# GOVERNANCE OF LOW-CARBON TRANSITION IN THE FINNISH BUILDING CONSTRCUTION SECTOR

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**ABSTRACT**

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Abstract:

Buildings are responsible for about one third of Finland's greenhouse gas emissions and at the EU level, buildings and their construction account for about half of all material and energy use. So far, there has been no national governance to control the life cycle carbon footprints of buildings. This is about to change as the reform of the Land Use and Building Act is about to introduce the carbon limits in the stage of building permit application. However, due to the urgency of change from the global warming perspective, public procurement is used as a tool to bridge the gap until the law takes force expectedly by 2025.

The aim of this study was to map the current modes of governance fostering the low-carbon transition in the Finnish building construction sector, the corporate perspectives to the governance and business-originated transition, and the necessity of regulative governance for the low-carbon transition to occur.

In this qualitative study, 20 interviewees representing the policy, public procurement, and corporations in the field of building construction were interviewed. The study was conducted partly in cooperation with the Canemure project of the City of Helsinki. The findings show that all interviewed stakeholders agreed on the necessity for regulation and its effect erga omnes to speed up the low-carbon transition of the sector. The businesses have contributed to the development of the novel national carbon footprint calculation method, therefore working for regime destabilization, still operating in the field of business realities that currently do not support business-originated transition due to construction material cost structures. The study also found that even though the inclusive working methods of transition governance used by the Ministry of the Environment made the corporations participate in the regime destabilization, the strong national policy driving wood-frame construction evoked resistance within the corporations that demanded for more room for the business-originated innovation instead of predefined methods.

Key words: low-carbon transition, transition governance, building construction, carbon footprint calculation, wooden multistorey construction

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Tiivistelmä:
Noin kolmannes Suomen kasvihuonekaasupäästöistä aiheutuu rakennuksista. EU-tasolla rakennukset ja rakentaminen kuluttavat noin puolet kaikesta käytetystä raaka-aineesta ja energiasta. Toistaiseksi Suomessa talonrakentamisen elinkaarisia hiilijalanjälkiä ei ole ohjattu kansallisen lainsäädännön keinoin. Tähän on tulossa muutos maankäyttö- ja rakennuslain kokonaisuudistuksessa, jossa esitetään raja-arvoja rakennushankkeiden hiilijalanjäljille sekä ilmastoselvitystä osaksi rakennuslupavaihetta. Ilmaston nopea lämpeneminen vaatii kuitenkin vuonna 2025 voimaan aiotuksi tulevaa lainsäädäntöä kiireellisempiä ilmastotoimia, jossa siirtymää voidaan pyrkiä vauhdittamaan julkisen hankinnan keinoin.

Tutkielman tavoitteena oli tutkia sekä lainsäädännön että julkisten hankintojen ohjauskeinoja Suomen talonrakennusalan vähähiilisyyssiirtymässä, yritysten näkökulmia julkisin keinoin ohjattuun ja yrityslähtöiseen siirtymään, sekä haastateltujen sidosryhmien näkökulmia lainsäädännön tarpeellisuuteen siirtymän toteutumiseksi. Tutkielmassa haastateltiin yhteensä 20 asiantuntijaa, jotka toimivat politiikkatoimiin vaikuttavissa organisaatioissa, julkisia hankintoja tekevissä organisaatioissa sekä julkisiin kilpailutuksiin osallistuvissa rakennusalan yrityksissä. Tutkielma toteutettiin osittain yhteistyössä Helsingin kaupungin Canemure-osahankkeen kanssa.

Tutkielman tulokset osoittavat kaikkien haastateltujen sidosryhmien edustajien olevan yksimielisiä lainsäädäntöohjauksen tarpeellisuudesta ja kaikkia alan toimijoita yhtenäisesti koskevana sen uskotaan vauhdittavan siirtymää. Yritykset ovat osallistuneet uuden kansallisen, ympäristöministeriön työstämän, hiilijalanjälkimenetelmän kehitystyöhön, jonka johdosta ne ovat osallistuneet myös vallitsevan järjestelmän (regime) ja oman toimintaympäristönsä epävakauttamiseen. Samanaikaisesti yritysten toimintaympäristö vaikeuttaa yrityslähtöistä siirtymää mm. vähähiilisempien materiaalien kustannusrakenteen kautta. Tutkielman tulokset myös osoittavat, että vaikka ympäristöministeriön osallistavat työskentelymenetelmät ovat tuoneet yritykset osalliseksi nykyisen toimintaympäristön muutosprosessia, yritykset vastustavat politiikkatoimin varsin voimallisesti edistettävän puurakentamisen osuutta osana julkista ohjausta ja vaativat yrityksille enemmän vapauksia toteuttaa yrityslähtöisiä innovaatioita (niche) ilmastopäästöjen vähentämiseksi ulkopuolelta määriteltyjen menetelmien sijaan.

Asiasanat: vähähiilisyyssiirtymä, vähähiilisyyssiirtymän ohjaaminen, talonrakennus, hiilijalanjälkilaskenta, puukerrostalorakentaminen

Säilytyspaikka: Jyväskylän yliopiston kirjasto

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# 1 INTRODUCTION

Increase in atmospheric greenhouse gases is leading to global warming as a result of the greenhouse effect. The global temperature has risen about one degree Celsius since 1880 and most of the warming has occurred during the past six decades (Finnish Meteorological Institute, 2017). The warming effect is most intensive at the northern hemisphere where the warming takes place at double speed (Finnish Meteorological Institute, 2021) and in Finland the mean temperature has risen about 2°C since 1880 (Finnish Meteorological Institute, 2020). If no action is taken to stop deposition of greenhouse gases in the atmosphere, the global mean temperature is opted to rise up to 3.0-6.2°C by the IPCC's (2022) RPC8.5 (Representative Concentration Pathway) model.

The Paris Agreement attempts to stop global warming at the level of two degrees Centigrade (ME, 2021d) and the European Union is working on the target through the European Green Deal that aims for climate neutrality by 2050 (MFA, 2020). Finland is taking firm action and striving for carbon neutrality by 2035 (Finnish Government, 2019) and its largest city, the City of Helsinki (2022), has set carbon neutrality of 2030 as an important strategic goal.

To achieve these goals progressive in the global scale, the Finnish government has set carbon neutrality as a high-priority strategic goal and published a roadmap to carbon neutrality that sets emission reduction targets for different sectors (Finnish Government, 2019). According to the Marin's Government Programme, a wide range of national legislation will be supplemented and elaborated including e.g., the Climate Change Act, Nature Conservation Act, Forest Act, Waste Act, Mining Act, Land Use and Building Act, as well as Act on Public Procurement and Concession Contracts to better comply with the necessary actions to meet the goals of carbon neutrality.

In Finland, buildings are responsible for about one third of the national greenhouse gas emissions and about 40% of the total energy consumption (Green Building Council Finland, n.d.-a). At the EU level, buildings and their construction account for about half of all material and energy use (Bionova, 2017). Therefore, actions targeted at building construction have a remarkable potential in the national and EU carbon-neutrality strategies. Finland is responding to the challenge through the upcoming statute changes in the Land Use and Building Act by 2025 where the requirement of a climate declaration will be introduced. The climate declaration is expected to include normative carbon limits for different building types, and it will be based on the new national method of carbon footprint calculation (Kuittinen & Häkkinen, 2020). The climate declaration is designed to be turned in at the stage of construction permit application. Similar national guidance on carbon footprint limitation is currently in force in Norway, The Netherlands, France (ME, n.d.-e), and Belgium (Bionova Ltd, 2017).

To bridge the gap of no regulative guidance in the current acute need for speeded transition, the Finnish Government (2019) has decided to use the public

procurement as a tool in adding some of the necessary low-carbon changes in the construction projects already in this earlier phase. The value of public procurement in Finland is in total of €30-50 billion annually making it a remarkable tool in the chase of the carbon neutrality goals (Kalimo et al., 2021). The municipalities and municipal enterprises account for 44% of the total public procurement with the value of over €20 billion, and the procurement areas with most environmental impact are buildings' energy, building construction, travelling and transportation, as well as food and food services (Kalimo et al., 2021).

Being the largest city in Finland, the City of Helsinki's value of external procurement is about €2.5 billion (City of Helsinki, 2021) of which the largest procurement areas are in construction, office and expert services, and IT equipment and services (Carbon Neutral Finland, 2019). Due to the largest population, Helsinki also has the largest procurement-related carbon footprint. In 2018, Helsinki's total carbon footprint was 0.81 million tons CO2e of which the largest portion consists of investments in construction and the related building and maintenance services (Carbon Neutral Finland, 2019). City of Helsinki being just one example of major actors in public procurement, the public procurers of the building construction sector in total have an important position in the carbon-neutrality transition. By applying the right procurement criteria, the public procurers have power in decreasing input of climatic pollution and creation of markets for environmentally friendly products and services. The largest cities and public procurement organizations in Finland also have the resources in functioning as the forerunners in the municipal field by creating cooperation and piloting new methods in their building construction projects.

To explore the possibilities on how public procurement can make an impact and speed up the low-carbon transition through introduction of more sophisticated sustainability criteria in tendering, various parties such as organizations and projects are contributing to the task. One of such projects is Canemure, Towards Carbon Neutral Municipalities and Regions, that aims at supporting and promoting low-carbon solutions in the fields of transport, renewable energy, buildings, urban planning, agriculture, and forestry (Finnish Environment Institute, 2018). Coordinated by the Finnish Environment Institute and funded by the EU Life Programme, the project consists of 13 sub-projects across the country of which one coordinated by the City of Helsinki concentrating on the development of low-carbon and sustainable public procurement (Carbon Neutral Finland, 2022).

The overall concept of fostering low-carbon transitions has received a lot of academic attention especially in the European context and therefore the field is rich with previous studies on themes such as sustainability transitions (e.g., Rotmans et al., 2001; Geels & Schot, 2010; Grin et al., 2010), transition governance (e.g., Loorbach et al., 2017; Hyysalo et al., 2019), governance of 'green' niche innovations (e.g., Avelino & Rotmans, 2009; Geels, 2014), and policies of wood-frame building construction (e.g., Hurmekoski et al., 2015; Vihemäki et al., 2020;

Toivonen et al., 2021). The transition in the Finnish context has included the reports of governmental organizations pursuing introduction of regulatory carbon footprint calculation (such as Bionova, 2017; ME, 2019a; ME, 2021a) followed by studies on environmental criterion in public procurement (e.g., Koivusalo et al., 2021; Huomo et al., 2022) that concentrate on the viewpoint of policy development and application. Building construction corporations have been provided with opportunities to participate in the development of the upcoming national carbon footprint calculation method e.g., through piloting projects (ME, 2019b) and by providing comments on the calculation method drafts suggested by the Ministry of the Environment (e.g., MJ, 2021).

The topic of this study is contemporary in the field of building construction in Finland due to the upcoming novel regulation for low-carbon transition. The aim of this study was to explore the low-carbon governance in the field of building construction, and through public procurer and construction corporation interviews, to map the perceptions to the upcoming regulation and carbon footprint calculation method, to the obstacles and the advantages of business-driven transition, and to what extent is transition governance needed for the transition to take place. Looking into the literature of fostering sustainability transitions, there seems to be a somewhat consensus that it is possible to foster transitions, however the effect of governmental policies as well as free-market approach are questioned as methods (e.g., Rotmans et al., 2001; Rotmans & Loorbach, 2010). The study was conducted using the multi-level perspective framework (e.g., Rip & Kemp, 1998; Rotmans et al., 2001; Geels & Schot, 2010) and the transition governance (e.g., Grin et al., 2010; Loorbach et al., 2017; Hyysalo et al., 2019), through which it looked forward to contributing to the understanding of the viewpoints and agency of different stakeholders in the low-carbon transition process in the levels of regime and niche, in particular. Due to the lock-in factors, such as resource-related and political co-dependencies (Avelino & Rotmans, 2009; Geels, 2014), governmental policies can work on the regime dynamics to destabilize regimes (Loorbach et al., 2017; Turnheim & Geels, 2013) and foster the emergence of niche innovations (Geels & Schot, 2010; Smith & Raven, 2012). The concept of regime lock-ins and destabilization as well as niche promotion is elaborated through examples of wood-frame building construction in the Finnish context (e.g., Aaltonen et al., 2021; Hurmekoski et al., 2018; Lazarevic et al., 2020; Toivonen et al., 2021).

This study aims at answering the following research questions:

**1. What is the current state and foreseeable changes of regulation and public procurement as governance instruments in fostering the low carbon transition in the Finnish building construction sector?**
**2. What are the necessity and effect of governance in fostering of low-carbon transition in the Finnish building construction sector?**

# 2 LOW-CARBON TRANSITION IN BUILDING CONSTRUCTION

This chapter aims at drawing the picture of the role of building construction sector as a source of greenhouse gas emissions and its impact on the climate. In addition to the business' self-imposed action to reduce their greenhouse gas emissions, also external actors have agency in the corporate low-carbon strategies and transition. In this study, focus is put on legislative regulation and public procurement criteria as the governance mechanisms fostering the transition. Alongside the upcoming changes in the Finnish Land Use and Building Act, the building construction companies are about to face new legislative obligations that are based on carbon footprint calculation putting the perspective in the core of this chapter.

## 2.1 Climate change and the building construction sector

### 2.1.1 Climate change and carbon-neutrality goals

At the global level, the temperature has risen about 1.1 Centigrade beyond the pre-industrial levels and it is expected to exceed the limit of 1.5 Centigrade in the early 2030's (IPCC, 2021a). Simultaneously, Finland and other arctic areas face the warming digits two-fold (Finnish Meteorological Institute, 2021). With the Paris Declaration, nearly 200 countries have agreed to cut their greenhouse gas emissions to limit the global temperature-rise well below 2 Centigrade (UN, 2022). Respecting the limit of 1.5 Centigrade is crucial as the closer the limit comes and the further the limit is passed, the more unprecedented natural phenomenon will follow, such as heatwaves, wildfires, droughts, floods, and storms resulting in loss of habitats and ecosystems impacting the human ecosystem services (IPCC, 2021b). According to UN (2021), however, the current commitments made by individual countries is expected to result in a rise as high as 2.7 Centigrade by 2100 and that reaching the target of 1.5 Centigrade would require cutting the greenhouse gas emissions by seven-fold.

In line with the Paris Agreement, the European Union is striving for carbon neutrality by 2050 through its Green Deal programme (European Commission, 2019). Finland, again, is aiming to become carbon neutral by 2035 and carbon-negative shortly after this (Finnish Government, 2019). *Carbon neutrality* means the equal balance between the carbon emissions and the carbon sinks whereas *carbon negativity* stands for the sink-capacity exceeding the amount of emitted carbon (Kuittinen, 2021). Striving for carbon negativity is one important act for climate change mitigation to capture the excess carbon deposited in the atmosphere (Kuittinen, 2021).

### 2.1.2 Impact of the building construction sector

According to the recent scenarios by the Intergovernmental Panel of Climate Change (2021), the estimated (50% likelihood) remaining carbon budget for the limit of 1.5 Centigrade is about 500 GtCO2 and about 1,350 GtCO2 for the limit of 2 Centigrade. The World Green Building Council (2019) estimates that the buildings are responsible for about 39% of the global carbon emissions, of which 11% resulting of the buildings' embodied carbon. About 50% of all global raw materials are used in construction (Kuittinen, 2021). It is noteworthy that, if the current production methods are being followed, the manufacturing of products for the use of heavy industries alone will cause emissions of 918 GtCO2 by 2050 and it should be cut down to 300 GtCO2 to comply with the global warming limit of 2 Centigrade (Material Economics, 2018). Of the 918 GtCO2-scenario, the value chain of buildings accounts for 33% of steel, 20% of plastic, 25% of aluminium and 65% of cement (Material Economics, 2018), resulting in a rate of 340 GtCO2 for building construction alone.

Within the European Union, buildings, and their construction account for about half of all material and energy use (Bionova, 2017) and the carbon emissions of the building materials account for 250 MtCO2 annually (Material Economics, 2018). In Finland, buildings are responsible for about one third of the national green-house gas emissions and about 40% of the total energy consumption (Green Building Council Finland, n.d.-b).

Due to the significance of the building construction sector in causing the greenhouse gas emissions, need for low-carbon governance through regulation has been identified (Kuittinen & Häkkinen, 2020). Regulation for building construction carbon footprints is already in place in the Netherlands (since 2018), France (2020), and Sweden (2021) (ME, n.d.-e). In Finland, the regulative guidance of carbon footprints has been prepared since 2016 and it is expected to take force by 2025 (ME, n.d.-e). A closer look at the new Land Use and Building Act and the related carbon footprint calculation method is taken in the next sections.

### 2.1.3 Carbon footprint formation of building design

The carbon footprint of the buildings' life cycle is formed of production of building materials (26-42%), construction site activities (3-8%), use-phase (energy 46-69%, maintenance, and replacement of materials 4-11%), and deconstruction and disposal of materials (1-4%) (Kuittinen, 2021 in Ruuska & Häkkinen, 2014; Organschi et al., 2021).

For the time being, the *operational emissions* of the use-phase energy consumption of a building still cause the largest share of its life cycle emissions. However, the relative share of the emissions caused by the other phases of a building's life cycle will become highlighted through improvement of buildings' energy efficiency and decrease of emissions in energy production caused by the transition towards renewable energy sources (ME, n.d.-e). The phase-out of use of coal for energy or heat production by 2029 (MEAE, 2019) and increasing the

production of electricity of renewable sources (Finnish Government, 2016) are expected to lower the carbon-intensity of use-phase energy resulting in increase of relative significance of other construction-related emissions.

The building materials and products are responsible for the so-called *embodied emissions* caused by the physical formation of a building. The structural frame of a building causes typically about half of a building construction's emissions although construction on unstable soil (stabilization) may result in significantly higher proportion (Kuittinen, 2021). There the embodied emissions can be reduced by using alternative materials that are less emission-intensive and/or materials that have absorbed and are able to store carbon, such as wood (Hemström et al., 2017). To work energy-efficiently, a building requires appropriate Building Systems, such as HVAC and electrotechnology, as well as enhanced insulation resulting in higher material-intensity and therefore in increased number of embodied emissions (Röck et al., 2020). Due to their shorter life cycles, the Building Systems may be replaced multiple times during the building's life cycle, therefore resulting in more equipment-related emissions and therefore an increase of life cycle emissions of the energy-efficient buildings (Röck et al., 2020). Also, the difference in carbon emissions when building new and renovating old must be noted. For example, in line with a calculation performed by Sweco for the City of Helsinki (2019), a complete renovation of a building combined with construction of complementary additional floors resulted in lower carbon emissions compared to a newly constructed building of recycled concrete (life cycle of 50 years). They found that the difference occurred in the phase of new material production.

## 2.2 Governance in fostering the low-carbon transition

### 2.2.1 National climate strategy addressing building construction

Finland's ***National Energy and Climate Strategy*** has been updated by each government since 2001 and preparations for the next new strategy has begun in 2020 (MEAE, n.d.). The most recent strategy by the Finnish Government in 2016 acknowledges the importance of the built environment as a source of greenhouse gas emissions and defines land-use, construction of energy efficient new and repaired buildings, maintenance, material efficiency and use of renewable energy sources as the key actions to mitigate the sector's climate impacts. The strategy of 2016 aligns policies for the buildings' low-carbon transition through energy efficiency improvements, promotion of renewable energy production and use, reducing the carbon footprint of building materials and products, promoting construction of wood, and improving material efficiency (e.g., circular economy). The low-carbon governance solutions addressing the land use include synergies with the transportation system, facilitation of renewable energy production, and a comprehensive design of the urban structure and functionality to facilitate the

opportunities to create low-carbon lifestyles, including functioning public transport systems, lane networks for the pedestrians and cyclists, and accessibility to the recreational and natural spaces.

