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# Green Transformation in Ostrobothnia

Inspecting Multi-Level Perspective and Pathways in GRETA -Project

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**TIIVISTELMÄ:**
Ilmaston lämpeneminen on yksi maailman suurimmista kriiseistä ja se on saanut muun muassa Euroopan unionin reagoimaan. EU:lla on uusi vihreän kasvun strategia, Green Deal, jolla se pyrkii kehittämään Euroopasta ensimmäisen hiilineutraalin maanosan maailmassa. Vihreällä siirtymällä tässä kontekstissa tarkoitetaan siirtymää kohti kestävää taloutta, jossa tulevaisuudessa ihmisillä on yhtä paljon mahdollisuuksia hyvinvointiin kuin tällä hetkellä maailmassa on. Vihreässä siirtymässä on kyse talouden rakennemuutoksesta, jossa yhteiskunnasta tulee hiilineutraali ja kestävä. Euroopassa ollaan vahvasti toteuttamassa uudistuksia, joilla saadaan tuettua vihreää siirtymää ja ilmastotavoitteiden saavuttamista.

Tämä pro-gradu tutkielma lähestyy vihreää siirtymää multi-level perspective- teorian näkökulmasta. Tähän teoriaan tutustutaan käyttäen paljon Frank Geelsin ja Johan Schotin kirjallisuutta, yhdistellen sitä Euroopan Komission teettämään Green Dealiin, sekä Dominique Forayn älykkään erikoistumisen teorioihin ja malleihin. Geelsin ja Schotin multi-level-perspective on työkalu, jolla pyritään tutkimaan eri tasojen (Landscape, regime, niche) taipumusta muutokseen paineen alla. Lisäksi käydään läpi eri sosio-teknologisten muutospolkujen roolia vihreässä siirtymässä Pohjanmaan alueella. Quadruple-helix sekä älykäs erikoistuminen ovat mukana taustateorioina, sillä ne ovat suuressa roolissa mukana aluestrategioiden luonnissa, ja tulevaisuudessa aluestrategiat tulevat olemaan yhä enemmän vihreitä strategioita. Näihin taustateorioihin perehdytään kirjallisuuskatsauksen keinoin ja ne käydään läpi kirjoitelman alussa.

Tämä pro-gradu on tehty GRETA-projektissa, jossa tutkitaan keinoja, joilla alueet voivat saavuttaa vihreän kehityksen tavoitteita älykkään erikoistumisen strategioiden avulla. Tutkimus on tehty laadullisen tutkielman tavoin haastatteluin, jotka pidettiin maaliskuussa 2021. Haastatteluissa kysyttiin eri sektoreilla toimivien asiantuntijoiden näkemyksiä eri tasojen roolista vihreässä siirtymässä ja siitä, mitä muutospolkua pitkin he uskovat siirtymisen vihreään talouteen syntyvän Pohjanmaan maakunnassa. Tulokset analysoitiin GRETA-projektiryhmän kesken ja niitä tuloksia on käytetty tässä pro-gradussa, jossa niitä analysoidaan lisää peilaten teoriaan.

Tutkielma tuo esiin ongelmakohtia, joita Pohjanmaan alueella kohdataan, kun vihreää siirtymää ollaan kehittämässä eteenpäin. Yhteistyön ja kommunikaation katsottiin olevan kriittisiä keinoja luoda vihreää kehitystä alueella. Pohjanmaa on yleisesti ottaen hyvin dynaaminen ja innovatiivinen alue, jolla on halua kehittyä erityisesti energiateknologian saralla. Tutkielmassa huomataan epäkohtia muun muassa siinä, miten Euroopan unionin jakamat varat vihreään aluekehitykseen eivät välttämättä jakaudu oikeudenmukaisesti niille, jotka oikeasti ovat mukana taistelussa ilmastonmuutosta vastaan. Haastattelut toivat esiin mm. epäkohtia landscape-tason antaman paineen ja sen saaman palautteen välillä, kuten kommunikaatiossa alueellisen tason ja Euroopan unionin välillä.

