarations to create carbon footprint indicators, which would be included in building project energy certifications.

6.3 Based on the case study, what kind of matters and aspects should be brought forward in the whole property and construction sector?

Image 4: Property and construction sector needs highlighted by the study. (Lyytikäinen & Pohjola, Verona Growth, 2021.)

6.3.1 Role of plastics in aggregated environmental impacts

The term 'low plastic' caused different reactions among the interviewees, and many of them found the term misleading. Several interviewees thought that the term is not necessarily ideal or descriptive of the desired result. The majority of the interviewees felt

that the issue should be approached by assessing and optimising aggregated environmental impacts instead of striving to reduce the use of an individual material.

In addition, the wide range of existing plastic types should be taken into account more when discussing plastics. Single-use plastics and similar products and products with a longer life cycle should be examined separately. Many of the interviewees felt that this kind of discourse is currently very lacking. In any case, all the experts and operators in the ecosystem of construction agreed that operators should always strive to maximise recyclability and generate as small a carbon footprint as possible, regardless of the material in use.

6.3.2 Demand for data on plastic streams and plastics' aggregated environmental impacts

According to the interviewees, the biggest obstacle preventing operators from maximising the recycling of plastics and reduce the use of the material is the lack of awareness and information. All the plastics-related stakeholders and members of the ecosystem felt that more data is needed on building projects' plastic streams and environmental impacts in order to create concrete guidelines, indicators and threshold values.

Several interviewees proposed a standard system for assessing and comparing the emission impacts of different plastic materials. This kind of system would help establish criteria that would guide operators and encourage them to produce and use solutions with minimal negative environmental impacts. The system would be especially important regarding products with a longer life cycle that will remain in a building for years. The product quality standards are generally stricter for these products. Products' environmental impacts should be examined for their entire life cycle while taking the quality standards into account.

In order to establish a standard system, further research must be carried out on recovered secondary raw materials' long-term influence on aggregated environmental impacts. Regarding recycled plastics, the interviewees mentioned the need for improved raw material traceability, product descriptions and certifications. Recycled plastics could be used more widely and the identification rate of different plastic types would be higher in material circulation. Wider use of recycled plastics also requires the revision

of many product standards. It will be very difficult to promote the low plastic cause without the generation and implementation of the aforementioned data.

6.3.3 Enactments and policy instruments

The lack of resources was pointed out as one of the factors hindering the recycling of plastics. The majority of the interviewees admitted that they do not have concrete recycling goals, which is why they have not allocated resources to the recycling of plastics or other materials. Provisions and enactments on recycling usually impact or at least boost operators' objectives. In that sense, legal and regulatory provisions are policy instruments that promote the reduction of plastics use.

The Land Use and Building Act reform will affect the use of plastics indirectly as it requires developers to include a low carbon statement in their planning permission applications. This and the potential provision on a mandatory climate emission report introduced by the reform would form a larger framework for the comparison of carbon footprints and overall environmental loads. However, this would require a national standard evaluation method for carbon footprint calculation and an emission database to be established. A standard evaluation method would be used to create a material content declaration (including carbon footprint data) for every new building and help compare different materials' environmental load in the project planning phase.

Several interviewees proposed that economic incentives should be allocated to companies that are taking concrete measures to promote the use of recycled plastics, since the motivation to use recycled plastics is strongly tied to project costs. In terms of cost, recycled material cannot compete with virgin material. The establishment of circular economy models requires investments and companies that are ready to invest in the production of recycled materials or pay for their use and collection. Taking all this into account, the interviewees believed that economic incentives would help further the development of a recycling market. Enterprise networks are also necessary for the development of circular economy models. Different waste components should have their own recycling chains.

Regarding recycled plastics, the interviewees raised the issue of strict regulations and construction product standards. Operators in the manufacturing industry have influence

over product standards, which is why they should strive to promote standards that make the use of recycled plastics easier.

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APPENDICES

APPENDIX 1 Interviewed experts

Ilari Aho, VP Sustainability & Regulatory Affairs, Uponor

Sauli Eerola, CEO, Muovipoli

Rami Erkkilä, Customer Relations Manager, Green Finance, Municipality Finance Plc (MuniFin)

Vesa Ijäs, Chief Architect, Housing Finance and Development Centre of Finland (ARA)

Markku Kainulainen, Project Leader, Premico

Sari Kauppi, Senior Researcher, Finnish Environment Institute

Matti Kuittinen, Special Adviser, Ministry of the Environment

Ulla Laapotti, Energy Specialist, Housing Finance and Development Centre of Finland (ARA)

Rainer Noppa, Construction Developer, Lujatalo

Jouni Pehkonen, Site Supervisor, Project Metsäkissa, Lujatalo

Mika Pelander, Project Leader, Premico

Päivi Piispa, Project Manager, Ministry of the Environment

Eveliina Tackett, Quality Manager, Building Supervision of the City of Oulu

Marko Turunen, Customer Relations Manager, Lassila & Tikanoja

Two materials industry experts