*Energy efficiency of buildings* has been addressed by the Finnish legislation since 1976 and several relevant updates to the Land Use and Building Act have taken place between 1999 and 2012 (Kivimaa et al., 2017a). Since 2010, the European Union has addressed the energy performance of buildings with a directive (EPBD) (EUR-Lex, 2010) that has set a requirement of 'nearly zero-energy buildings' from 2021 on (European Commission, n.d.). The *carbon emissions sourcing from building materials and products*, on the other hand, have not been guided in regulative measures so far, thus having based on voluntary action on carbon footprint calculation (Bionova, 2017) through use of commercial environmental assessment tools such as RTS Environmental Classification, LEED, and BREEAM, or the Level(s) environmental reporting system by the European Commission (ME, n.d.-e)

The construction-related carbon emissions have gained increasing attention since 2017 when the potential of regulative guidance in the low-carbon transition was mapped by Bionova Ltd (2017). The investigation resulted in establishment of the low-carbon roadmap for buildings in accordance with the National Energy and Climate Strategy (ME, n.d.-e). The programme on low-carbon building construction is governed by the Ministry of the Environment (ME) whose assignment includes actions in reducing carbon emissions in the unregulated stages of building construction, those being mainly related to material production, construction, and recycling (ME, n.d.-d). The aim of the programme is to create a credible carbon footprint calculation method to work as the tool enabling introduction of national regulation and carbon limits around the mid 2020's.

*The Land Use and Building Act* defines the rules for the use of land and building construction and therefore creates the foundations for sustainable design and implementation of building construction projects (Finnish Government, 2016). The aimed regulation for the low-carbon building construction is included in the currently ongoing reform of the Land Use and Building Act that is planned to include *authority to issue decrees* (*asetuksenantovaltuus*) to serve the introduction and implementation of a *climate declaration* (*ilmastoselvitys*) as a part of the construction permit phase (MJ, 2021). The regulative guidance of building construction's low-carbon transition is expected to pass by 2025 when the statute of climate declarations and carbon limits would be targeted at those new and renovated buildings in need of a construction permit (MJ, 2021).

The first version of the national carbon footprint calculation method was published in 2019 after which it was piloted both by several public as well private building construction projects to develop the method further and to build the capacity of those working in the field (MJ, 2021). The second version of the calculation method was published in 2021 as the Ministry of the Environment requested for comments on their proposal of the climate declaration statute intro-

duction. The calculation method is designed to cooperate with the national emission database for construction developed and maintained by the Finnish Environment Institute SYKE (CO2data, n.d.).

Verification of creditable and unified calculation of the carbon footprints of various construction projects is defined as of high importance and the capacity building of the key participants, such as the designers and project leaders, is considered essential. However, the ME proposal of 2021 took an unclear stand on validation saying that the carbon footprint calculation of a construction project would be carried out by a consultant, or a designer selected by the project lead and no specific proof of qualification would be requested (ME, 2021d, p. 32). Responsibility of the information presented in the upcoming climate declaration can be compared to the energy declaration (Green Building Council Finland, 2021) that in its current format has been a part of the construction permit process and worked as a tool for energy efficiency transition since 2013 (Finlex, 2013) where the law on a building's energy certificate includes a definition of the qualification requirement for the person drawing the calculation. For example, the Green Building Council Finland (2021) in their comment on the ME's statute proposal state that there is a need to pay more attention on the verification methods. In accordance with the Green Building Council Finland's comment followed by 71 other statements, the Ministry of the Environment identified the issue of qualification requirement as one of the key issues to be developed further in their work towards the final version of the law (ME, 2021b).

### 2.2.2 Low-carbon transition and the embodied emissions

As stated above, the upcoming national regulation will be especially targeted at reducing the carbon emissions of the building construction sector of its embodied emissions, with highlighted focus on the materials and products. The embodied emissions include all those carbon emissions that are produced during the life cycle of a building, starting from extraction of raw material and manufacturing of the necessary materials and products, to the material-related operations during the use-phase and all the way to the end-of-life, deconstruction and reuse, recycling or disposal (World GBC, 2019). To simplify the big picture of embodied emissions it can be said that the embodied life cycle emissions are gained by reducing the operational use-phase energy of the total life cycle emissions. A closer look at the life cycle stages is taken in the section 2.3.

According to Kuittinen and Häkkinen (2020), the carbon-intensiveness of the materials and products is mainly caused by use of fossil fuels in the stages of material manufacturing, transportation, and other product-related processes. They continue that manufacturing of some materials is more carbon-intensive than others, for example when cement manufacturing is considered, processing of limestone as a raw-material results in its decomposition and therefore is a significant cause of emissions (in Andrew, 2018). Therefore, the emissions of the

manufacturing stage can be addressed with the transition towards more sustainable energy sources, however, those embodied emissions tight to a nature of a manufacturing process will need another approach.

Concrete as the bearing structure of buildings displaced wooden frames during the 1950's after which it has dominated the frame-construction (Huuhka & Lahdensivu, 2016). 5% of multi-storey buildings and 88% of small residential buildings were constructed of wooden frames in 2017 (Sipiläinen, 2018). The national target of wood-frame public construction projects is to hit the percentage of 31 by 2022 and a share of 45% by 2025 (ME, 2020). In 2019, the public building construction projects accounted for about 18% of all construction of new buildings in Finland, of which 15% were wood-frame buildings (Kiiskinen, 2021).

The discussion of carbon intensity of building materials and alternative low-carbon materials essentially includes wood, which is Finland's most significant renewable natural resource and an important part of Finland's national economy and economic well-being (Natural Resources Institute Finland, n.d.). At present, the Finnish forests sequester about a third of the Finns' carbon dioxide emissions (MAF, n.d.). Removal of wood from the forest has negative impacts on, for example, the area's vegetation mix, water quality and landscape, leading to a multiplier effect on the removal of ecosystem services such as carbon sequestration, leisure activities and hunting (de Groot et al., 2010). However, wood-bound carbon also remains in structures of building life cycles as carbon storage, thus construction of wood material has been strongly promoted due to its potential for social and climate policy effectiveness (ME, n.d.-c). The national energy and climate strategy includes a goal to promote building construction of wood in line with the bioeconomy strategy (MEAE, MAF, ME, 2014). In the government term of 2015-2019, wood construction was an important part of the government's bioeconomy promotion policy, which led to establishment of the national wood building program for 2016-2022, led by Ministry of the Environment (n.d.-c). Also, the prime minister Marin's government program of 2019 aims at increasing wood-frame construction by twofold during its four-year term. In the context of the wood building program, ME states that the use of wood reduces the life cycle carbon footprint of building construction in the phases of material production for construction, use and recycling, and thereby is an effective way to promote the goals of the national energy and climate strategy by 2035. However, as concluded by Toivonen et al. (2021, p. 2, in Lazarevic et al., 2020; Toppinen et al., 2019), "despite of the long-term enhancement policy, WMC [wooden multi-storey construction] still represents a clear niche within the overall construction market, characterized by few companies being involved in the business networks".

### 2.2.3 Low-carbon transition and the national Green Deals

As described above, the embodied emissions cover a wide range of other sources of emissions besides the chosen raw-materials and product manufacturing covered in the previous section. According to Kuittinen and Häkkinen (2020, 185), however, many of these emission sources, such as transports, construction work

phase, demolition work phase and waste management, "have a marginal impact" compared to the workload that their investigation requires.

Finland's national regulative guidance is expected to cover the life cycle emissions of the building construction projects and to support the capacity building prior to the regulation to take force, the Ministry of the Environment has introduced national voluntary green deal concepts for emission-free construction sites, sustainable demolition, and plastics in construction (ME, n.d.-a). The green deals are implemented under 'The Finland we want by 2050 – Society's Commitment to Sustainable Development' program that is the tool for the Finnish implementation of the global sustainable development commitments to the UN's Agenda 2030 (Commission for Sustainable Development, 2016).

The *green deal of emission-free construction sites* was initiated in 2020 as the Ministry of the Environment signed a voluntary agreement with five large cities and other public building constructors to promote sustainable public procurement (Commission for Sustainable Development, n.d.-b). The aim of the agreement is to cut the emissions of the construction sites and to be free from use of fossil fuels by the end of 2025. The objective for 2030 is related to the transports and machinery of which 50% should run with electricity, biogas, or hydrogen.

The *green deal of sustainable demolition* is an agreement made between the Ministry of the Environment and RAKLI, an association promoting the interests of constructors, investors, and professional owners, in 2020 (Commission for Sustainable Development, n.d.-a). The aim of the green deal is to encourage the property owners and constructors to map the materials and harmful substances of a demolition site for reuse and recycling purposes.

The *green deal of plastics in construction* was first signed in 2020 between the Ministry of the Environment and eight associations representing different fields of material and product manufacturing and use to promote the circular economy of the plastics within the construction sector (Commission for Sustainable Development, n.d.-c). The aim is to promote circularity covering separate collection, reuse, and recycling of packing plastics especially sourced at the building construction sites. The objectives for the future include reducing the amounts of plastics used.

### 2.2.4 Public procurement as a tool for transition governance

The term *public procurement* refers to the purchasing of goods and services outside an organization run with public funding (Kivistö & Virolainen, 2019). Public procurement is a tool in support of larger scale societal goals and the term *green public procurement* is used to emphasize the potential of public procurement in mitigating harm to the environment caused by a good or service acquired (ME, n.d.-d).

In Finland, there are 2 800 independent procurement units, and the size of Finland's public procurement is estimated at 30-50 billion euros, depending on the source (Nissinen & Savolainen, 2019). According to the study by Merisalo et al. (2021), the total size of public procurement in 2018 was 47 billion euros of

which 31 billion euros purchased goods and services from the private sector operators. Estimated by Kivistö and Virolainen (2019), the size of public procurement including the purchases made within the scope of public operators, could exceed 50 billion euros of which 14% are by the state, 44% by the municipalities and local authorities, and the remaining part by the other public operators, such as universities and parishes (Kivistö & Virolainen, 2019). In the level of the European Union, the value of public procurement is about 14% of the GDP therefore making public procurement a powerful tool in addressing the values of sustainable development (ME, n.d.-d). The carbon footprint of national public procurement can be calculated using the ENVIMAT calculation method (Nissinen & Savolainen, 2019) according to which the goods and services purchased by the Finland's public sector are the source of nearly 20% of Finland's greenhouse gas emissions and nearly 25% of raw-material use (Kalimo et al., 2021).

As of data from the years 2010-2016, the Finland's annual purchases in the field of building construction was about 7 billion euros of which 21% was used on construction of new buildings and 32% on renovation projects mostly at the level of the municipalities (55%) and the state (10%) (Kuittinen & le Roux, 2017a). According to Kalimo et al. (2021) and based on the ENVIMAT analysis carried out by in Nissinen & Savolainen (2019), both the buildings' energy-use and construction cause approximately one quarter each – therefore a half when combined – of all carbon emissions caused by the public procurement. Public procurement is seen as a significant tool in supporting the low-carbon transition of the building construction sector prior to the national regulation to take force around the mid-2020's (Kuittinen & Häkkinen, 2020).

The procurement by the public operators is regulated by the European Union's *Directive 2014/24/EU on public procurement* (EUR-Lex, 2014) followed by the Finnish national legislation of *1397/2016 Act on Public Procurement and Concession Contracts* (Finlex, 2016). Public procurement is affected also by national legislation applied by different sectors, such as act on public contracts in the utilities sector (Kalimo et al., 2021). The European Union's *Directive 2018/2001 on the promotion of the use of energy from renewable sources* guides the member states to the use of energy-efficient products in construction of new buildings as well as renovation projects (Kalimo et al., 2021). The aim of the legislative guidance is to promote more environmentally and socially responsible choices, and they enable inclusion of environmental criteria in the competitive tendering of public construction projects and their planning (Kuittinen & le Roux, 2017a). Finland's act on public procurement is under reform as the Marin's government (Finnish Government, 2019) decided to include carbon and environmental footprint calculation in the procurement criteria of those purchases resulting in the greatest environmental impacts. The legislative reform will also consider the *Strategic Programme for Circular Economy* established in 2021 to include the procurement criteria of low-carbon construction in all building construction projects of public operator from the year 2022 onwards (ME & MEAE, 2021). The proposal of the reform is presented to the Finnish Parliament in 2022 and the new legislation is expected to take force in 2023 (Haatainen, 2022).

In accordance with the National Energy and Climate Strategy and the government's decision of 2013 on promotion of cleantech solutions in public procurement, the Ministry of the Environment has created a guide and procurement criteria to be used for green public procurement in public building construction projects (Kuittinen & le Roux, 2017a). *The Green public building Procurement guide* (Kuittinen & le Roux, 2017a) includes the aspects of green public procurement and describes the features of the procurement process of a design service or a building construction project. The guide *Procurement criteria for low-carbon building* (Kuittinen & le Roux, 2017b) describes the tendering requirements according to applicability, minimum levels and scoring in the procurement of design services, construction work contracts, materials, and equipment.

*Market prospection,* a discussion between a procurement unit and the potential tendering businesses, is a part of the project planning preceding the formal procurement procedure and can be used as a mapping method in case the procurement unit is unsure of the most environmentally friendly solution available in the markets (Kalimo et al., 2021; Koivusalo et al., 2021). *Market discussion* is voluntary and relatively free form in the stage of tendering competition preparation but when carried out during the competitive tendering round, strictly limited and formal (Airaksinen, 2021; Motiva, 2020). Both the market prospection and discussion are of utmost importance to achieve the environmental benefits of green public procurement in building construction, e.g., to define the adequate level of requirements as well as the applicable technical solutions to be pursued in the tendering competition (Kuittinen & le Roux, 2017a; 2017b). The chosen procurement criteria must not only be effective in terms of carbon footprint and other environmental impacts, but also executable by the tendering corporation as well as economically feasible (Airaksinen, 2021; Kuittinen & le Roux, 2017b). A market discussion can also be utilized as a marketing device of the upcoming tendering competition to gain more tenders from the relevant businesses and thereby to improve the possibility of finding the best possible solution (Airaksinen, 2021). A tendering competition can include criteria to support innovation in promoting the low-carbon solutions in the built environment and should the tenderer offer such solutions, a calculation of the potential savings in carbon emissions must be presented (Kuittinen & le Roux, 2017b).

## 2.3 Carbon footprint calculation in transition governance

Building construction results in impacts to the climate and the environment, such as through direct (operational) or indirect (e.g., material-related) release of greenhouse gases into the atmosphere or through change in land use as forested areas are cleared for new buildings (e.g., loss of carbon sinks and habitats). In line with the Finnish Land Use and Building Act reform, this study concentrates on the release of greenhouse gas emissions and their impacts over the climate. In the

following, the frame of emission calculation, impact assessment and their application in the transition governance is touched upon.

### 2.3.1 Assessment of life cycles and carbon footprints

For a product to exist, it first requires a design process, extraction of raw materials from its stocks in the nature, a manufacturing process for the product to take its form, and transportation in between these phases. After taken into the intended use, the product exists and serves its purpose during the use phase during which it may require maintenance, repairing or energy for running it, until it reaches the end of its life where it becomes unnecessary in the original purpose and will be disposed. The described process is called the product's *life cycle* in which the individual steps and phases result in impacts to the environment and/or to the climate, such as *greenhouse gas emissions (GHGs)* into the atmosphere (Klöpffer & Grahl, 2014). In addition to carbon dioxide (CO2), also other gases such as methane (CH4) and nitrous oxide (N2O) are categorized as greenhouse gases (IPCC, 2014). In the atmosphere, the different greenhouse gases absorb the heat from the sun in different volumes which means that they result in the similar *greenhouse effect* with very different quantities. For example, in line with the IPCC Fifth Assessment Report (AR) of 2014, one unit of CO2 equals to 28 units of CH4 and 265 units of N2O during a 100-year time horizon. Using these factors, it is possible to define the *global warming potential (GWP)* of various GHGs where the calculation result is displayed as *carbon dioxide equivalents* (CO2-eq or CO2e). This method facilitates calculation and comparability of GHGs in the impact assessment. To facilitate uniformed calculation processes of different products and services in search of their GWPs, the calculation methods are expected to be based on the relevant *standards* that define e.g., the accepted sources of emission data, and the relevant life cycle stages to be considered in calculation (Bionova, 2017). The concept of a 'standard' stands for a document that is formed and confirmed in accordance with commonly accepted rules (SFS, n.d.). *Standardization*, on the other hand, refers to the process where best practices, solutions and requirements are brought together resulting in a standardized document (SFS, n.d.). The two main standardization levels for the Finnish construction companies mainly follow the international *ISO standards* and the European *EN standards* (Bionova, 2017). The *International Organization for Standardization* (ISO) consists of national organisations of standardization in which Finland is represented by the Finnish Standards Association (SFS, n.d.). The European level standards (EN) are produced by the European Committee for Standardization (CEN) (SFS, n.d.).

To study the various environmental impacts that a product has throughout its life cycle, so called cradle-to-grave approach, *Life Cycle Assessment (LCA)* can be used (Klöpffer & Grahl, 2014). LCA is commonly leaning on the ISO 14040 (Environmental management — Life cycle assessment — Principles and framework) and ISO 14044 (Environmental management – Life cycle assessment – Re-

quirements and guidelines) series of standards that define the common principles and requirements of life cycle assessment (Klöpffer & Grahl, 2014). LCA can be used as a tool in assessment of a wide range of impacts to the ecosystems (such as climate change, acidification, and eutrophication), humans (such as ozone depletion and toxicity) and natural resources (such as depletion of forests, water, and fossil energy sources) (Heijungs & Guinée, 2012; Margni & Curran, 2012).

As described above, climate change is one of the multiple environmental impacts that can be studied under the life cycle assessment. Climate change as an environmental impact is based on the GWP calculation of greenhouse gas emissions (expressed in carbon dioxide equivalents) using the *Carbon Footprint (CF) analysis* (Klöpffer & Grahl, 2014). Thereby the term *carbon footprint* of a given product or service stands for the total quantity (gram, kilogram, ton) of carbon dioxide equivalents (CO2-eq) that the product or service accounts for in GWP. For the calculation to result in uniform information that can be used for comparing the carbon footprints of two similar products, the assessment and calculation must be based on unanimous calculation methods and emission data (ME, 2019a). The standard ISO 14067 (Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification) guides the calculation and reporting of carbon footprints in line with the ISO 14040 and 14044 standards.

Whereas the term carbon footprint reflects the global warming potential and the negative impacts to the climate, the term *carbon handprint* is being used to represent the positive impacts to the climate. The concept of carbon handprint being relatively young, there is no individual standard for the calculation, thus it aligns the standards used in life cycle assessment and carbon footprint calculation (Pajula et al., 2021).

### 2.3.2 Methods and services for carbon footprint calculation

Carbon footprint calculation based on a standardized calculation method combined with appropriate emission data facilitates emission comparison of different construction project delivery systems and their emission reduction potential (Bionova, 2017). Attention must be paid to the fact that calculation methods do not always rely on the same standards nor include the same boundaries which creates a gap between their levels of demand (Bionova, 2017). Many methods and calculation tools also both use and guide on using assessment tools, emission factors or emission databases of various sources that all create dispersion in the calculation results (Bionova, 2017). So far, due to the lack of regulatory requirements, the carbon footprint calculation of the Finnish building construction has been conducted based on the customer demand which has oftentimes been fulfilled through commercial environmental classification and certification systems, such as Finnish RTS, or international LEED (Leadership in Energy and Environmental Design) or BREEAM (Building Research Establishment's Environmental Assessment Method) (Bionova, 2017).