**AVAINSANAT:** Green transformation, Innovation, Multi-level perspective, Smart Specialization, Transformation Pathways, Green Deal, Ostrobothnia

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# 1. Introduction

The world is facing an existential crisis. Climate change and environmental degradation are the main threats for the globe and humankind. Climate change is boosting problems on every sector, it creates environmental degeneration, extreme weather conditions, insecurity of food and water, economic disruption, terrorism etc. Not a single place in the world is safe from the effects of it. The greenhouse gas emissions are now higher than ever, and they are rising all the time. Our globe cannot cope this way of warming up, as scientists are saying that we are already one degree Celsius above preindustrial levels and very close to the "unacceptable risk" (United Nations, 2021).

Everything is turning green and that includes the economic growth as well. Green Transformation in the context of the paper means the transformation into sustainable economy. Economic growth can be said to be the factor that adds well-being in the society. Sustainable economic growth is achieved when the gross domestic product does not decrease, while the next generations will have as many opportunities than we had in our lifetimes. (Pohjola, 2014, p.171).

Green Deal is European union's growth strategy to transform the Union into a modern and resource efficient economy. (European Commission, 2020). European Union has researched that very ambitious recycling and circular economy actions are able to reduce greenhouse gasses of about 424 to 617 million tons CO2-eq. This number comes from recycling package and municipal waste and reduce of landfill. (Schroeder et al., 2019). Green energy, as for example wind and solar power, are good sources in a way that they are widely applicable in many places around the globe and they have a big effect on the green energy production of the globe. (Margeta & Glasnovic, 2010, p. 1). 73% of the carbon emissions come from energy production (Richie & Roser, 2021). It can be said that circular economy and green energy production are crucial elements when transforming to green economy and when pursuing green growth.

Regional and national strategies are important regarding green transformation. European Union's innovation strategy, smart specialization, is a way to get entrepreneurs, specialists, public organizations and other actors to work for regional economic growth and in this case sustainable growth. European Green Deal and Smart Specialization linked with multi-level perspective, gives a very good and interesting platform to start researching the possibilities of green transformation (Mariussen et al, 2021, p. 3).

The concept of multi-level perspective from Frank Geels is a way to approach transformation towards green innovations and transformation. Multi-level perspective shows the way green transformation might be coming from the pressure of landscape which means the level of decision and policy makers (European Union, national government), or the innovations from the niches (companies, citizens, universities). Regime level is the regional level and it is the operational level, which is affected by the decisions made in landscape and innovations coming from niches. It's giving a way to visualize the transformation in the society and industries and which way the change in the current regime is formed (Gibbs & O'Neill, 2017, p.165).

Theory of multi-level perspective will be opened up and its connection to green transformation and European Union's Green Deal will be told. Geels' figure on multi-level perspective demonstrates well the pressure coming from climate change, European Union and how it might affect Ostrobothnia and regional innovation level. (Geels et al., 2019, p.26-17). Transition pathways are also a way to look through green transformation. They give us scenarios in which we can examine the way niche innovations are rising to regime and how landscape-level pressure is affecting the changes. Those pathways are regime reconfiguration pathway, de-alignment and re-alignment pathway, technological substitution pathway, regime transformation pathway. (Geels & Schot, 2007, p. 406-408).

The Figure 1 shows the structure and architecture about how climate change affects the European union area and all the actors inside it. Climate change is the reason why Green Deal was developed and why European union is working towards sustainable solutions.

It affects the decisions in today's world in almost every aspect, as EU is making its own programs and guiding nations to do their own. National governments have their own climate programs, which are guided by the European union and Green Deal. Finland is the most eager to reach carbon neutrality as the goal in Finland is to be carbon neutral in 2035 (Ministry of environment, 2021). Those programs are also guiding the regions and the actors working there. Companies, universities and Non-governmental organizations (NGO) are affected by the rules and legislation coming from European union, their own national government and also by the regions own regional government. The arrow from the region circle is showing that the decisions and results coming from the regional level are also affecting the decisions made in the European union and national level. For example, the results of the GRETA-project might really well make an impact on the decisions made in not only regional level, but higher up too.