So far, there is no common EU level regulation in sight in using carbon foot-print calculation as a GHG emission reduction method of building construction projects. However, the European Union is in the process of developing the Level(s) methodology as a voluntary measure to unify certain aspects of impact assessment and quality improvement in the building construction sector within the EU countries (ME, n.d.-b). Level(s) has been piloted in the member countries and Finland participated this phase in 2018-2019 with an extensive project catalogue (ME, n.d.-b). Level(s) is not yet completed, and it will be further developed. Once ready, Level(s) will consider the environmental impacts broadly, climate being just one of them. The main goals of Level(s) include consideration of life-cycle carbon footprint, resource-efficient use of materials, use of water, human health aspects, adaptation to climate change, and life-cycle costs (ME, n.d.-b). In reference to the Global Warming Potential, carbon footprint calculation of Level(s) is based on the EN 15804, EN 15978 and ISO 14040/44 standards (Dodd et al., 2017). One of the core ideas of Level(s) is that it could work as a unifying yardstick for the international commercial environmental certifications such as LEED and BREEAM. It is up to the markets if this development will take place.

The emission data used in calculation of embodied emissions and different phases of a building life cycle are available from different sources, but their quality varies (Bionova, 2017). One method to acquire information on the construction products is through the *Environmental Product Declaration (EPD)* that provides information of different environmental impacts of a product on which the EPD has been drafted for (Bionova, 2017). As the EPD complies with the EN 15804 standard and is verified by a third party, the results are consistent, and the products intended for the same purpose are comparable (RT, n.d.-b). In Finland, the EPDs are verified by inspectors assigned by the Confederation of Finnish Construction Industries (RT) after which RT publishes the approved declarations.

### 2.3.3 The Finnish carbon footprint calculation method

As described in the section 2.2.1, Finland is aiming to regulate the carbon footprints of the building construction sector by 2025 to foster a faster low-carbon transition of the carbon-intensive industry. The regulation intervention point is targeted at the stage of the construction permit application in line with the energy declaration process (MJ, 2021; Green Building Council Finland, 2021). Some environmental management systems, such as RTS, LEED or BREEAM, including options for carbon footprint calculation are available and they have been used by the sector as voluntary measures in building construction projects (Kuittinen & le Roux, 2017; Bionova, 2017). Although they lean on the same standards to the large part, still they differ in some areas as elaborated on in the previous section. To unify the calculation results for the regulation purposes, the Ministry of the Environment is pursuing to introduce for a new national carbon footprint calculation method and a national database for emissions factors (MJ, 2021).

The Ministry of the Environment (2021c) defines a low-carbon building as one having a small carbon footprint and a large carbon handprint. The biggest

impact on the carbon footprint of a building construction project can be achieved in the early stages of planning and design after which the design is mainly implemented as such (Kuittinen & le Roux, 2017).

The calculation method will include the total greenhouse gas emissions during a building's life cycle, both the embodied as well as the operational (Kuittinen & Häkkinen, 2020). In building construction, a product's life cycle begins with raw material extraction, e.g., steel, wood, or stone. The product's life cycle proceeds then from raw material transport, to processing and manufacturing, to the use-phase and towards the end of its life where it is finally disposed through waste management or reuse of materials. The life cycle stages of a building are *A1-3 product stage* (A1 raw material supply, A2 transport, A3 manufacturing), *A4-5 construction process* (A4 transport, A5 construction work), *B use stage* (B1 use of products, B2 maintenance, B3 repair, B4 replacement, B5 refurbishment, B6 operational energy use, B7 operational water use), and *C end-of-life stage* (C1 deconstruction, C2 transport, C3 waste processing, C4 disposal) (ME, 2021a).

In the Finnish carbon footprint calculation method, carbon handprint is being used to represent the positive impacts to the climate that would not take place without the construction project e.g., binding of atmospheric carbon into the soil or a building, and emissions avoided by enhanced construction methods (Pahkakangas et al., 2020; Ministry of the Environment, 2019a). The concept of carbon handprint in the field of building construction is relatively new and therefore the calculation has no established international standard (Gaia Consulting, 2020). Nevertheless, the upcoming Finnish national method that is designed to consider the life cycle carbon emissions of buildings also includes the assessment of the carbon handprint based on the EN standards (ME, 2021a). The method for carbon handprint calculation includes the following life cycle phases: D1 greenhouse gas emissions avoided through use of reused building parts or recycled materials, D2 utilization of materials as recycled fuel or energy, D3 surplus of renewable energy production in the building or on the property, D4 use of long-life building products containing organic or technical carbon, and D5 binding of atmospheric carbon in concrete-based products through carbonation. Also, the calculation result of the carbon handprint is displayed as *carbon dioxide equivalents* (CO2-eq or CO2e).

The Finnish carbon footprint calculation method can be used together with the national database for emission factors (co2data.fi) or with product specific EPDs (ME, 2021a). The national database for emission factors is developed and updated by Finnish Environment Institute in cooperation with the Ministry of the Environment as well as businesses and other organizations taking interest in the area (Carbon Neutral Finland, 2021). The database holds the average emission data on the construction products available in Finland as well as the construction processes in Finland's conditions (CO2data.fi, n.d.).

In Finland, the building construction sector follows the standardization work done by the *CEN Technical Committee TC 350 Sustainability of Construction Works* where the participation of the SFS is delegated to the Confederation of

Finnish Construction Industries (RT) (n.d.-c). Also, the CEN/TC 350 standardization work and standard package is founded on the ISO 14040 series of standards (Bionova, 2017; RT, n.d.-a). The standard for carbon footprint calculation method of the building construction sector is EN 15978 (Assessment of environmental performance of buildings – Calculation method) defined in line with the European CEN/TC 350 standard package. The standard EN 15804 (Environmental Product Declarations – Core rules for the product category of construction products) of the same standard package defines the product level calculation as a part of the entire building's life cycle assessment.

# 3 TRANSITION GOVERNANCE AND MULTI-LEVEL PERSPECTIVE

Use of fossil-based energy forms has resulted in anthropogenic climate change and global warming (EEA, 2021) and the necessity of addressing the causes and consequences of this action has become pressing (UN, 2017). To understand the possibilities in influencing the emission production resulting in global warming, it is necessary to understand the underlying systems, both technical as well as those originated in human behaviour, their multitude, and their interactive dynamics. As the current societal systems utilizing fossil fuels as the driver of economic growth has transformed over a long period of time, both the technological development as well as human attitudes have developed to comply with this economic model and are deeply embedded in all the societal actions. This section aims at drafting the theoretical scene to facilitate the path of understanding the underlying structures and interdependencies of socio-technical systems and the possibilities in fostering the transformations of these systems towards more sustainable and low-carbon procedures.

## 3.1 Transitions in transformations towards sustainability

### 3.1.1 Systems

The interrelated energy supply and climate crisis are considered as *persistent problems* that emerge as symptoms of the unsustainable use of energy in the societies (Grin et al., 2010). What makes these persistent problems also *complex problems* is their deep embeddedness and entrenchment in all central societal structures ultimately resulting in systemic failures (Romans & Loorbach, 2010). In the following, a short overview of the systemic structures and their complexity is provided.

According to Young (1964, in Rotmans & Loorbach, 2010), a *system* is "a representation of a part of reality that is bounded vis-à-vis its surroundings and consists of a number of entities (components) that interact with each other". A *sub-system*, again, is one part of a system, where constitution of the larger system is a sum of the subsystems (Rotmans & Loorbach, 2010). *Socio-technical systems*, on the other hand, consist of individual systems in the fields of technology, science, regulation, user practices, markets, cultural meaning, infrastructure, production, and supply networks (Geels, 2004) that are "maintained, reproduced and changed by various actor groups" such as "firms and industries, policy makers and politicians, consumers, civil society, engineers and researchers" (Geels, 2012, p. 471). Ackoff (1971, in Rotmans & Loorbach, 2010) defines a process "as a time-dependent relation that changes the state of a system".

### 3.1.2 Sustainability transitions

From the persistent problem perspective of the interrelation between the unsustainable energy systems and climate change, a systemic transformation towards more sustainable societal practices is needed. To change an unsustainable socio-technical system towards sustainability requires radical change, called *socio-technical transitions*, through co-evolution and multi-dimensional interaction between the actors of the systems within the socio-technical system (Geels, 2012). Socio-technical approach includes the material, social and cultural aspects and their interactions help mould the structures of sub-systems towards more sustainable ones (Geels & Schot, 2010). Since the issues of sustainability are deeply embedded in all societal systems, transitions towards sustainability require a multi-, inter-, and transdisciplinary approach (Loorbach et al., 2017).

The concept of transitions is defined by many scholars in many different terms. Frantzeskaki & De Haan (2009) describe transitions as a fundamental change in structure, culture, and practices. Rotmans and Loorbach (2010) argue, that transitions result in fundamental structural changes in the societal sub-systems. Grin et al. (2010, p. 2) define *sustainability transitions* "as a quest for new value systems". Loorbach et al. (2017, p. 599, 602) refer to sustainability transitions as "large-scale societal changes, deemed necessary to solve "grand societal challenges" … [that] should be understood as systemic, and that dealing with such challenges is only possible through fundamental systemic changes in societal regimes." Thus, the diverse language used in description of transitions, Rotmans et al. (2001) summarize the central idea of transition as a radical change-process taking place gradually albeit continuously as a co-evolutionary development in the economic, cultural, technological, ecological, and institutional levels, ultimately leading to transformation of societal structures or sub-systems.

According to Romans et al. (2001), transition has the system dimensions of speed, size, and time-period of change. They continue, that transitions are *multi-dimensional* meaning that the change takes place in different *phases* and that those phases can occur in different pace across the different *domains* of the system. Based on Rotmans et al., (2001) and Loorbach (2007), the phases are determined as a predevelopment, take-off, breakthrough, and stabilization. In more recent literature, such as Loorbach et al. (2017), building-up-phases of experimentation, acceleration, emergence, institutionalization, and stabilization are being used, combined with processes of breaking down (optimization, destabilization, chaos, breakdown, phase out). Bringing their own peculiarities into the transition dynamics, different domains have their own internal dynamics leading to change in their own pace, such as cultures changing very slowly compared to economic changes that take place rather suddenly and again to institutional and technological changes situating somewhere in between (Rotmans et al., 2001). Loorbach et al. (2017, p. 607) describe the interaction between domains as co-evolution and "thinking beyond linear causalities". The transition phases and speed are difficult to predict as they take place in a nonlinear manner which means that they

do not develop gradually in a linear direction, rather proceeding in disruptive leaps (Loorbach et al., 2017).

Once the momentum for systemic change grows stronger, it "empowers and accelerates an enormous amount of disruptive innovations, including technological innovations, institutional and economic change, as well as changing lifestyle practices" (Loorbach et al 2017, p. 602). The changes in different domains reinforce each other (Rotmans et al., 2001) that destabilizes the system regime equilibria towards a systemic transition to occur (Rotmans & Loorbach, 2010). Loorbach et al. (2017) define transition having occurred once one dynamic equilibrium has transformed to another.

Loorbach (2021) interestingly also pointed out his discussion with Frank W. Geels who argued that due to its ex-ante perspective, sustainability transitions cannot be considered as transitions in the traditional meaning of ex-post approach, in the first place. Instead, Loorbach continues, sustainability transitions are to look forward; to understand the role of power and agency in transitions, to formulate future visions and paths towards them, as well as to experiment and to learn of the experimentations. Therefore, futures visions play a crucial role in externally motivated change to show the direction for the desired change and e.g., back-casting can be used as a method in mapping the route towards the desired futures visions (Hurmekoski et al.,2018).

According to Geels & Schot (2010, p. 11-12), transitions have the characteristics of co-evolution, multi-actor processes, radical shifts, long-term processes, and macroscopic. Rotmans and Loorbach (2010, p. 128-9) define the most important transition's system characteristics as "i) a shift from one relative (dynamic) equilibrium to the other; ii) the determinants of the new equilibrium can differ from those of the previous equilibrium; iii) the new equilibrium is located at a different system level than the old equilibrium; and iv) stability is a relative notion and certainly does not indicate a permanent state. The new equilibrium is a dynamic equilibrium, i.e., there is no status quo because much is changing below the surface." To understand the transition dynamics, Grin et al. (2010) have determined co-evolution, multi-level perspective (MLP), multi-phase perspective as well as co-design and learning as the central and overarching concepts of sustainability transitions. Loorbach et al. (2017) guide the understanding transitions through the concepts of nonlinearity, multilevel dynamics, co-evolution, emergence, as well as variation and selection. In the following, the multi-level perspective as the central concept relevant to the topic of this study is being presented.

### 3.1.3 Multi-level perspective (MLP)

The multi-level perspective (MLP) of transitions is used to describe and visualize the multitude and multiple levels of actors in a socio-technical system, their interactive dynamics in system equilibria and in a transition process (Loorbach et al., 2017). The multilevel model conceives the social organisation of a system in

three levels, called *micro, meso* and *macro* by Rotmans et al. (2001) or *niche, regimes* and *landscape* by Rip and Kemp (1998). Described by Geels and Schot (2010, p. 29) the MLP "provides mainly the global model of transitions that captures the overall process". The three levels are of different stability and size, regimes being a part of landscapes and niches being part of regimes, niches working as generators of novelties (creating *variation*) out of which the regime and landscape levels perform *selection* and *application* (Grin et al., 2010). In their more recent paper, Loorbach et al. (2017, p. 607-8) begin with the perspective that "transitions are always related to their context and that attention is given to interscale dynamics, be it technologically (e.g., upscaling), institutionally (e.g., multilevel governance), or spatially (e.g., spatial diffusion)".

The complex socio-technical systems have arranged themselves during a long period of time to formulate a perfectly co-functioning and relatively stable entities, namely the regimes. The regimes are the structure (Rip and Kemp, 1998), the dominant configurations (Loorbach et al., 2017), that comprise of networks, communities, and organizations and include "the interests, rules and beliefs that guide private action and public policy" (Rotmans et al., 2001, 19). Defined by Rotmans and Loorbach (2010, p. 108), "we call the deep structure the incumbent regime: a conglomerate of structure (institutional and physical setting), culture (prevailing perspective), and practices (rules, routines, and habits)". The situation following such an absorbed and patterned situation is called *lock-in*, still change within regimes does occur. Lock-in causes change to proceed to rather predictable directions instead of radical ones, which is called *path-dependency* (Geels, 2012). Therefore, regimes resist change, a push from its equilibrium, thus under sufficient pressure either from the landscape or niche levels will adapt to change and new equilibria (Rotmans et al., 2001). Regimes facing pressure may turn defensive, trying to knock out opponents (actors or process), reactive by adapting through system improvement or innovative by actively contributing to the change process (Rotmans et al., 2001). Regime is the dynamic and optimum equilibria of a complex system and ultimately transition can be understood as regime change – once the regime has been replaced by a new one, the transition is completed (Loorbach, 2021).

Niches are the alternatives to the dominant structures, cultures, and practices (Loorbach et al., 2017). They are "variations to and deviations from the status quo" of the regime that occur e.g., in "new techniques, alternative technologies and social practices" (Rotmans et al., 2001, p. 19). Individual people, companies, environmental movements, or local governments can work as niche actors who are able to come up with novelties of technology, behaviour, or policy development to break into the regime and push the regime to a change process (Rotmans et al., 2001). On the other hand, the push or the demand for change can also come from the regime itself or ultimately from the landscape level that opens up the window of opportunity for the niche innovations to take-off (Rotmans et al., 2001). Whereas regimes can be described as stable without much work by the actors, niches are unstable and in need of constant support of its actors (Grin et al., 2010). To succeed, niche innovations need nurturing and protection by those

willing or incentivised (e.g., economically) as the niche phase between invention and market introduction may take a long time, even up to many decades (Geels & Schot, 2010).

The landscape level is the context of the social organization of a system representing the exogenous trends in the long-term and the structures situated in the background providing for the actions within the system (Rip & Kemp, 1998). The very "being" of a landscape is defined by the boundaries of a system, however, overall, it can be described as a holder of "material infrastructure, political culture and coalitions, social values, worldviews and paradigms, the macro economy, demography and the natural environment" through actors such as governments or climate change (Rotmans et al., 2001, p. 19). Changes in the landscape level can work as a catalyst and push for change in the regime to facilitate opportunities for the niche innovations to emerge, taking their sufficient stage of development vis-à-vis the particular window of opportunity (Geels & Schot, 2010).

## 3.2 Transition governance – fostering sustainability transitions

As described above, socio-technical transitions unfold as changes of multitude in levels, phases and domains thus taking considerably long time, such as a generation or two, even up to 50 years or more (Markard et al., 2012). Considering the pressing issue of climate change and need of radical carbon emission reduction, such a long transition period is not an affordable luxury of our time (IPCC, 2021b). Therefore, options in fostering the course and speed of sustainability transitions through the societal momentum and level of destabilization by discovering the potential points of *leverage*, places to intervene in a system, and *tipping points*, the edge of equilibrium, are to be investigated more carefully (Loorbach, 2021).

Looking into the literature of fostering sustainability transitions, there seems to be a somewhat consensus that it is possible to foster transitions, although there is divergence in the methods and leverage points for impact creation. According to Loorbach et al. (2017, p. 602), "The core ambition of transitions research is to better understand such [sustainability] transitions, to anticipate and adapt to undesirable transitions and to explore possibilities to advance and accelerate desired transitions". Presented by Rotmans and Loorbach (2010, p. 148), "Classical top-down steering by government (the extent to which social change can be effected by government policies) as well as the liberal free-market approach (the extent to which social change can be brought about by market forces) are increasingly questioned as effective management mechanisms to generate sustainable solutions at the societal level". They continue (drawing from March and Olson, 1995; Rhodes, 1996; Milward and Provan, 2000; Edelenbos, 2005), that "Governance literature identifies the new forms of interactive and participatory decision making as ways to create societal consensus and/or pressure as a counterbalance to more hierarchical or bottom-up, market approaches". According to

Rotmans et al. (2001), "Transitions involve a range of possible development paths, whose direction, scale and speed government policy can influence, but not entirely control". In their paper of 2009, Rotmans and Loorbach argue that "societal systems, because of their complexity, cannot be directed in command and control terms. We do, however, hypothesize that it is possible to use the understanding of transition dynamics to influence the direction and pace of a transition of a societal system into a more sustainable direction." In the following, a short overview is taken in the literature concentrating on the market forces as an actor in sustainability transitions, followed by an overview on the fostering capacity of governance.

### 3.2.1 Free-market approach

In the transition literature, corporations are traditionally being considered as being part of the incumbent regime, that by nature and definition resists change and are characterized by lock-ins and path dependencies (Geels, 2012). On the other hand, corporations are considered to being able to contribute to sustainable development and social change by contributing to "bottom-up" sustainable innovation (Rotmans & Loorbach, 2010). The perceptions on the business' true ability and willingness to contribute to sustainability transitions vary. Drawing on the theory of complex adaptive systems, Ritala (2019) views the issue from the sceptical, pragmatic, and idealist perspectives where the sceptical perception suggests that corporate innovation prioritizes economic growth, the pragmatic stands for coevolution and sustainable business models, and finally the idealist perspective takes the corporate innovation development with all other domains for the good for all. An example of a highly critical tone has been presented by Banerjee (2008, p. 73), as he argues that corporations are able to ignore questions of responsibility in their quest for profit-seeking due to their connectedness with the "highest levels of the political economy" and that "radical revisions at this level [political economy] can only occur if there is a shift in thinking at a macro level". According to Hillman and Hitt (1999), corporations use also political strategies, such as information, incentivising, lobbying, or confrontation, to resist change. A more positive tone has been raised by Porter and Kramer (2006) as they see businesses as the agents holding the sufficient resources to work for sustainable development and while doing so, gain competitive advantage through sustainable business models.

### 3.2.2 Governance approach

Combining the limited options of the corporations of the current economic model to induce change at the regime level, the long time-periods requested for the socio-technical system-changes, and the urgency of change, research on the possibilities of fostering sustainability transitions has received growing attention

during the past two decades (Loorbach et al., 2017). At the same time, the direction of change in societal transitions are dependent on politics and political decisions in the society (Rotmans & Kemp, 2003). The higher-level goals (landscape), such as international treaties or national low-carbon politics, can be formed into regulation and policy programs followed by application and followed up by the performing level (Geels, 2012). All levels (landscape, regime, niche) have their own purpose in the system dynamics thus actors and contribution of all levels is needed if the change is to be accelerated (Rotmans et al., 2001). Although governments do not insert the niches into the system, as such, however, governments have the capacity to foster the emergence of niches (Geels & Schot, 2010) that play an important role in addressing the regime dynamics, such as sunk costs and lock-in (Loorbach et al., 2017).

The term *governance* emerged between the 1980s and 1990s to stand for the policy-creation cooperation between the governmental, corporate, and non-governmental sectors (Peters & Pierre, 2001). Kivimaa et al. (2017b) define governance as including articulations of policy, politics, and polity (drawing from Lange et al., 2013) and as "the patterns that emerge from the governing activities of social, political and administrative actors" (drawing from Kooiman, 2003). *Policy*, as defined by Anderson (2015, p. 7), is "a relatively stable, purposive course of action followed by an actor or a set of actors dealing with a problem or a matter of concern" and public policy are policies "developed by governmental bodies and officials". Argued by Patterson et al. (2017, p. 12), "While the importance of governance and politics is recognised within various conceptual approaches to transformations … overall it is underdeveloped and needs greater attention". According to Smith and Raven (2012), public policy can be used as an instrument to protect niches through favourable treatment in legal frameworks.

Fostering of sustainability transitions is referred to as *transition governance* (e.g., Hyysalo et al., 2019; Loorbach et al., 2017). Loorbach (2021) defines transition governance as "radical on the long-term, diplomatic on the short term" including the principles of systemic, selective, back-casting, adaptive, and learning-by-doing and doing-by-learning. Hyysalo et al. (2019) define vision-building, pathway-construction, and experimentation as the most important starting-points to fostering a sustainability transition process. Discussed by Grin et al. (2010), "Making connections between innovative practice experiments and changes at the regime level is at the heart of transition governance in any form". Several approaches to transition governance have been proposed, such as transition management (TM), strategic niche management (SNM), reflexive governance, and policies for innovation systems, and according to Loorbach et al. (2017, p. 613), "what these different approaches have in common is particular attention for system innovation and socio-technical co-evolution." Transition Management (TM) is a Dutch-originated approach to sustainability governance, and it has been used and further developed by researchers since early 2000s (Rotmans & Loorbach, 2010). The particular strengths of this approach are considered to include the inclusive and co-evolutionary way of binding all relevant stakeholders in the

work process towards the visions and practicalities to escape and overcome the lock-ins and path-dependencies (Rotmans et al., 2001; Rotmans & Loorbach, 2010).

Although the governance possibilities in advancing transitions by "stimulating 'green' niche-innovations" (Geels, 2014, p. 25), Avelino and Rotmans (2009, p. 559) argue that "the regime usually has more power than niches, in the sense that the regime mobilizes more resources than niches do". Elaborated by Turnheim and Geels (2013, p. 1766), "destabilisation is understood to entail interactions between three processes: accumulation of external (economic and socio-political) pressures, strategic responses to these pressures, (gradual) weakening of commitment to established regime elements". In his article, Geels (2014) elaborates further on the regime power-relationships and the co-dependencies between the corporations and the policymakers and identifies it as a lock-in factor. Therefore, Geels (2014, p. 25, 37) argues, "politically inspired regime destabilization may be necessary to create opportunities for the wider diffusion of renewables, which now face uphill struggles against resistant regimes".

## 3.3 MPL and the low-carbon transition in the context of the Finnish wood-frame building construction

The field of reducing carbon emissions of the Finnish buildings has previously been studied mainly from the perspective of energy (system) efficiency, and optimization (e.g., Olkkonen et al., 2021; Hirvonen at al., 2020; Hirvonen et al., 2019; Sekki et al., 2016). Studies are also found on the novel energy solutions (e.g., Åkerman et al., 2020), urban planning (e.g., Hukkalainen et al., 2017), and building design process (e.g., Häkkinen et al., 2015). As the governance of the low-carbon transition in the context of construction materials and structural frames is relatively recent, the previous research conducted under the concept is rather scarce. On the side of innovation, scientific articles (e.g., Lazarevic et al., 2020; Aaltonen et al., 2021) can be found in relation to the wood-frame multi-storey construction as a niche in low-carbon transition which may reflect the strong political support and policy focus presented in chapter 2. Therefore, this overview of the previous study follows the path guided by Finland's low-carbon governance as perceived from the viewpoint of the wood construction as a part of the Finnish construction system. One study (Lazarevic et al.; 2020) taking the perspective of regime destabilization in low-carbon governance was found in the Finnish context. Also, the perception of one study (Lindblad, 2020) done in the Swedish context is included in this review.

According to Hurmekoski et al. (2015, p. 194), the current construction sector regime constitutes of the "dominant construction practices and the institutional lock-in" that they define as "the established construction practices, value networks, and product suppliers based on concrete and masonry [who] have been able to institutionalize their position in Europe during the 20th century".

Lazarevic et al. (2020), define the concrete frame construction as the incumbent in the field of building construction thus creating a lock-in in the related materials and technological solutions resulting in path-dependency and a key barrier to diffusion of the wood-frame multi-storey construction. Hurmekoski et al. (2018) in their study identified several structural and cultural path-dependencies in the pursuit of increasing the market share of wood construction in Finland. Strict national building codes were seen to cause extra costs to wood structures which hinders diffusion of wood construction. The suppliers of wood products were also found to be both unexperienced (know-how) as well as lacking interest in taking more responsibility (higher added value resulting in higher risk) in the building construction sector.

Vihemäki et al. (2020) conducted a study over the role of intermediary actors in the diffusion of wooden multi-storey construction as a part of the low-carbon transition in Finland. In their study they identified niche intermediaries (the Finnish Timber Council Ltd, the Federation of the Finnish Wood Working Industries), regime-based intermediaries (the National Wood Building Programme, the Finnish Forest Centre, Wood Finland), and systemic, more neutral intermediaries working in different levels (the Green Building Council Finland, research organizations, higher education institutions). Despite of these classifications, the study found that the different intermediaries had several overlapping roles, e.g., over different projects and networks. The regime-based intermediary actors were funded by Finnish Ministries (Environment, Employment and Economic Affairs, Agriculture and forestry). All the intermediaries shared the interest in advancing low-carbon construction in Finland or the benefits related to economics or employment. In policy influencing, the niche intermediaries "were active in creating and managing networks for standard creation and in compiling knowledge", and systemic intermediaries "engaged in political vision building, … compiling knowledge to support policy shifts, translating policies into practice and creating networks for standard creation" (p. 445). The study also found the non-presence of user or process intermediaries that would be important in the diffusion stage. The findings of the study show that two respondents (VTT Ltd and the Green Building Council Finland) highlighted material neutrality in promotion of low-carbon construction methods. Also, a respondent representing the public sector criticised the role of the Ministry of the Environment in promoting the wood construction, and as well brought up his perception that "the construction industry at large was strongly questioning the promotion of the wood construction by ME" (Vihemäki et al., 2020, p. 445). Another interesting finding of the study was that "the niche intermediaries were more closely associated with the wood industry (e.g., lobby organizations or industry associations) rather than the construction industry" (p. 446). The study found lobbying done most actively by the regime-based and niche intermediaries, naming the Finnish Timber Council Ltd being one of the most active ones in advancing the agenda of wood construction, thus resulting in the government decision of the wood building programme.

In the field of wooden multi-storey construction (WMC), Toivonen et al. (2021) studied the policy narratives as well as their implications on governance and found four different storylines of which three are supporting and one rejecting the application of WMC policies. The narratives supporting wood construction ("pro-WMC") were identified being from the approaches of 'bioeconomy' (ministries, the Forest Centre), 'wood industry' ('pro-wood' construction corporations and lobby organizations), and 'climate change' (public expert organizations such as ministries, SITRA, LUKE, VTT) that all perceived that policy development could serve goals of sustainable development. The opposing narrative ("WMC-negative"), on the other hand, was found to constitute of "lobby organizations of other materials and companies not using wood in multi-storey building" who were found to "question the science base [of sustainability and climate benefits] of the arguments used by the advocates of wood construction" and to oppose introduction of lifecycle carbon footprint calculation into the building regulation (p. 6).

Similar to the study of Vihemäki et al. (2020), also this study found support that the perceptions on the low-carbon qualifications of different materials are diverse. They found support for both demands of material-neutrality as well as giving benefit to wood as the structural material. Whereas the pro-wood business actors were found to call for "financial enhancement policy measures to accelerate positive WMC market development" (p. 5), the WMC-negative corporations were opposing such policies.

Another example comes from Växjö, Sweden, where the city is trying to profile as a green city and has chosen to use policies of wood construction as one means in its pursuit towards its goal. In his study over Växjö's policies of wood construction, Lindblad (2020) identified public procurement and land allocation as the key policy tools. Selling land through allocation to wood construction was identified as a more flexible tool in speeding up the diffusion of construction of wood, although it was found to create confusion for the construction corporations of the expected outcomes as "they see themselves as a seller of a building solution rather than a buyer of land, hence making the municipality a producer of a building development project" (p. 10).

In relation to regime destabilization, Lazarevic et al. (2020) found that creative destruction – as they call it – is particularly important when the path-dependency resistance of the incumbent regime is strong. In the context of this study, such a path dependency was found in relation to the concrete frame construction. Lazarevic et al. (2020, p. 10) state that "WMC illustrates a case where the incumbent building regime institutions have been destabilised only to the extent that it now permits building technologies to compete on a more even playing field". They recommend as a conclusion to their study, that to further foster the development of the niche of wooden multi-storey construction, more focus on market creation should be given, e.g., in public procurement.

Interest remains what will eventually happen to construction of wood with so many expectations. Hurmekoski et al. (2018,) studied the possible pathways and came up with two alternatives: the consensus pathway and the dissensus

pathway. The consensus pathway was identified as the most supported option where the transition is expected to occur through the core measures of "standardization of elements and the harmonization of regulation" (p. 3650) and is expected to result in "gradual increase of competition and the resulting increased credibility among the construction professionals" (p. 3644). The dissensus pathway, supported by only some of the interviewees, "emphasizes the need for moving downstream in the construction value chain to directly create demand and for introducing more stringent environmental regulation or internalizing the environmental externalities to the costs of construction" (p. 3653). One of the interesting findings of this study was that "two thirds of the interviewees explicitly stated that stricter norms based on obligation are needed in order to realize the environmental targets on a reasonable time scale" (p. 3649). The interviewees especially called out for norms that allowed innovation of diverse and competition-driven solutions instead of pre-defined ones.

# 4 DATA AND METHODOLOGY

The profound aim of research is to systematically look for the truth (Hair et al., 2016) to produce new knowledge (O'Gorman & MacIntosh, 2015). In the disciplines of business and management, researchers search for the objective of business phenomena through the lens of social scientists as the field essentially involves people, and studies human attitudes and behaviour in groups and systems (Hair et al., 2016). Through the new generated information, research in the field of business and management pursues to describe business phenomenon to enhance the performance of the business to better serve its stakeholders (Hair et al., 2016).

This study was in part conducted in cooperation with the Canemure subproject run by the City of Helsinki. During the summer of 2021, the project interviewed policy and procurement experts to gain a better understanding of the current availability of carbon footprint calculation methods and tools as well as to study their readiness for utilization in setting of environmental criteria in public tendering processes. As a result, a report on application of carbon footprint calculation in public procurement was produced (Huomo et al., 2022). The interviews were conducted in the fields of food and food services, infrastructure construction and asphalting, as well as building construction. I took part in all interviews in the role of a trainee, thus as the thesis topic orientation was decided on in an early stage, the interview questions of the building construction sector experts were complemented with those of interest to this thesis study. After the traineeship, the thesis interview data was further complemented with one more public procurer interview as well as interviews of four building construction corporations participating in public procurement tendering competitions.

The aim of this study was to map the current capacity of public procurers and construction corporations in the field of carbon footprint calculation, and their perceptions on the necessity and effect of the forthcoming national regulation to include carbon footprint calculation in all novel building construction projects. In total three (3) policy experts of three organizations, 12 public procurement experts representing five (5) public procurement organizations, and five (5) representatives of four (4) building construction corporations were interviewed for this thesis study.

According to Hair et al. (2016), a research project in the field of business starts with the phase of formulation in which e.g., the need and problem of the research are being defined, continues with the phase of execution including e.g., the sampling method selection and data collection, and finishes with the analytical phase where e.g., the collected data is analysed and interpreted. The following section of 4.1 introduces the most common research methods used in the field of business and management and justifies the selection of qualitative research method used in this study. The sections 4.2 and 4.3 further specify the details of data collection and analysis of the data.

## 4.1 The methodological approach

Data for business research purposes can be primary or secondary data. According to Hair et al. (2016), the term *secondary data* refers to data that is pre-existing and therefore it is not specifically collected to be utilized in the study at hand. *Primary data*, on the other hand, is data that is newly acquired to serve particularly the identified research problem. Although some studies use only one source of data, in some cases also combining the secondary and primary data as *mixed-methods research* is possible or even necessary (Lichtman, 2017).

Acquiring of primary research data in business and management research can be conducted through quantitative or qualitative approach and methods. According to Hair et al. (2016), *quantitative approach* aims to discover precise results or quantification of data whereas *qualitative approach* pursues to discover phenomenon. Although the methods can in some cases be combined for more accurate results, many times they are used individually. Whereas quantitative approach produces summarized data on many characteristics within the area of research problem, qualitative approach concentrates on discovering information of only a few characteristics in a deeper level (Hair et al., 2016).

Quantitative approach as a business research method relies on statistical information collected from e.g., existing records of a company or through questionnaires, that can result in large samples and amounts of numerical data (Hair et al., 2016). After data collection, the numbers can be used for statistical analysis and to describe the characteristics of the research problem. Qualitative approach is best utilized in areas of research with novel elements that require description through words rather than numerical data (Hair et al., 2016). Data collection of qualitative research is oftentimes conducted through interviews that, compared to quantitative data collection, take a longer time for both researcher as well as interviewee, handles fewer questions in more in-depth level, and consists of smaller samples. After data collection, the analysis of the words is done by the researcher to discover the potential meaning of the data.

The foundation to a study is laid in selection of the research design that pursues providing the study with the necessary information through the most productive process (Hair et al., 2016). The most commonly used research designs are exploratory, descriptive and causal, where *exploratory research* is used for new discoveries through open questions, *descriptive research* is used to better define a certain phenomenon, and *causal research* is used to explain the cause-and-effect relationships of different variables (Saunders et al., 2012). According to Hair et al. (2016), whereas exploratory design is commonly used in qualitative research, the two latter designs are more statistically driven and therefore more in use in quantitative research.

The research design of this study is exploratory as to the novelty of the research area to the researcher, the need to discover relationships and patterns of low-carbon policies and practicalities, as well as to map the themes and ideas of

the stakeholders in low-carbon transition. A qualitative approach for this study was chosen because the objective was to identify the common topics of interest and possibly varying viewpoints, attitudes and needs of different stakeholders in relation to the low-carbon transition. According to Eriksson and Kovalainen (2008), mapping of such common grounds from differing viewpoints is best done through qualitative interviews. Smaller samples of primary data are also more often studied using qualitative methods compared to the studies with large amounts of data utilizing the quantitative methods (Hair et al., 2016).

A qualitative study can be conducted using interviews and observation as collection methods for primary data (Hair et al., 2016). The interview types include structured, semi-structured and unstructured that differ from one another in flexibility and consistency (Eriksson & Kovalainen, 2008; Hair et al., 2016). Whereas a *structured interview* is carried out in a highly standardized manner to avoid biases, an *unstructured interview* resembles more a free-form conversation between the researcher and the interviewee, leaving the *semi-structured interview* type in between to allow use of additional, unanticipated questions (Eriksson & Kovalainen, 2008). In addition to individual interviews, semi-structured interview as a method also allows the use of focus group interviews that aims at better bringing the common discoveries and experiences to daylight in a more efficient manner (Hair et al., 2016). According to Hair et al. (2016), organizing of the interviews may subject the data to bias, mainly due to capabilities and thematic expertise of the interviewer / researcher who operates as the moderator during the interview sessions, especially in the case of focus group interviews. Other points of data collection where it may be subjected to bias, Hair et al. (2016) continue, are e.g., selection of the interviewees with relevant information, sufficient number of interviewees, the honesty of the interviewees in a particular question, and skills of the researcher in data interpretation.

In this thesis study semi-structured interview as a data collection method was chosen because the topic was considered complex and novel to all parties. Due to the limited amount of prior data, it was important to set more open-ended questions that could be complemented with additional questions if further clarification was needed. It was also important to allow the interviewees to express the very topics they considered as the most topical and important. The role of the interviewee was identified as a potential source of bias due to the complexity of the topic combined with the non-existing prior experience of researcher within the topic. To avoid bias through selection of interviewees, expertise of the Canemure experts was utilized. To promote openness and to avoid the bias of possible dishonesty of the interviewees, pseudonymization of data was applied to protect the privacy of the interviewees.

## 4.2 Data collection

To collect the necessary data for a study, a *sample* of the representative group of potential interviewees must be selected. In qualitative, exploratory research this is oftentimes done using *nonprobability sampling* where the sample is not pursued to represent the whole of the target community, instead the sample is selected according to the researcher's judgement to best contribute to the discovery orientation (Hair et al., 2016). The nonprobability sampling methods include convenience sampling, judgement sampling, quota sampling, and snowball sampling, of which *judgement sampling* allows the sample selection based on the researcher's judgement to conveniently represent the targeted expert community. The size of a sample in qualitative research is usually small compared to the quantitative research that looks forward to production of data that allows drawing of conclusions representing the entire population or community (Hair et al., 2016).

In accordance with the judgement sampling, all interviewees of this study were handpicked to represent the best available expertise of their own fields. The relevant policy organizations (session 1) and organizations of public procurement (sessions 2-4) were selected for the interviews by the Canemure experts of the City of Helsinki and based on their relevance and diverse experience in the thematic subject matter. The fourth public procurement organization (session 5) was selected by the thesis researcher due to the organization's specialization in public procurement in the area of public construction. The corporate interviewees (sessions 6-9) were selected based on their involvement in public procurement construction projects as well as proactiveness in market discussion aiming to promote sustainability in construction, and they were named by the public procurers during their interviews. Interview invitations were sent to altogether five (5) corporations of which four (4) gave an answer.

In total nine (9) interviews took place of which one (1) for the three (3) policy experts, four (4) for the 12 public procurement experts, and one (1) interview for each of the four (4) building construction corporations. The semi-structured interviews were conducted partly as focus group interviews (sessions 1-4) and partly as interviews between an individual organization and the researcher (sessions 5-9). The focus group interviews were facilitated in cooperation with the Canemure experts who had some in-depth knowledge in the subject matter and were therefore able to lead the discussion also beyond the questions listed in advance. In the later stage of interviews also the knowledge level of the thesis researcher was sufficient to take the discussion on within the predefined themes. The interviews were carried out with different interview methods partly due to the thematic differences of the target groups, and partly due to the scheduling arrangements of individual interviewees. Table 1 further elaborates on the data of the interview sessions and interviewees.

The interview questions of policy and public procurement experts were defined by the Canemure experts to a large extent. The set of questions of the public procurers were complemented with questions relevant to this study. The aim of the predefined questions was to lead the interviewees to the relevant topics of discussion and allow further questions by the interviewers. The interview frame and predefined guiding interview questions were delivered to the interviewees prior to the interview, see Appendix I and II. All questions were not presented in all interview sessions rather the discussion focused on the topics found relevant by the interviewees.

In the interview sessions of the corporations, out of four interviews, three were with one corporate representative and one interview with two interviewees. Individual semi-structured interviews were chosen in the case of corporations as the public procurers brough up in their interviews their perceptions of corporate participants' unwillingness to engage in (market) discussion if representatives of other corporations are present. To facilitate open discussion and collection of data, individual interview sessions were arranged for each of the corporations. To protect the data of individual interviewees, the data of the interviewees and their organizations has been pseudonymized and no detailed information of the corporations, such as turnover, is given. The interview questions were modified based on the themes raised up in the interviews of the policy and public procurement experts to gain a more in depth understanding of the corporate viewpoint in these topics. The interview frame and predefined guiding interview questions were delivered to the interviewees prior to the interview, see Appendix III. All questions were not presented in all interview sessions rather the discussion focused on the topics found relevant by the interviewees.

The interviews of policy experts (session 1) and public procurement experts (sessions 2-4) were scheduled for 90 minutes, and they took place in June and August of 2021. The interviews of public procurement experts (session 5) and corporate representatives (sessions 6-9) were scheduled for 60 minutes, and they took place between September and November of 2021. All interviews were carried out using Microsoft Teams and the sessions were recorded under the consent of the interviewees for research purposes. Interviews were conducted in Finnish language and all interview data has been translated into English language.

Table 1: Key characteristics of the interviewees and interview sessions

| **Session 1** | **Semi-structured focus group** | **90 minutes** |
|---|---|---|
| Interviewee 1 | NGO | Interviewees with specialized expertise in policy development in the field of building construction |
| Interviewee 2 | Governmental organization | |
| Interviewee 3 | Governmental organization | |
| **Session 2** | **Semi-structured focus group** | **90 minutes** |
| Interviewee 4 | Municipality 1 | Interviewees with specialized expertise in public procurement in the field of building construction |
| Interviewee 5 | | |
| Interviewee 6 | | |
| **Session 3** | **Semi-structured focus group** | **90 minutes** |
| Interviewee 7 | Municipality 2 | Interviewees with specialized expertise in public procurement in the field of building construction |
| Interviewee 8 | Municipality 3 | |
| Interviewee 9 | | |
| Interviewee 10 | | |
| Interviewee 11 | | |
| Interviewee 12 | | |
| **Session 4** | **Semi-structured interview** | **90 minutes** |
| Interviewee 13 | Non-municipal public procurer 1 | Interviewees with specialized expertise in public procurement in the field of building construction |
| **Session 5** | **Semi-structured interview** | **60 minutes** |
| Interviewee 14 | Non-municipal public procurer 2 | Interviewees with specialized expertise in public procurement in the field of building construction |
| Interviewee 15 | | |
| **Session 6** | **Semi-structured interview** | **60 minutes** |
| Interviewee 16 | Corporation 1 | Specialized expertise in environmental compliance and cooperation with public procurers |
| **Session 7** | **Semi-structured interview** | **60 minutes** |
| Interviewee 17 | Corporation 2 | Specialized expertise in environmental compliance and cooperation with public procurers |
| **Session 8** | **Semi-structured interview** | **60 minutes** |
| Interviewee 18 | Corporation 3 | Specialized expertise in environmental compliance and cooperation with public procurers |
| Interviewee 19 | | |
| **Session 9** | **Semi-structured interview** | **60 minutes** |
| Interviewee 20 | Corporation 4 | Specialized expertise in environmental compliance and cooperation with public procurers |

## 4.3 Data analysis and interpretation

The phase of data analysis is to organize the large amount of collected data to create new and meaningful information of the topic at hand (Eskola & Suoranta, 1998). As interview as a qualitative research method aims at discovery of viewpoints, themes, and attitudes, also data analysis begins with the identification of the forementioned patterns in the data, called *inductive reasoning* (Hair et al., 2016). Whereas inductive approach aims at creating ideas based on the data collected, *deductive reasoning* begins with a presumption and theory followed by data collection (Hair et al., 2016). According to Hair et al. (2016), the process of data analysis begins with transcription of (video) files, then continuing to the thematical *coding* of the dataset, *data reduction*, and *data display*, and finally to the stage of *drawing conclusions*. The aim of coding is to reduce the amount of information to simplify the process of data analysis, to facilitate identification of the most relevant content (Bryman & Bell, 2011; Hair et al., 2016). Continued by Hair et al., data reduction is necessary in finding and managing the most relevant data that should be further emphasized and similarly finding the irrelevant parts of the dataset to be ignored. Once the most relevant themes and patterns have been identified, the phase of data display will help the researcher to find the linkages between the findings and existing theory.

The data analysis of this thesis study has been conducted through the *interpretive* lens that Hair et al. (2016, p. 297) describe as an "attempt to understand phenomena through meanings … rather than seeking an objective, bias-free reality". According to the methodological approach described above, the interview video recordings of this study were first transcribed. In the transcription phase the identification details of individual interviewees and their organizations were protected through *pseudonymization* where each was assigned with a code used in the analysing process by the researcher. The main themes and sub-themes of common interest were identified in the entity of the dataset by coding them to match each other in an Excel file. Afterwards the amount of data was reduced as it was found irrelevant from the point of view of the research questions or not matching the chosen thematic fields.

Discovery of the findings results in the phase where conclusions are drawn to answer the predefined research questions (Hair et al., 2016). In this study, conclusions were drafted already in the phase of data collection and finalized in accordance with the phases of literature review. Hair et al. suggest that the accuracy of conclusions is best guaranteed by using information from differing sources and approaches, and by crosschecking the dataset for verification. In the study at hand, information has been collected through existing policy documents, academic literature, as well as interview data of a varied stakeholder group to verify the relevance of different approaches and accuracy of data.

The data analysis can be biased if the researcher is not able to identify the most important findings for reasons such as unawareness in the subject matter and identification of an interviewee as an outlier or a pioneer (Hair et al., 2016).

As the researcher of this study has no prior expertise in the field of building construction, it is possible that some details under this theme have gone unnoticed. However, it is to be noticed that this study concentrates rather on the interviewees' perceptions on the introduction of carbon footprint calculation in building construction projects and governance of low-carbon transition instead of building construction procedures as such.

# 5 RESULTS AND ANALYSIS

## 5.1 History of guiding carbon footprints in the Finnish building construction works: regulation and public procurement

**Policy experts**
So far there has been no obligative national regulation on use of carbon footprint calculation in the building construction sector in Finland. By the interview of the policy experts, if the building construction sector chose to take climatic or environmental consideration, they could do so by voluntary measures, such as through standardized carbon footprint calculation methods or using commercial certification such as RTS, LEED or BREEAM. So far, certification has been used mainly for commercial buildings constructed for investors representing a small portion of building construction. Most of building construction is residential buildings in which the carbon footprints have not been calculated in any means. Some critical voices towards the use of commercial environmental certification systems were raised among the policy experts:

> *"Environmental certification systems are just a list of requirements, and the builders can choose what to emphasize. And in reality, the builders do not choose to use the most challenging criteria." (Interviewee 1)*

**Public procurers**
All public procurers agreed that previously the climate and environmental impacts have been addressed in public procurement mainly through use of energy and energy efficiency. Also demand for production of renewable energy has become topical during the recent years. The guidance has been carried out by tendering criteria in the procurement process or through instructions. Although reduction of greenhouse gas emissions, especially related to energy efficiency of buildings, has been guided by using instructions, including instructions on guiding carbon footprint or circular economy is still considered challenging:

> *"If we talk purely of carbon footprint or circular economy, that are relatively new concepts to consider, we still do not have a lot of concrete issues to include in the instructions. It is pointless to state that the expected result is as low-carbon as possible because it has no real meaning in the project. As soon as we get the concrete carbon limits or material requirements, we should be able to make the instructions more concrete." (interviewee 14)*

In general, instructions on project planning were considered having power in guidance because the applied requirements, such as carbon limits, are the same for all projects. The applicable level of carbon limits for different types of projects

has been tested e.g., through the RTS environmental management and the guidance tool for life cycle assessment by the Energy Wise Cities project (EKAT).

The Green Deals for reducing emissions at construction sites and sustainable demolition were also seen a way of addressing both climate and environmental impacts of public procurement. The green deals have been used or piloted by most of the interviewees and some have used bonuses to reach the goals and encourage innovation. Those interviewees having used bonus models, reported of positive outcomes. They also highlighted that guidance in planning, schedule-setting for tendering, and drafting the environmental plan for the construction site must be paid more attention to in the future. The contractor should be able to get a firm commitment from the subcontractor already in the tendering phase.

All of the procurers named guidance of the project planning as the phase where carbon footprint calculation can be utilized in public procurement both in in-house planning or as a purchased service. In this case, no carbon limits can be set in the implementation phase of the project as there the constructor implements the project as it is designed by the project planner and tendered out by the public procurer. In the tendering process of the constructor, guiding criteria can be set e.g., in setting carbon limits for product-specific materials. In tendering of projects that include both planning and implementation, emissions can be guided by setting a carbon limit as a minimum requirement that all tenders must achieve:

> *"Carbon footprint calculation has been used as comparative criteria in comparison of different constructors but based on the experience in some piloting projects it seems that a relatively tight carbon limit results in lower emissions than a comparison. When the planning responsibility is in the own organization, the planning group can take the solutions further and not all solutions have to be known in day one. In other project forms it is necessary to be able to state the goal in the very beginning in which case the constructors do not willingly go under or over the goal, depending on the goal, and only do what has been demanded on." (Interviewee, 4)*

Tendering of projects including both planning and implementation (*suunnittele ja rakenna, SR*) was considered challenging as no carbon limits have been set and still the goals are needed already prior to the project planning phase. In such cases some of the interviewees have first carried out a "light" version of the project planning phase before tendering the planning and implementation phases as a package deal. The light version of the planning has enabled analysis e.g., if the construction site is eligible for a sufficient amount of geothermal heating that then could be asked for in the tendering process:

> *"As there are cost pressures, such calls for tenders have been released that it would be nice if renewable energy was included in the tenders. In these cases, you know that you will not get any. Setting relatively tight carbon limits for the project to achieve seems to work better. Especially in SR contracts it would be nice that [companies] could present something innovative to achieve good results in cost-effective ways. Unfortunately, it does not seem to work that way yet." (Interviewee 5)*

Currently carbon footprint calculation to guide carbon footprints of public building construction projects is carried out in very different phases of planning and there is no one unanimous approach. Many of the procurers voiced that already now the calculation is scheduled to take place somewhat in the phase of the construction permit application as instructed in the upcoming Land Use and Building Act. In most of the organizations and projects the calculation has been done by an external consultant. However, many raised up an issue that due to budgeting reasons, the consultant has only attended the project in the beginning and therefore has not been around in later stages to make sure of the accuracy and feasibility of the calculations and planning. This problem was being addressed as many of the interviewed organizations were in process of tendering for a framework agreement in consultancy which is hoped better to address the issue and to bring the consultant into the planning group:

> *"So far the calculations have been done too late and as an extra task. In the future we are planning to tie the life cycle consultants in the projects already in the project planning phase in such a way that we can actively set more ambitious targets on emission reduction and to identify those stages where a certain type of project can achieve emission reductions. Integrating the life cycle designer into the planning group for the duration of the entire project is important". (Interviewee 13)*

Many different calculation methods have been used by the public procurers. Most of them have used the RTS environmental management system that utilizes the REM calculation method and they see many positives in use of the RTS system. It is perceived as cost effective, having a ready and comprehensive framework considering both environmental impacts and quality of the building from many viewpoints. All projects have not been automatically audited or certified, instead a project may be checked through different individual values, such as management of moist and cleanliness, assurance in functionality of building systems, many process-related phases, or energy efficiency. Only BREEAM was raised up as another environmental management system that has been piloted by some of the public procurers to gain understanding of its functionality. Using commercial certification systems was not seen necessary in a larger scale as there is no need for official certification of public buildings and construction projects. Also, in the case of BREEAM, the method was sometimes used in "shadow certification" to find out how well a project would comply with the requirements. All interviewed public procurers had piloted the national calculation method and its increased use was perceived topical as the new regulation emphasizes carbon footprint calculation over other environmental impacts. The national method was being used also to gain consistent and comparable calculation results for future needs, as calculation results of different methods are not comparable:

> *"Since the beginning of 2020, we have carried out carbon footprint calculation on every project with the idea to generate our own databank of the results and draw*

*our own carbon limits already before the year 2025. Still the calculations accrue quite slowly as quite many calculations per building type are needed to draw some conclusions." (Interviewee 4)*

All the procurer organizations had gained experience in carbon footprint calculation, although some of them were clearly forerunners. For example, one of the interviewed organizations was following the idea - also brought up by the policy experts – that calculations are done extensively in large projects and investments to compare options and to justify the best solutions. In this organization, information of a project's entire carbon footprint, carbon footprint per square meter, and the life cycle costs were collected and tabulated. They were also in process of calculating the carbon footprint of their entire property base. By making the calculations backwards, they said, would gain further information on use-phase impacts, material decisions, energy decisions, building's life cycle, etc. Accumulation of information would enable drawing conclusions on the cost effect of purchasing carbon neutrality.

So far, the procurement organizations had not systematically followed and verified the carbon footprints of the finalized projects. However, in some piloting projects carbon footprints had been calculated in many project phases. Dispersion of procurement in the chain of constructors was seen as a challenge in verification as the main constructor may not have access to all material and quantity information used by a subcontractor. To tackle this issue, the quality of information and means of collecting it should be decided already in the beginning of the project.

**Corporations**

All the business representatives interviewed agreed that, so far, efforts to address climate impacts have been made specifically by controlling energy during use-phase and improving energy efficiency. All the companies interviewed were committed to building energy-class A houses. Two also said they were using or planning to introduce use of an environmental system. Three out of four respondents also saw that in-service energy was still the largest the construction business was best placed to influence. The fourth construction company also considered use-phase energy significant, but as the sector has been working on the topic for so long, the respondent saw the form of use-phase energy as well as energy efficiency as a digested way of working, from which one should move on to developing of other aspects already. In terms of use-phase energy, all construction companies highlighted geothermal heating as the most significant opportunity to reduce emissions from use-phase heating. It was also being brought up that introduction of geothermal heating to the customer was easier as the price of district heating had been increased significantly. Two interviewees brought up that such economic justification of a lower-emission product for the customer is an important step in the low-carbon transition.

> *"Geothermal energy has an ecological nature but also the incentive related to the price development compared to district heating." (Interviewee 16)*

However, the businesses pointed out that the decisions affecting the emissions most are made at the design stage of a project. In this case, a company's ability to influence the project's emissions is mainly in those project forms in which the company makes its own plans. These include companies' own production and turnkey construction projects for public procurers. If a public procurer cares for the design phase itself and a tender is only for the execution of a contract, the companies consider having no real opportunity to influence project's emissions.

> *"In contract construction projects, all plans and product selections come directly from the customer. The role of the subscriber is significant in this matter, and the subscribers have also begun to be stricter on this issue, although in some respects it is still quite small." (Interviewee 17)*

> *"The contract construction projects do what the customer wants and the customer is willing to pay, above all else." (Interviewee 16)*

Overall, aspects of energy use seemed to be the most popular topic in the emission reduction toolkit for construction companies, e.g., in powering up the construction or demolition site, quality and quantity of used energy in material production, use of renewable or low-carbon energy in all phases, and use-phase heating source, such as geothermal. All in all, the companies thought that, in principle, a company has many means to influence the emissions of construction, but the distribution of the cost of influencing is seen as problematic.

> *"What I see here as a challenge is the 'vicious circle of blame' taking place in the construction industry i.e., there is always someone who says that yes, we can do it if someone else pays for it." (Interviewee 19)*

The interviewees said that in the chain of raw material suppliers, material suppliers, construction companies, and the customers, all explain to each other how they would manufacture low-carbon products if another party was willing to pay the increased price. One of the interviewees pointed out that the business case of choosing low-carbon materials instead of traditional ones is still lacking, unless it is linked to financial savings elsewhere, e.g., lowering lifecycle operating costs. Companies saw that the low-emission products would also need a financial incentive from the customer's point of view, and the responsibility aspect alone were not enough at that stage to convince the customers to use more money.

> *"I have not yet come across to any option in low-carbon materials that would be cheaper or even the same price as a traditional product. Of course, we have the profitability of the projects calculated based on the existing materials, so it is not just so simple that we can just change the material. The profitability calculations of the*

*projects must be renewed, and we can think of a way to negotiate a lower the price of the lower carbon product for us." (Interviewee 16)*

*"The public procurer sites usually have such strict boundary conditions that making an impact there is quite minimal. It is very unfortunate, but materials of lower carbon are still more expensive. Yes, we can do whatever the customer wants, but when we bring that option on the table and put the price tag on it, then that interest disappears at that point. They [materials]just are more valuable, so then maybe that interest in exchanging the materials will diminish a bit." (Interviewee 18)*

## 5.2 Future guidance of carbon footprints through national regulation: reform of the land use and building act

**Policy experts**

According to the policy experts, the greatest impact on the carbon footprint is achieved when it is considered in the very beginning of project planning, in the stage where implementation options are being weighed in the "raw level". In the phase of interviews, the national calculation method did not yet enable this in a detailed level. However, weighing options to each other is possible to some level even without exact calculations as the carbon-intensity of different building methods are known. The best phase in achieving the most accurate results of carbon footprint calculation is after the construction project and the actualized decisions on the construction materials and methods are known. From the regulation viewpoint, however, the best phase to carry out the carbon footprint calculation is the stage of construction permit application. In this stage not all information of construction methods and materials is known exactly, and estimates must be used. Still, they are on an adequate level to guide emission reduction. According to the policy experts, the upcoming regulation in Finland will focus on guiding the climate emissions and include other environmental impacts in the next phase.

In the development process of the national calculation method, the construction companies have been involved through piloting projects. The information has been used to further develop the calculation instructions to meet the needs of different users. The companies have also been heard in reference to limitations in emission data availability. In cases where the data availability is limited, "shortcuts" such as table values (and other ways to assist assessment) are being provided. The method also enables its' use for voluntary calculation and emission assessment beyond compliance, e.g., in emission-free construction sites.

The carbon footprint calculation for the climate declaration will be carried out by utilizing emission data either from the emission database created by the Finnish Environment Institute (CO2data.fi) or of environmental product declarations. Emission data of building systems has significance but is difficult to know/have the information early in the planning phase. This data is expected to apper in the emission database. The same applies to the life cycle stages with low

dominance, such as construction process, transport, and deconstruction where values based on square meters are being developed. Due to the EU principles for free movement of goods, it is not possible for the method or the emission database to favor domestic goods. Therefore, the carbon border adjustment mechanism (CBAM) is expected to address the issue of material-related emissions.

The policy experts pointed out that developing both the calculation method and the emission data would have been impossible in term of resources if the entire building construction sector was not onboard. The sector has widely been included in development through piloting projects and feedback of the usability as well as of the accuracy of emission data. Especially when every business views their own product categories a bit closer:

> *"The building construction field is still debating what are the "right" and "wrong" methods and emission data. Once the finalized method is available, the debate will end, and action will start." (interviewee 1)*

The policy experts agreed that the verification of calculation results is important to guarantee veracity. The method of verification has not yet been decided on and it is in process led by the Ministry of the Environment. The options are to check all calculations by machine or human work, test by random sampling, or to trust law-abiding action and not to check any.

**Public procurers**

As the first draft version of the national method has been available since 2019, it has been tested by the public procurers, in which the opportunity of getting prepared was considered important. Experience of calculation has been gained through piloting projects to facilitate capacity building for the future regulative guidance and climate declaration. The regulation reform is also considered to alleviate the work done as when taking force, it will be equally binding to all operators. Intention of going beyond compliance was also voiced in the interviews:

> *"Even though the national calculation method combines the emissions of materials and use-phase as one value, still it is likely that we will divide it in two in a way that there will be different carbon levels required for the building-phase and the use-phase. This is done so that one could not be used to compensate another and to maintain an adequately ambitious level for both." (Interviewee 4)*

**Corporations**

The interviewed companies saw regulatory guidance mainly as a good way to control climate emissions. However, there are several concerns related to e.g., boundaries of calculation, setting carbon limits, calculating the carbon handprints, consideration of the whole life cycle, determining the life cycle length, and valuation of materials to each other, such as concrete and wood:

*"Yes, I think regulatory guidance is a good thing to pursue. Still, when a new practice is made for a whole industry, there are challenges involved." (Interviewee 19)*

*"It will be quite a good method to find out where those emissions come from. However, the whole picture of the whole life cycle should be considered and reflected on the fact that the emissions of a certain material alone does not yet tell everything. For example, some insulation material that is lower in carbon may have poorer thermal insulation and the house needs to be heated more. And then more energy is spent, the building may end up with a bigger carbon footprint." (Interviewee 18)*

*"There is a lot of disagreement about this, ambiguity in the climate calculations and the related background twist, e.g., in concrete vs. wood construction. The comparison between wood construction and concrete construction is not in the level where the whole life cycle from cutting the trees to the carbonization features of concrete would be included. Then this life cycle length that in such climate calculations can have a significant effect on, for example, which building material or method is the most environmentally friendly. As soon as these emphasis issues and emission factors are in place, and focus brought to the entire life cycle, it probably is a good way to promote this issue and to make the companies think about it." (Interviewee 17)*

All companies said they have started lowering their carbon footprint in their own building production. Some of the interviewed companies performed the calculations inhouse and some through purchased consultancy services. All companies stated that the calculations were performed using the national calculation method. Although not yet required by law, companies have seen it as important to start accumulating both accounting skills as well as gathering information on where the emissions effects of projects come from and where they can best be influenced. Special attention was given to Ministry of Environment's inclusive way of working, in which companies have been able to comment and influence the development of the method. Companies have provided opinions on different versions of the methodology, either directly or through the Confederation of Finnish Construction Industries. For contract construction projects, none of the companies performed calculations systematically, but it was being planned. The debate was whether the calculations are the responsibility of the construction company or the customer for the contract construction projects.

Concerns of the calculation method and the climate declaration were related to the verification method, which had not yet been decided on. One company representative pointed out that also a person performing the calculations for energy consumption (E figure) is required to have certain qualification. Two companies raised licensing as an important form of verification. Companies are also pondered on liability issues in case the calculation does not correspond to reality:

*"I am a little annoyed by the fact that there is no qualification requirement – anyone can be considered to have done the calculations for a project." (Interviewee 16)*

The setting of the carbon limits related to the climate declaration was considered to have an impact only if the limits are strict enough and keep getting stricter:

> *"The carbon limit is one good way. We have not taken a stand on if it is good or bad, but it would make it clearer, not to the ways of how to achieve it, but it would be up to the supplier to determine the solutions to achieve it." (Interviewee 18)*

> *"I am afraid that those limit values will be very nominal to make a real impact in the sector. That they are made so loose that they do not pose too many challenges to the companies, but also that they do not take the sector forward enough. I think it would make sense for the limit to be tightened every two years or so. There we would have a clear starting point and a long-term view of how the companies should evolve over the years." (Interviewee 19)*

Companies also pointed out, on request, alternative ways in which the low-carbon transition could have been approached. As the most important thing, guidance over the low-carbon materials was raised into discussion. The interviewees thought that considering the multiple requirements already existing in the field for the construction companies, material producers should also be addressed in guidance. Alternatively, the material producers should take more voluntary responsibility over the low-carbon transition of their field:

> *"I have given some thought about whether we would get to the same or very similar results, if we had more requirements for the producers of building materials… It is not working right now for the constructor to have those reduction requirements and then the building material producers will be able to technically implement those lower carbon materials, but then they ask more price for it. Either because they cost more or because they can put a bigger price tag on them as they know that the constructors are under these requirements." (Interviewee 16)*

> *"The cavity slabs of lower carbon value are 15-20% more expensive than the regular ones. That a company would voluntarily switch to a 20% more expensive cavity slab is a pretty big threshold for many companies. The development could be guided so that it is mandatory to use them [materials of lower carbon]." (Interviewee 18)*

## 5.3 Future guidance of carbon footprints through public procurement

**Policy experts**

The policy experts saw public procurement as an important way of guiding carbon footprints also in the future, especially providing for the process of capacity building. Prior to the new legislation to take force and introduction of the new

carbon limits, the policy experts saw multiple possibilities for the public procurers to influence the emission guidance. Procurement and tendering of design services was seen as an affordable phase compared to the construction phase. Designing and comparing of alternative approaches hold great liberties:

> *"Procurement and tendering of design services. A lot of comparisons can be requested to be done which is an affordable phase of work compared to the costs of the actual construction works." (Interviewee 2)*

The carbon footprint of a construction project is being defined already in the project planning phase. Where tendering covers the construction works phase only (*urakkakilpailu*), criteria related to carbon footprint calculation has no relevance since the (material and building method related) emissions have already been determined during the project planning phase. Once the regulative carbon limits are set, the work of public procurers becomes easier. At that point they will be able to use the regulatory carbon limits or set a lower limit beyond compliance, as a choice. The carbon limits will also enable finding sets of choices on different building types to result in carbon savings.

Consideration of the service network design and reconsidering if to build or to renovate was seen as one way to consider creation of emissions. In the discussion it was also raised up if a public procurer could demand detailed information of calculations and values as a part of tendering. Gaining such information would build on the procurers' capacity and enable recalculations to improve the procurement process for the future:

> *"In this phase, the procurers should demand for more raw-level data of the methods and emission values used in the construction project calculations to gain information and to facilitate setting carbon limits for the future." (Interviewee 3)*

The final suggestion raised by the policy experts was to encourage the businesses in finding innovative solutions in projects including both design and construction phases. As a best practice example, the design competition of the Finnish-Russian School by the Senate Estates was raised.

**Public procurers**

According to the public procurers, guiding the carbon footprint and circular economy were seen as the most topical issues to address in public procurement. Also, the origins of energy was given more attention and options of increasing sources of renewable energy in construction projects was being mapped:

> *"The goals of carbon neutrality and the price of district heating are driving us to consider new energy solutions. Pits of 300 meters deep are no longer sufficient in geothermal heating and now we are considering those going as deep as one kilometre." (Interviewee 14)*

Looking beyond the regulative guidance of carbon footprints, material-related emissions were seen as the next step in the work of reducing emissions, although the work was still quite in the making. All the interviewed organizations had their own roadmaps or targets for circular economy, still reuse of materials was seen as a new approach, and it would take time to set related requirements:

> *"As we gain more concreteness in the area of circular economy, we will take them into our planning instructions and requirements. … The statutory level is required to the minimum but as we try to go beyond compliance in all of our doing, so we will do in this issue as well." (Interviewee 4)*

> *"Always our organization has tried to go beyond compliance, and we will do so in this case, too." (Interviewee 5)*

So far, reuse of materials was seen as greatly challenged as often they do not fulfil the quality requirements, nor do they have a CE marking. Instead, the materials including some recycled material mainly carry the CE marking:

> *"Circular economy is tightly related to our carbon neutrality strategy, and we see it as one possible tool in reducing emissions. We should aim for resource efficiency by reusing old building elements and old furniture and not to buy new ones automatically. However, it has shown to be challenging. One aspect is to improve sorting and recycling and thereby increase the recycling rate." (Interviewee 13)*

Also, consideration between the options of whether to build new or to renovate was seen potentially having great impacts, although it is not always possible due to the changed needs or requirements for their use.

The cities owning land were also seen having possibilities in implementing large guiding methods through setting conditions in plot transfer. Such conditions could include e.g., increasing the amount of wood-based building construction on certain areas, carbon footprint calculation results, or guidance in price, quality, and sustainability as criterion.

**Corporations**

All the interviewed companies had participated in public procurement tenders and, as a result, had also met a few climate and environmental procurement criteria set by the public procurers. However, all interviewees specifically mentioned that the criteria met were by no means extensive and did not include anything that would have made tendering impossible, besides the requirements related to timber construction. The criteria most commonly encountered were related to recycling of waste, circular economy and environmental friendliness of construction equipment. In addition, quality criteria related to the carbon footprint and E figure had been included in the competitions over plots. As the most ambitious projects encountered, two are being mentioned in discussion: the City of Helsinki's low-carbon green block project (*vähähiilinen viherkortteli*) and the

Ruskeasuo tram depot project (*ratikkavarikko*), in which there were plenty of evaluation points tied to e.g., the carbon footprint, the green factor, and energy efficiency. Criteria tied to the carbon limits had not yet been met by companies, whereas if the carbon footprint calculation had been used as a criterion, the best score was given to the tender offering the lowest carbon footprint:

> *"In the tendering, there may be a desire for a circular economy perspective and what this project could do to promote the construction circular economy. I think it has rarely gone from there to requesting for some certain measures, instead asking for what the company would do. And I think they pretty much accept all these different waste sorting, recycling, and reduction suggestions." (Interviewee 16)*

The interviewed companies pointed out that choosing the right solutions can lead to lower carbon values on calculations, thus implementation of these solutions can ultimately prove out costly to the customer. The companies brought into discussion their observation that the public procurers do not always carry out the projects as planned due to the final price tag of the solutions of lower carbon:

> *"A client may have ambitious carbon neutrality goals and they know in theory how to get this done in construction projects. They try to bring these methods into these contract construction projects and then they may be very surprised that it actually costs 20% more to accomplish the things they asked for." (Interviewee 16)*

The interviewees point out that the public procurers are now strongly in favour of using wood as building material. Two of the interviewed companies offer wood-based products, two do not, but in all companies the popularity of timber construction is perceived as problematic. The requirement for timber construction is perceived as problematic, as it is not in line with everyone's strategy, so it excludes certain companies from competition. On the other hand, the brisk push from the public sector has also led companies to investigate the matter and explore if there could be an interesting market for them. Another criticism raised by the companies is related to the life cycle emissions that they feel are not considered sufficiently when comparing construction of wood and concrete:

> *"It's a bit painful. Is it really the best way for the customer to tell you what exactly the measures are that you need take to cut the emissions or would it simply be better for them to tell you the limit to go under and then you can decide the measures on how to get there. The tendency seems to be so strong that either you agree on construction of wood, or you cry and agree on construction of wood." (Interviewee 16)*

> *"I am not astonished of the hype around the timber construction as it has been strongly lobbied. … I see it problematic that they require some specific solutions and not so much that they would declare the environmental impacts the project should achieve. For example, if it is required to build wooden apartment buildings, that in turn, narrows the field quite a lot. More should be done to justify what*

*impacts are pursued with that wooden apartment building, because all those effects are also available with other solutions. … If the tendering was not based on pre-set solutions, it would allow more companies to take part in it and allow the companies' own innovation to take place." (Interviewee 18)*

*"The City of Helsinki developed a project like this, which is specifically structured of wood, which made us back away from it. Overall, however, our approach to reducing emissions from construction is material-neutral. I see that all materials have certain challenges from the point of view of their overall responsibility, and in a way, it would make the most sense to construct long-lasting buildings with the least possible environmental impacts. For example, the concrete industry is now developing at a rapid pace – what innovations are coming from there. And an awareness of the real climate impact of wood use in terms of raw material sourcing. All in all, we hope that the public procurer would not favour some material over another, because it does not necessarily mean that the material itself will solve the real emission reduction." (Interviewee 19)*

Controlling emissions of a construction project either through requirements of public procurement tendering criteria or performance bonus models receives twofold feedback. The role of public procurers in driving change in the sector was considered important, but attention was drawn to the fact that if the difficulty level of projects is to be taken too far, amount of tenders would decrease, and the cost of projects would increase. However, setting and discussing climate goals for projects and making them clear and transparent with the various parties involved in the project was seen as a key objective:

*"I think that the public procurers have a big role to play in being a pioneer and a leader in managing climate responsibility. I also think that the bonus models can encourage the contractors to perform." (Interviewee 19)*

*"At the moment, perhaps partly due to the market situation, public construction may not be as attractive as in worse times. If companies have their hands full of their own construction projects they may not be the first to offer in public construction that comes with some additional difficulty levels attached." (Interviewee 17)*

*"All requirements should come as a selection criterion rather than through a bonus scheme. Alternatively, if you want to keep it, then the bonus should be pretty significant to motivate you enough." (Interviewee 18)*

## 5.4 Businesses in the low-carbon transition

**Public procurers**

As the public procurers stated their cooperation with the business sector, great variation was seen. Some organizations had cooperation beyond compliance, some had a discussion connection e.g., with suppliers of materials and equipment of new upcoming products and solutions, and some had no connection with the business sector beyond the official process of public procurement. Market dialogues following the official process, however, were followed by all interviewees. As the market dialogue framework follows the Act on Public Procurement and Concession Contracts, it was considered a "safe" tool where no head start is given to anyone by mistake:

> *"When radical goals are being set, the preparedness of the business field must be mapped out to gain tenders in the procurement process." (Interviewee 13)*

The market dialogues have taken place, for example, in assessment of cost impacts of the green deals, in development of carbon footprint calculation and life cycle costs, in projects of circular economy, and in the tendering processes of the consultancy framework agreements. Even though the market dialogue was considered as an important tool in the official public procurement, its effectiveness was not considered functional. The experiences of the public procurers were unanimous: the businesses did not participate the discussion during the market dialogue events. Queries in writer format gained more answers, instead:

> *"The market dialogues remain in a pretty general level. Those who participate, do not make many suggestions. They lurk who others are present and prefer to listen rather than talk." (Interviewee 14)*

> *"In a general discussion where the participants are expected to comment in front of everyone, it is not necessarily the way [to get suggestions]. When an opportunity for written commenting is given, it is much more efficient." (Interviewee 7)*

Some public procurers sent out questionnaires to construction companies and developers also beyond the official market dialogue framework to map their capabilities and opinions. Some SR projects have included consultation procedures where the tenderers have had a possibility to make questions of the procurement, the process and the criteria. In such a case, one public procurer had noticed that carbon limits set for the project were not commented on, instead the questions received were related to the use of the calculation method. A corporation can comment on the procurement criteria also after being selected as the contractor, which was raised up as one option for cooperation between the public procurer and the business sector. This applies to the projects where the contractor enters it already in the planning phase (e.g., SR) and can provide valuable information for

the public procurer to use for remodelling the process for the future. Also providing training was seen as a form of cooperation.

When the public procurers were asked of their opinion on the necessity of external (public) guidance in the low-carbon transition, all interviewees were convinced of the importance:

> *"It [a market-conform transition] would require so much demand, that it would automatically guide the emission reductions. Probably that happened to some extent, too, but traditionally coercive means are necessary at the construction sector to get everyone to do something, at least." (Interviewee 13)*

> *"If the procurement unit does not set the criteria, who would tender for something that makes the investment more expensive. It must come through regulation and demands of the procurement units." (Interviewee 7)*

> *"Currently it is difficult to tell what and how much the market can be asked for. It is a hen-egg-setting. If we do not demand, no markets are established. And as the markets are not there, we do not know what we can order for." (Interviewee 14)*

Answers to the question if the public procurers have experienced business proactivity in making suggestions in low-carbon transition or gaining savings in emissions, the replies were similar:

> *"I have not personally faced such innovativeness." (Interviewee 7)*

> *"I have not faced, nor have I heard that someone else had faced such yet." (Interviewee 11)*

Also, positive tones are being raised:

> *"As I have discussed with some businesses in the construction product industry or manufacturers of building elements, they see having an environmentally friendly product as a clear competitive advantage even if it was a bit more expensive. We want to support [this development] and the procurement should be lined to favour products of lower carbon emissions." (Interviewee 14)*

**Corporations**

All the interviewed companies had participated in a market dialogue organized by a public procurer and saw the market dialogue as an important means of interaction. The debate was seen as particularly important because public actors' own carbon neutrality goals were seen as guiding action in a way that was not always appropriate or feasible from a business perspective. It was precisely the increase in common understanding that companies expected from market dialogue in order to make the conflict between the good goals and the realities of real life visible and to narrow them down. One company was looking forward to

a public procurer, for example, to carry out an advanced circular economy pilot project in which working together could increase common understanding:

> *"The City of Helsinki would like to implement all its own construction sites in a low-emission or even zero-emission style. And this, if I understand it correctly, is not a reality by no means. We talk a lot about whether we have tower cranes that run on electricity, for example. I guess they exist, but the cost is crazy. These kinds of issues come up in those dialogues which is very important." (Interviewee 16)*

> *"There they have asked us what a certain approach would cause and whether it would be possible to accomplish. And then they have been told that yes it can be accomplished, but it costs money. In the example of construction machines, electric machines are not yet a reality. But changing fuel to a greener one means the fuel being more expensive and thus the hour of operation of the machine becomes more expensive, the offer becomes more expensive, the end product becomes more expensive." (Interviewee 17)*

> *"For example, the city planning regulations may require significantly worse solutions from the point of view of emissions for pure outlooks reasons. For example, some metal facades or masonry facades or such are required, that in turn are not holders of the lowest of carbon values of these facade options." (Interviewee 19)*

None of the business representatives interviewed, based on their own experience, shared the view and experience of the public procurers that companies would not participate in the market dialogue. However, upon request, they brought up possible reasons behind the experiences of public procurers. One of the interviewees suggested that the market dialogue could be organized in a different way, e.g., through a written procedure, to avoid companies feeling that they might reveal their own competitive advantages in an open discussion event. Another interviewee described the building construction sector as a "traditional" sector, where the perspectives on sustainable development are relatively new and raised up an associated problem of negative attitudes as a key challenge. The interviews also highlighted the valuation and appreciation of sustainability perspectives in the company's internal culture, which is how the people taking part in the events are selected: companies should consciously send people who know how to raise up the issues related to sustainable development in discussion:

> *"Now that sustainable development has an instrumental value but still does not have an intrinsic value, then perhaps we will focus on it now. But we still have a lot of attitude problems within the construction projects." (Interviewee 16)*

All interviewees saw regulatory guidance necessary in the low-carbon transition. This was justified in particular by the need for uniform requirements, as not all actors in the sector share similar views on responsibility. The lack of coordinated control affecting all actors equally puts the so-called voluntary operators in an

unequal situation in a pricing competition. The development of the national calculation method was seen as a possible stumbling block, as only its passage and therefore use as a commonly accepted calculation method will facilitate equal treatment. Some companies also raised up that a transition of a too fast pace should be avoided so that the costs associated with new requirements would not borne by the customer all at once:

> *"Yes, in today's world, where we talk about responsibility and environmental values and use them as marketing tools, we would go in that direction on our own, too. But legislative guidance will help and speed things up." (Interviewee 17)*

> *"Guidance is absolutely necessary, and especially now that it brings more costs, many do not voluntarily start to think about it if it does not come from the side of guidance." (Interviewee 18)*

> *"I definitely see the need for regulatory guidance in low-carbon transition. ... It will lead to the situation where those who set out to do the forefront of things and develop their own operations can gain a competitive advantage from it. But that such an arrangement would be entirely due to companies wanting to be responsible, I would see that change would be much slower." (Interviewee 19)*

One of the interviewees pointed out that the company would not be able to achieve the climate goals it had set for itself without the cooperation of its material suppliers. Some material suppliers are pioneers who also have their own goals, but according to the interviewee, the smallest suppliers also need to be awakened to development. The company pointed out that as a socially responsible player, their role is to push the smallest players to development, as staying put would mean falling out of the market.

All companies said that they were taking voluntary measures in emission reductions, and the reason was e.g., external pressure from stakeholders, customers, and employees. As the most important voluntary measure, all companies pointed out the decision to build only houses of the energy-class A. Preparing for the requirements of regulatory guidance, especially regarding competence in carbon footprint calculation, and thus collecting accounting data for the development of one's own operations, was also seen as a voluntary measure. The provision of geothermal sites, for example, was also highlighted when discussing voluntary measures.

To the view raised by public procurers that companies are reluctant to come up with voluntary solutions to achieve emissions savings, companies responded that sustainable solutions are new to companies, too, and therefore not yet commonplace and established procedures. Awareness and knowhow of new solutions may not yet be at a high level at different levels of the project, which may also lead to negative attitudes. On the other hand, one interviewee raised up that some projects were looking to raise the level of ambition to stand out from the competition:

*"By doing things the style in which our machinery is already tuned, it is probably where the best benefits come from. We are ready to design and review and offer new solutions, but I don't think that they will come without asking for it." (Interviewee 16)*

*"When the solutions are not familiar, they are considered to be a greater threat than they really are. Many solutions would be relatively cost-effective and easy to implement, but since there is no awareness of it and no experience, then there is a high threshold to start proposing them and trying them out. … No industry is as old-fashioned as the construction industry. Doing as always has been done – it is still of pretty standard response in the field." (Interviewee 18)*

# 6 DISCUSSION

Momentum for the sustainability transition is building - not only because of the IPCC reports and the Paris Agreement but also national political will and related policy work that are clearly pointing out the path and will of the society to engage in a sustainable future. The approaching momentum is gradually forcing the businesses to see that change will be needed to comply with the new requirements of the new system. Simultaneously, the same development gives the corporations a vision of the future system and gradually makes them trust in the direction of change and to build confidence on making the necessary investments to comply with the new, foreseeable system.

For this study, three groups of experts - policy, public procurement, and building construction corporations - were interviewed to map their perceptions over the stage of the low-carbon transition in the Finnish building construction sector. The main aim of this study was to map the current scene of low-carbon governance and the perception of the stakeholder groups over the importance of different modes of governance for the sustainability transition to take place.

Through the literature (e.g., Finnish Government, 2019; ME, n.d.-e; MJ, 2021) and the interviews of the policy and public procurement, the findings were that 1) the Ministry of the Environment in Finland is in process of developing a new carbon footprint calculation method as well as constructing an emission database in cooperation with the Finnish Environment Institute to work as the basis for and in cooperation with the new Land Use and Building Act aiming to reduce carbon emissions of the building construction, and 2) the public procurement in Finland is gaining importance in the low-carbon transition process and the public procurers are building up their capacity as well as collecting data through experiments and pilot projects to comply with the new upcoming regulation. Based on the multi-level perspective (MLP) framework as well as the interviews, the main findings of the study show that all stakeholders interviewed perceive the new upcoming regulative governance and the related carbon footprint calculation method as the key for the transition to occur. However, as the calculation method as well as the new Land Use and Building Act are still in the making, the consensus of many aspects of the calculation boundaries is still missing. One of such disagreements is around wood-frame construction as the construction corporations see problems in the life cycle calculation boundaries compared to other frame construction materials, e.g., concrete. The main findings are reflected upon in more detail in the following.

## 6.1 History, present and future of low-carbon governance

The study was to map the current state and foreseeable changes in the governance over the Finnish building construction sector towards the national and regional low-carbon goals. The focus was put especially on the governance of regulation as well as public procurement, thus aligning the perspective of the interviewees.

The findings based on the literature (e.g, Bionova, 2017; ME, n.d.-d) and the policy expert interviews state, that currently there is no national legislation to guide the carbon footprints of the building materials and structures/frames of new buildings. However, the Ministry of the Environment in cooperation with the Finnish Environment Institute and various other stakeholders, such as public/regional organisations, NGOs, building construction corporations and organisations presenting their joint interests, is in process of preparing a joint method for calculating carbon footprints in the sector. The method is bound together with the emission database, and once completed, introduced as a part of the reframed Land Use and Building Act. The law will be supplemented with authorization/mandate to issue a decree (*asetuksenantovaltuus*) to facilitate setting of carbon limits for construction projects and the necessary amendments to the limits. The law is expected to take force by 2025, thus due to political disagreements, the passing of the law may be prolonged. The first version of the calculation method was published in 2017 after which it has been put in use in various piloting projects to gather knowledge for the Ministry of the Environment to further develop the method as well as to build up data for the use of individual municipalities or corporations. The work aims at building up the stakeholders' capacity in carbon footprint calculation before the regulatory governance takes force.

Regarding the governance through public procurement, the findings show that the carbon footprints have been guided especially by addressing use of energy and energy efficiency using instructions, tendering criteria, and environmental certification of RTS as the tools. Especially instructions were considered useful and functional as they addressed all projects and contractors alike. However, due to the novelty of carbon footprint and circular economy viewpoints, public procurers said they still were lacking sufficient data to draft the new instructions accordingly. The limited availability of carbon data also was considered to limit the possibilities of using carbon limits as procurement criteria, at this point.

The Ministry of the Environment's Green Deals for reducing emissions at construction sites and sustainable demolition are also tools that are aiming to help reduction of emissions and to assist all stakeholders to consider these aspects in their projects already prior to the new regulation. All the interviewed public procurers were familiar with the Green Deals, and most of them had already utilized the principles of the green deals in their construction projects. The green deals have been taken into the action pallets e.g., in the City of Helsinki, to

pave the way towards their goal of carbon-neutrality. However, the interview findings of the corporations show a different viewpoint. The corporate interviewees point out that public procurers sometimes have unrealistic expectations towards the available machinery, such as electrified vs. gasoline fuelled, and the related cost effect which may result in incapability of meeting the procurement criteria.

Both the public procurers as well as the corporate representatives find the market dialogue as an important tool in finding the common ground in order to reach the best possible result, however, the methods of market dialogue are found ineffective which should be addressed by both parties in the future. As to the Finnish Government's (2019) program, the public procurers have strong guidance and mandate from the strategic level to participate in and contribute to the low-carbon transition through public tendering and procurement. The importance of market discussion as a tool for governance has been identified, as well as the need to strengthen the employees' qualification in carrying out and facilitating this discussion (e.g., City of Helsinki, 2021). The same need for market discussion procedure improvement was raised within the corporate representative interviews in the context of better gaining common understanding as well as reaching the feasible methods on the options of working towards the low-carbon and other environmental goals set by the society. Both interviewed groups having identified the market discussion important as well as in need for improvement, it would be recommended to look for solutions that emphasize co-evolution and learning in creation of acceptability and engagement in changing the ways of perceiving and doing things.

All interviewed parties identified the project planning phase as the key point where the project life cycle emissions are determined. So far, the life cycle carbon emissions have not been addressed through governance. As the renewed Land Use and Building Act takes force, this aspect will be covered by regulation. Until then, it is up to the public procurers to act in which the necessity has been identified, as suggested by the interview data. The forerunner public procurers were in the process of tendering for a framework agreement in consultancy in which a consultant will be involved in a construction project from the planning phase to updates and the end of the project. Due to the novelty of the carbon footprint calculation field, all levels of all organizations were still lacking capacity and know-how and strengthening of these skills is expected to take some time. The corporations also pointed out that due to the *traditional nature* of the building construction sector, time and education will be needed for the attitude-change to occur. The corporations must also pay attention to prioritization of values e.g., in selecting representatives of relevant expertise to participate in the market discussion events of public procurers.

## 6.2 Role of governance in transition actualization

As established above, the overall momentum for systemic change towards sustainability is building, which again creates opportunities for the niche innovations to break through the regime level and knock out its equilibrium. However, the interview findings of this study show that all the interviewed stakeholder groups – intriguingly also the corporate representatives – agree that the current state of governance is not yet sufficient for the construction sector to reach the edge of equilibrium, thus the regulation raining over all stakeholders is needed. The policy experts and the public procurers, representing the side of public policy, all agreed that regulation binding all corporations alike is needed for pushing change in their action towards sustainable procedures. However, approach of the corporations differs as they lay their groundings based on business arguments. According to the construction companies, the low-carbon materials are more expensive therefore resulting in a higher price in project tendering. The construction companies argue that as the customers, ultimately also the public procurers, decide on the winning tender according to the price instead of its sustainability aspects, including the low-carbon materials and working methods in the project, which may result in an uneven competition between the corporations. Therefore, they say, a law binding all stakeholders - competitors and customers alike - is needed for the transition to be speeded up.

In accordance with the MLP framework used as the theoretical starting point, the both interviewee sides - the public sector as well as the construction business - are members of the club regime that is defined to resist change. They are both also holders of aces what comes to the opportunities in destabilizing the regime equilibrium for the transition towards a more sustainable one. The public procurers destabilize the regime by demanding low-carbon procedures, still resisting change by rejecting the higher price related to the low-carbon materials. The corporations participate in the regime destabilization by participating in the piloting projects and by contributing to the carbon footprint calculation method development. Still, as established above, one of the business-driven factors keeping up regime resistance and lock-in is the debate over the increasing costs caused by the transitions that are inevitably related to the corporate competitive edge of survival and profit-seeking. The corporations also point out that in the current draft model of the new Land Use and Building Act, the obligation of carbon emission reduction falls on their area of duties, whereas the product manufacturers remain uncontrolled thus they are the ones gaining the potential competitive advantage and increased value resulting of the change.

Drawing from Rotmans et al. (2001), policies supporting transitions gain support of the stakeholders if the decision-making has been carried out in a participatory manner. The results of this study show, that the corporate sector has considered as highly positive being involved and heard in the method-creation and regulation-preparation processes. Therefore, the transition vision has

reached the corporations and they have been able to impact on the path-formulation. If the passing of the Land Use and Building Act is prolonged (or ultimately knocked out), the Ministry of the Environment has been able to disseminate knowledge to the stakeholders which, taking into account the co-learning as well as learning-as-doing and doing-as-learning aspects of transition governance, has already fostered the transition process forward. With this governance model, very similar to the Transition Management (TM) Framework, the Ministry of the Environment has been able to bring a colourful crowd of stakeholders to the same table and to engage them in cooperation that may result in an entirely new carbon footprint calculation method that is both applicable as well as accepted in the field of Finnish building construction.

The calculations using the (preliminary) method has been practiced by the field since 2017 which has resulted in building of knowledge and capacity across the sector. Within the interviewed stakeholders, various different carbon footprint calculation methods have been piloted. The methods were found to be based on somewhat different procedures and emission data, therefore resulting in different and incomparable calculation results which is a significant reason for the sector to support the acceptance of the national calculation method as a part of the new Land Use and Building Act.

As identified from the interviews, the niches in the Finnish building construction sector are the new low-carbon materials (by the material producers) but also the innovations in working practices (such as use of renewable energies) and investments (e.g., in in-house knowledge capacity). The interview results show that whereas public procurers find lack of innovativeness and pro-environmental behaviour in the actions of the corporations, the corporations on the other hand find inflexibility in the action of public procurers resulting in inability to demonstrate new innovative approaches. The corporate opinion is based on the issue of wood construction. The public procurers view wooden construction as an important method to radically reduce carbon emissions of the building construction. Brought up in the interviews, corporations disagree on the carbon footprint calculation of wooden constructions and argue that also other methods of construction in reaching the same results are available. They continue that instead of locking the wooden construction as the only low-carbon option already in the beginning and rather by simply defining the desired climate or environmental effects, the corporations would be able to innovate new ways to reach the desired goals. Drawing on the results of both public procurers and corporations, the introduction of the carbon limits alongside with the Land Use and Building Act would serve the perceptions of both stakeholders.

Due to the strong support by the Finnish Ministries and policy frameworks towards the wood construction, it is evident that the public policy is protecting wood construction as a niche. Similarly, as discovered by Vihemaki et al. (2020), the results of this study show varying perceptions over the low-carbon qualifications of different types of construction materials, and the reluctance of the construction industry to engage in wood construction. Interestingly, Toivonen et al. (2020) found in their study that the 'WMC-negative' corporations

(*wooden multistorey construction*, *WMC*), mostly represented by those businesses not engaged in wood construction, questioned the sustainability and climate benefits of wood construction. Although, sustainability and climate benefits per se were not addressed in this Master's Thesis, the interviewed corporations (including those engaged and not engaged in wood construction) can be viewed opposing wood construction demands by the public procurers. Their opposing claim was based on the boundary-definition of wood in carbon footprint calculation which they claim not to represent the true lifecycle of the material. Put in other words, the corporations resist the current way of calculating the lifecycle carbon footprint of wood as building material which to them does not reflect the true emissions of WMCs compared to other materials. The interviewed corporations not engaged in wood construction do not consider the current financial incentives adequate so that operations should be expanded to cover construction of wood. Similar to the findings of Hurmekoski et al. (2018), the findings of this study show that the corporations call out for opportunity for innovation in finding the solutions instead of predefined ones. In line with their findings, also the findings of this study indicate strong support for obligation-based, regulatory norms in order to speed up the change process.

Therefore, regarding the wood construction it seems evident that the corporations are not onboard with the vision of WMCs thus public procurers lack the support of this stakeholder group which emerges in low numbers of tenders on such procurement tendering rounds. Considering the positive perceptions the corporate representatives have on the development of the national calculation method as well as the upcoming related regulation, it can be asked if the public procurer could turn to the inclusive working methods utilized by the Ministry of the Environment in their work.

The low-carbon transition of the Finnish building construction sector is rather young. According to the study results, the work of carbon footprint consideration at the levels of public procurers as well as the corporations dates back only from recent times up to a few years. This stage of transition where e.g., the attitudes, skills, and technologies of all levels are being developed is crucial for the transition to set footage. To support the transition, according to Grin et al. (2010), supporting variation of possible niches in the pre-development phase for the regime to make its pick (selection) is important. Drawing from this perspective, it is necessary to bring up if the public procurer should define the very niches to support in search for the lowest carbon footprint or if the variation of niches should be protected for the regime (and landscape) to make the pick in accordance with the preferred mix of preferences. Could the public procurer come up with options of supporting business-originated innovation, e.g., by setting a carbon limit or other environmental benefits for the corporations to pursue and achieve. As stated above, the carbon limit set by the Ministry of the Environment is not yet available thus making the task of the public procurers a bit harder. Even though the piloting projects both for the Level(s) and the national calculation method, reinforced by the piloting projects of the public procurers, they may

still be insufficient for the public procurers to draw their own carbon limits prior to the guidance from above their heads.

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# APPENDIX 1 INTERVIEW QUESTIONS: POLICY EXPERTS

| Questions in original format in Finnish language | Questions translated into English language |
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| Mistä keskeisimmät talonrakentamisen ilmasto- ja ympäristövaikutukset muodostuvat? | What are the main climatic and environmental impacts of building construction? |
| Aiemmat ja tällä hetkellä käytössä olevat menetelmät | Previously and currently used carbon footprint calculation methods |
| Mitä menetelmiä on käytetty aiemmin ja millaisia on käytössä parasta aikaa? Mille tasolle menetelmät ulottuvat (esim. hankekohtainen, urakkakohtainen, rakennusosa, tuote)?<br>Mihin standardeihin/standardipakettiin menetelmät perustuvat?<br>Onko talonrakentamisen alalla eri toimijoiden välillä käytössä erilaisia menetelmiä (esim. urakoitsija, tilaaja, konsultti... )?<br>Jos jostain aiemmin käytetystä menetelmästä on luovuttu, miksi? | What methods have been used in the past and what methods are being used currently? To what level do the methods extend (e.g., project-specific, contract-specific, building component, product)?<br>On what standards / package of standards are the methods based?<br>Are there different methods used by different actors in the building construction sector (e.g., contractor, client, consultant ...)?<br>If any of the previously used methods have been abandoned, why? |
| Tulevaisuuden menetelmiä kansallisesti | National calculation methods of the future |
| Mitkä ovat tulevaisuuden kehityssuunnat (menetelmät, työkalut, hankkeet, työryhmät, tms.) alalla? Mille tasolle menetelmät on tarkoitus ulottaa (esim. hankekohtainen, urakkakohtainen, rakennusosa, tuote)?<br>Mihin standardeihin/standardipakettiin menetelmät perustuvat?<br>Miten menetelmän/menetelmien kehitys kytkeytyy kansalliseen ohjaukseen? Missä ollaan valmistelun osalta nyt, minne ollaan menossa ja millä aikataululla?<br>Mitä ovat ilmastovaikutusten lisäksi muut alan kannalta merkittävimmät ympäristövaikutukset? Mihin ympäristövaikutusten huomioimiseen kehityksen pitäisi suuntautua ja millä aikataululla?<br>Miten kiertotalous on huomioitu laskentamenetelmissä ja miten se tulisi huomioida tulevaisuudessa? Uusiomateriaalien käyttö? Entä hiilikädenjälki?<br>Miten tähän tilanteeseen on päästy talonrakentamisen alalla? Oppeja ja haasteita muille aloille jaettavaksi? | What are the future developments (methods, tools, projects, working groups, etc.) in the sector? To what level are the methods to be extended (e.g. project-specific, contract-specific, building component, product)?<br>On what standards / package of standards are the methods based?<br>How does the development of the method (s) relate to national guidance? Where is the preparation now, where are we going, and on what schedule?<br>In addition to the climate impact, what are the other significant environmental impacts of the sector? What should be the direction of development in terms of environmental impact and on what timetable?<br>How has the circular economy been considered in the calculation methods and how should it be considered in the future? Use of recycled materials? What about the carbon handprint?<br>How has this situation been reached in the building construction sector? Lessons and challenges to share with other sectors? |
| Kansainvälisen kehityksen huomioiminen kansallisessa linjassa | National development in relation to the international development |

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| Miten kansallisen menetelmän valinta/kehitystyö huomioi kansainvälistä kehitystyötä?<br>Mitä eroja on kansainvälisesti käytössä olevissa menetelmissä/kehityssuunnassa kansalliseen kehitystyöhön verrattuna? | How does the selection / development of the national calculation method consider international development work?<br>What are the differences in the calculation methods / development trends used internationally compared to the national development work? |
| Eroavaisuudet menetelmien välillä | Differences between calculation methods |
| Mitkä ovat keskeiset eroavaisuudet menetelmien välillä, esim. kaupallinen vs. EU:n kehityksen mukainen (esim. tulevaisuuden arviointi)? Millaisiin rajauksiin on päädytty (esim. kuljetusmatkat, liikkuminen)?<br>Millä tavalla muut menetelmät suhteutuvat ympäristöministeriön (YM) kehittämän menetelmän käytön edistämiseen (esim. tilanteessa, jossa YM:n menetelmä tulee osaksi rakennuslupaprosessia)?<br>Millaisia varmistusmenetelmiä näette tarpeellisiksi? Miten varmistusta voisi toteuttaa, jotta tuloksista saadaan vertailukelpoisia? | What are the main differences between the calculation methods, e.g., commercial vs. EU development (e.g., assessment of future)? What restrictions have been reached (e.g., transport, mobility)?<br>How do other methods relate to promoting the use of the national calculation method (e.g., in a situation where the national method becomes a part of the building permit process)?<br>What kind of verification methods do you see necessary? How could verification be carried out to make the results comparable? |
| Päästötietokannat | Emission databases |
| Millaisia päästötietokantoja alalla on saatavilla ja miten ne eroavat toisistaan?<br>Millä tavalla arvioisitte näiden tietokantojen käytettävyyttä yksittäisen toimijan näkökulmasta (yritys, julkinen hankkija)? | What kind of emission databases are available in the industry and how do they differ?<br>How would you assess the usability of these databases from the perspective of an individual stakeholder (company, public procurer)? |
| Markkina, sidosryhmät | Market, stakeholders |
| Mikä on alan toimijoiden kyvykkyys tuottaa luotettavia ja vertailukelpoisia päästötietoja? Minkälaista ohjeistusta tarvitaan primääridataa varten?<br>Miten markkina osallistuu menetelmien ja päästötietokantojen kehitystyöhön? Mitä ovat muut oleelliset sidosryhmät?<br>Onko teillä käytännön esimerkkejä hiilijalanjäljen ja/tai ympäristövaikutuksia huomioivien kriteerien käytöstä julkisissa palveluissa/hankinnoissa ja millainen vaikuttavuus niillä on ollut?<br>Onko tiedossanne käytännön esimerkkejä kansainvälisistä tai muissa pohjoismaissa käytössä olevista vastaavista kriteereistä ja niiden vaikuttavuudesta? | What is the ability of the actors of the industry to produce reliable and comparable emissions data? What kind of guidance is needed for production of primary data?<br>How does the market participate in the development of methods and emission databases? What are the other relevant stakeholders?<br>Do you have practical examples of the use of public procurement criteria considering carbon footprint and/or environmental criteria, and what impact have they had?<br>Do you know any practical examples of international or other similar criteria used in other Nordic countries and their impact? |
| Kustannukset | Costs |
| Voidaanko hiili-/ympäristöjalanjälkitietoon liittää kustannuksia nykyisissä, entä suunnitteilla olevissa menetelmissä? Entä elinkaarikustannuksia? | Can carbon / environmental footprint data be associated with costs in currently used or in methods under construction? What about life cycle costs? |

# APPENDIX 2 INTERVIEW QUESTIONS: PUBLIC PROCUREMENT EXPERTS IN THE FIELD OF BUILDING CONSTRUCTION

| Questions of original format in Finnish language | Questions translated into English language |
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| Mitkä ilmasto- ja ympäristövaikutukset tilaajapuolella koetaan keskeisimmiksi, joiden vähentämiseen tilaaja pystyy vaikuttamaan? Millä keinoilla näihin keskeisimpiin on pyritty vaikuttamaan? Mitä uusia vaikuttamiskeinoja on näköpiirissä? | What climate and environmental impacts are perceived as the most important and that can be influenced by the public procurers? What efforts have been made to influence these key issues? What new ways of influencing are in sight? |
| Onko hiilijalanjälkilaskentaa hyödynnetty rakennushankkeiden suunnittelussa ja tilauksessa? | Has carbon footprint calculation been utilized in the design and procurement of construction projects? |
| Mitä menetelmiä on käytetty aiemmin ja millaisia on käytössä parasta aikaa? Mille tasolle menetelmät ulottuvat (esim. hankekohtainen, urakkakohtainen, rakennusosa, tuote)?<br>Miten hiilijalanjälkilaskenta soveltuu eri urakkamuotoihin?<br>Kokemukset eri menetelmistä, työkaluista ja päästötietokannoista ja niiden käytettävyydestä? Miten ne eroavat toisistaan?<br>Jos jostain aiemmin käytetystä menetelmästä on luovuttu, miksi?<br>Miten laskennan tuloksia ja toteutumista seurataan?<br>Miten kiertotalous on huomioitu osana hiilijalanjälkilaskentaa/rakennushankkeiden päästövähennystä? | What methods have been used in the past and what methods are being used currently? To what level do the methods extend (e.g., project-specific, contract-specific, building component, product)?<br>How can carbon footprint calculation be applied to different types of contracts?<br>Experiences in different methods, tools and emission databases and their usability? How do they differ from one another?<br>If any of the previously used methods have been abandoned, why?<br>How are the results and implementation of the calculation monitored?<br>How has the circular economy been taken into account as part of the carbon footprint calculation / reduction of emissions from construction projects? |
| Tulevaisuuden suunnitelmat hiilijalanjälkilaskennan hyödyntämiseksi rakennushankkeiden suunnittelussa ja tilauksessa? Miten tilaajapuolella valmistaudutaan tulossa olevaan MRL-uudistukseen? | Future plans to utilize carbon footprint calculation in the design and procurement of construction projects? How is the procurer side preparing for the upcoming Land Use and Building Act reform? |
| Miten MRL-uudistus muuttaa tilaajapuolella tehtävää työtä?<br>Missä ollaan valmistautumisen osalta nyt, minne ollaan menossa ja millä aikataululla?<br>MRL-uudistus huomioi alkuvaiheessa vain ilmastopäästöt, joihin ohjausvaikutus kohdentuu. Onko tilaajapuolella suunnitelmissa huomioida myös muita ympäristövaikutuksia ja kiertotalouden edistämistä **yli** lakisääteisten vaatimusten? | How will the Land Use and Building Act reform change the work done by a public procurer?<br>Where is the preparation now, where are we going, and on what schedule?<br>In the initial phase, the reform will only consider the climate emissions. Are there plans on the procurer side to consider other environmental impacts and the promotion of a circular economy **beyond** complience? |

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| Millä tavalla on yhdistetty tai tarkoitus yhdistää hiili-/ympäristöjalanjälkitietoa elinkaarikustannustietoon tilaajapuolella? | How is the carbon / environmental footprint information combined or intended to be combined with the life cycle cost information on the procurer side? |
| Yhteistyö yrityssektorin kanssa & julkiset hankinnat | Cooperation with the business sector & public procurement |
| Mikä on mielestänne ohjauksen (lakisääteinen ja/tai julkisen hankkijan asettamat kriteerit) tarpeellisuus, jotta päästöjä talonrakentamisen alalla saadaan vähennettyä? Voisiko markkina päästä päästövähennyksiin myös omaehtoisen ohjautuvuuden toimenpiteillä?<br>Tekevätkö rakennusliikkeet itsenäisesti tai pyydettäessä vapaaehtoista (ei hankintakriteereihin tai lainsäädäntöön perustuvaa) päästöjen vähennystä tai ehdottavatko mahdollisia vaihtoehtoja päästösäästöjen saavuttamiseksi?<br>Minkälaista yhteistyötä tilaajapuoli tekee tarjoavan yrityssektorin kanssa? Miten käytetyistä lisäkriteereistä on keskusteltu/tullaan keskustelemaan tarjoavan yrityssektorin kanssa?<br>Onko markkinavuoropuhelun lisäksi käytössä muita menetelmiä, joilla markkinaa voisi kirittää/tukea ilmastotavoitteita kohti?<br>Minkälainen yhteistyö yrityssektorin kanssa auttaisi tilaajapuolta kehittämään toimintaansa?<br>Myös muissa julkisen hankinnan organisaatioissa painitaan samojen asioiden parissa. Miten paljon/millaista yhteistyötä kuntasektori / julkisen hankinnan organisaatiot tekevät tämän kehitystyön äärellä? | What do you think is the need for guidance (regulation and / or public procurement criteria) to reduce emissions from the building construction sector? Could the market also achieve emission reductions through voluntary control measures?<br>Do construction companies independently or upon request make voluntary (not based on procurement criteria or regulation) emission reductions, or do they suggest possible alternatives to achieve emission savings?<br>What kind of cooperation does the subscriber side have with the business sector? How have the additional procurement criteria used (carbon / environmental) been / will be discussed with the business sector?<br>In addition to market dialogue, are there other methods in place to support the market towards the climate goals?<br>What kind of cooperation with the business sector would help the procurer side to develop its operations?<br>Other public procurer organizations are also struggling with the same issues. How much / what kind of cooperation does the municipal sector / public procurer community do with this development work? |
| Esimerkit & julkiset hankinnat | Examples & public procurement |
| Onko teillä käytännön esimerkkejä hiilijalanjäljen ja/tai ympäristövaikutuksia huomioivien kriteerien käytöstä julkisissa palveluissa/hankinnoissa ja millainen vaikuttavuus niillä on ollut? Mikä on yritysten antama palaute ja kyvykkyys käytettyyn kriteeristöön?<br>Onko tiedossanne käytännön esimerkkejä kansainvälisistä tai muissa pohjoismaissa käytössä olevista vastaavista kriteereistä ja niiden vaikuttavuudesta<br>Miten teette yhteistyötä hankinta-asiantuntijoiden kanssa ja millä tavalla sitä yhteistyötä voisi kehittää (esim. markkinavuoropuheluiden järjestäminen, kaupungin/organisaation tavoitteiden seuraaminen)? | Do you have practical examples of the use of carbon footprint and / or environmental criteria in public services / procurement and what impact have they had? What is the feedback from companies and their ability to comply with the criteria?<br>Do you know any practical examples of similar criteria used in international or other Nordic countries and their impact?<br>How do you cooperate with the general procurement experts and how could this cooperation be further developed (e.g., organizing market dialogues, monitoring the city's / organization's goals)? |

# APPENDIX 3 INTERVIEW QUESTIONS: CORPORATE REPRESENTATIVES

| Questions in original format in Finnish language | Questions translated into English language |
|---|---|
| Ilmasto- ja ympäristövaikutukset talonrakentamisen alalla tähän mennessä | Climate and environmental impacts of the building construction sector so far |
| Mitkä ilmasto- ja ympäristövaikutukset yrityksessänne koetaan keskeisimmiksi, joiden vähentämiseen rakennusyritys pystyy vaikuttamaan eri hanke-/urakkamuodoissa?<br>a. Millä keinoilla näihin keskeisimpiin on pyritty vaikuttamaan?<br>b. Mitä uusia vaikuttamiskeinoja on näköpiirissä?<br>Mitä hiilijalanjäljen laskentamenetelmiä yrityksessänne on käytetty aiemmin ja millaisia on käytössä parasta aikaa? Toteutetaanko laskentaa yrityksenne omana työnä, ostettuna konsulttityönä vai muulla tavalla? | Perceived by your company, what are the most important climate and environmental impacts that a construction company can influence on in different forms of projects / contracts?<br>a. What efforts have been made to address these key issues?<br>b. What new means of influence are in sight?<br>What carbon footprint calculation methods have been used in your company previously and what are in use currently? Is the calculation done by your company as your own work, purchased as a consulting job or in another way? |
| Talonrakentamisen hiilidioksidipäästöjen ohjaus lakisääteisin keinoin: MRL-uudistus | Regulatory guidance of emissions in the building construction sector: Land Use and Building Act |
| Miten säädösohjauksen valmistelu on mennyt yrityksenne näkökulmasta? Onko nimenomaan hiilijalanjälkilaskentaan perustuva säädösohjaus hyvä tapa vähentää ilmastopäästöjä vai olisiko tähän muitakin tapoja? Miten talonrakennusalan päästöjä saataisiin vähennettyä nopeimmin laadun kärsimättä ja kustannustehokkaalla tavalla?<br>Miten MRL-uudistus ja sen myötä käyttöön otettava ilmastoselvitys tulee muuttamaan sekä yrityksessänne että koko talonrakennusalalla tehtävää työtä?<br>Lakisääteistä ohjausta on jo aikaisemmin hyödynnetty joissakin muissa EU-maissa, esim. Alankomaissa ja Ranskassa. Etsittekö muissa maissa jo hyödynnettyjä vähähiilisempiä ratkaisuja, jotta voitte täyttää kotimaisen lainsäädännön vaatimukset? Jos ette, miksi?<br>MRL-uudistus huomioi alkuvaiheessa vain ilmastopäästöt, joihin ohjausvaikutus kohdentuu. Onko yrityksessänne suunnitelmissa huomioida ilmasto- ja/tai ympäristövaikutuksia yli lakisääteisten vaatimusten, esim. edistämällä kiertotalousratkaisuja tai noudattamalla vaatimuksia kireämpiä raja-arvoja? | How has the preparation of regulatory guidance been from your company's perspective? Is regulatory control based specifically on carbon footprint calculation a good way to reduce climate emissions, or are there other ways? How can emissions from the building construction sector be reduced the fastest without compromising quality and<br>in a cost-effective way?<br>How will the Land Use and Building Act reform and the accompanying climate declaration change the work that is being done both in your company and in the building construction sector as a whole?<br>Regulatory guidance has already been used in some other EU countries, such as the Netherlands and France. Are you looking for low-carbon solutions already used in other countries to meet the requirements of domestic regulation? If not, why not?<br>In the initial phase, the reform will only consider the climate emissions. Are there plans to consider other climate or environmental impacts **beyond** compliance, e.g., by promoting circular economy solutions or complying with more stringent carbon limits? |

| Talonrakentamisen hiilidioksidipäästöjen (ja ympäristövaikutusten) ohjaus julkisten hankintojen keinoin | Guidance of carbon dioxide emissions (and environmental impacts) of the building construction sector through public procurement |
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| Oletteko yrityksessänne törmänneet julkisen hankkijan rakennushankkeiden kilpailutuksiin sisällyttämiin ilmasto- ja ympäristönäkökulmiin/hankintakriteereihin?<br>a. Oletteko törmänneet ilmasto- tai ympäristökriteereihin, joiden täyttäminen ei ole ollut mahdollista ja olisitte sen vuoksi joutuneet jättämään tarjoamatta?<br>b. Koetteko, että julkisella hankkijalla on tällä hetkellä tarpeeksi ajantasaista tietoa rakennusyritysten toimintaympäristöstä sekä esim. hankkeiden mahdollisista toteutustavoista ja osaavatko he huomioida näitä riittävästi kilpailutuksissaan ja ilmasto- ja ympäristövaikutuksiin liittyvissä hankintakriteereissään?<br>Oletteko osallistuneet julkisen hankkijan järjestämään markkinavuoropuheluun?<br>a. Mitkä ovat yrityksenne kokemukset ja näkemykset markkinavuoropuhelutilaisuuksista?<br>b. Ovatko markkinavuoropuhelutilaisuudet mielestänne oikea paikka antaa palautetta julkiselle hankkijalle vai annatteko palautetta/kehitysehdotuksia mieluummin jollain muulla tavalla?<br>Oletteko törmänneet julkisen hankkijan asettamiin bonus-/tulospalkkiojärjestelmiin esim. päästöttömän työmaan tai kestävän purkamisen green dealeihin liittyen? Mitä mieltä olette näiden bonusmallien toimivuudesta? | In your company, have you encountered climate and environmental aspects / procurement criteria included in the tenders for public works contracts?<br>a. Have you encountered climate or environmental criteria that could not be met and would therefore have been left out of the tendering competition?<br>b. Do you consider that the public procurer currently has sufficient up-to-date information on the operating environment of construction companies and, for example, on the possible implementation of projects, and are they able to take these sufficiently into account in their tendering competitions as well as in used climate and environmental procurement criteria?<br>Have you participated in a market dialogue organized by a public procurer?<br>a. What are your company's experiences and views on market dialogue events?<br>b. Do you think that market dialogue events are the right place to give feedback to the public procurer or do you prefer to provide feedback / development suggestions in some other method?<br>Have you come across any performance bonus schemes set by a public procurer, for example in connection with the green deals of emission-free construction sites or sustainable demolition? What do you think about the functionality of these bonus models? |
| Yritykset talonrakentamisen alan vähähiilisyyssiirtymässä | Businesses in the low-carbon transition |
| Mikä on mielestänne ohjauksen tarpeellisuus (lakisääteinen ja/tai julkisen hankkijan asettamat kriteerit), jotta päästöjä talonrakentamisen alalla saadaan vähennettyä? Voisiko markkina päästä päästövähennyksiin myös omaehtoisen ohjautuvuuden toimenpiteillä?<br>Teettekö yrityksenä itsenäisesti (tai asiakkaan sitä pyytäessä) vapaaehtoista (ei hankintakriteereihin tai lainsäädäntöön perustuvaa) päästöjen vähennystä tai ehdotatteko asiakkaalle mahdollisia vaihtoehtoja päästösäästöjen saavuttamiseksi?<br>a. Jos kyllä, miten asiakkaat suhtautuvat ehdotuksiin?<br>b. Jos ei, miksi? | What do you think is the necessity for guidance (regulatory and / or criteria set by the public procurer) to reduce emissions in the building construction sector? Could the market also achieve emission reductions through voluntary control measures?<br>As a company, do you independently (or at the customer's request) make voluntary (not based on procurement criteria or regulation) emission reductions, or do you suggest possible alternatives to the customer to achieve emission savings?<br>?<br>a. If yes, how do customers react to the proposals?<br>b. If not, why not? |

| Edelläkävijyys ja uudet liiketoimintamahdollisuudet | Operating as a forerunner and new business opportunities |
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| Julkisuudessa toisinaan näkee sanottavan, että Suomen muita maita edistyksellisempi vähähiilisyyssiirtymä luo uusia liiketoimintamahdollisuuksia Suomen rajojen ulkopuolella. Näettekö talonrakennusalalla, että Suomen mallin mukaan kehitetyt talonrakentamisen vähähiilisemmät ratkaisut tulevat luomaan kysyntää suomalaisten yritysten vähähiilisemmille tuotteille tai palveluille myös kansainvälisesti ja että muita nopeampi siirtymä luo edellytyksiä uusille liiketoimintamahdollisuuksille ja/tai kilpailuedun syntymiselle?<br>a. Koetteko, että ulkoinen ohjaus luo painetta uusiin innovaatioihin yrityksessänne? Mille osa-alueelle innovaatioiden kehitys painottuu?<br>b. Tuletteko tekemään yrityksessänne uusia investointeja (esim. tekniikka, tutkimus- ja kehitystoiminta, koulutus), jotta ulkoisen ohjauksen vaatimuksiin voidaan vastata?<br>c. Miten koette sidosryhmienne kyvykkyyden vähähiilisyyssiirtymässä, esim. materiaalitoimittajienne ja alihankkijoidenne kyvykkyyden uusien tuotteiden/materiaalien/rakennusosien jne. kehittäjinä ja toimittajina?<br>d. Miten koette kotimaisten kilpailijoidenne vaikutuksen omaan vähähiilisyyssiirtymäänne ja toiminnallenne asettamiinne tavoitteisiin? | It is sometimes said in the public discussion that Finland's more advanced low-carbon transition creates new business opportunities outside Finland's borders. Do you see in the building construction industry that the low-carbon building construction solutions developed according to the Finnish model will create demand for the low-carbon products or services of Finnish companies also internationally and that a faster transition will create new business opportunities and / or a competitive advantage?<br>a. Do you feel that external control is putting pressure on new innovations in your company? In which area is the development of innovations focused?<br>b. Will you make new investments in your company (e.g., technology, research and development, training) to meet the requirements of external management?<br>c. How do you feel the ability of your stakeholders in the low carbon transition, e.g., the ability of your material suppliers and subcontractors as developers and suppliers of new products / materials / components, etc.?<br>d. Do you see an impact of your domestic competitors on your own low-carbon transition and the goals you set for your operations? |