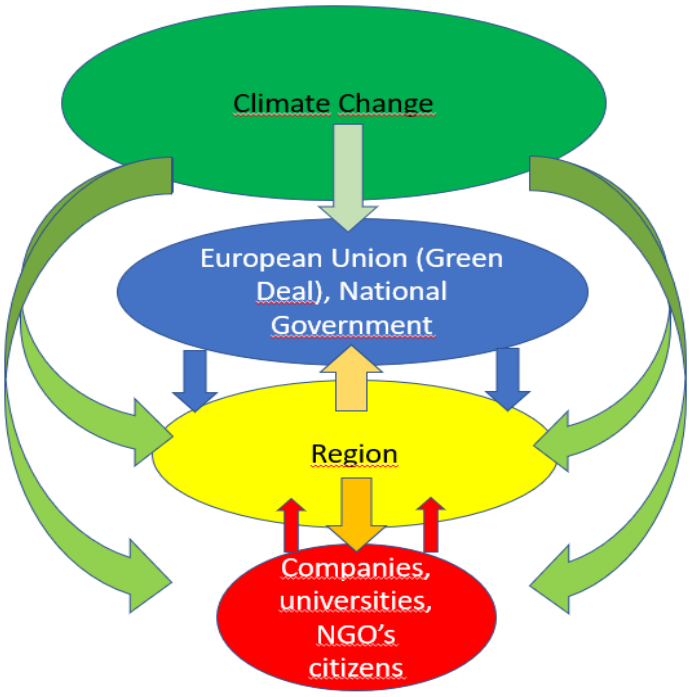


**Figure 1.** Structure of the studies background.

This study was written while working on an Interreg Baltic Sea GRETA-project. GRETA-Project (Green Transformation! A policy tool for regional smart specialization), is an extension project of the LARS-project (Learning Among Regions on Smart specialization). (LARS-Project, 2018). In the GRETA-project the focus will be on discovering ways to enable green transformation in European regions. What makes GRETA so important is that it takes a step towards environmental considerations in the context of innovations. World needs a quick and sustainable way to create more economical and regional growth. Green Deal and GRETA are a way to do so. GRETA is very strongly linked to smart specialization, European union cohesion policy tool that is a place-based approach for areas to find strengths and potential of the economy on an Entrepreneurial Discovery Process (EDP) with wide stakeholder involvement. (European Commission, 2020).

The interviews are from the project and the results of them are also used in the final results of the project. I conducted the interviews with assistant professor Antti Mäenpää and the questionnaire was created together by myself and the persons working in GRETA; Assistant Professor Antti Mäenpää, Professor Emerita Seija Virkkala and Research manager Åge Mariussen.

Personally, I chose this subject due to its social significance. I believe that this project can be crucial for many areas to find ways to create sustainable and green economic growth. First, I will go through the topic by telling about the theories and backgrounds of Green Deal, smart specialization and multilevel perspective. The research questions are reflected to the theoretical framework. In the Greta-project we interviewed experts from different sectors which have knowledge and experience on working with environmental questions and problems. There were experts from several different sectors: universities, public sector, NGOs and companies. From the experts we got a large view on the question about green transformation and which way it will be reached. The interesting conclusion is also the answer to the question about the role of the region.

## 1.1 Focus of the study

The focus of the study is to adapt the idea of green transformation into the theory of multi-level perspective and to examine the change in general level. After those considerations this study will change its focus towards the regional level of Ostrobothnia. In that section it will be examined what does the green transformation in Ostrobothnia look like from the standpoint of multi-level perspective.

When inspecting Green Transformation via multi-level perspective the research questions are as follows:
1) What is the role of different levels and pathways in Green Transformation?
2) How the region of Ostrobothnia is managing Green Transformation process in multi-level perspective?

These questions will be answered with some pondering about following deliberations; does green transformation rise from niches or does it come from pressure of landscape? And what is the relationship between these levels in the green transformation? What is the role of the region regarding green transformation? Which pathway is the way that green transformation will go through? These kinds of considerations are interesting and give a great outlook on problem that is at hand.

These questions are relevant in many ways, as the green transformation is a big question itself. Interesting thing is to see if the experts from the interviews do see the multi-level perspective and the pathways as a useful tool for green transformation and possibilities for growth. Also, one of the main interest points is the role of the region and especially the role of Ostrobothnia in this case. How do the experts see the regional cooperation in relation to green transformation and its possibilities or threats? With answering these questions, I believe I can get a good view on what the way for regions is to go forward in the green transformation and what are the problems between different levels in green transformation.

## 1.2 Structure of the study

I have planned this paper to as follows; first I'm going to tell about the European green deal and the importance of the program and its importance as a policy tool for green transformation. Green deal will be linked with the concept of European innovation policy, Smart Specialization, and I will be telling about the roots of it and its concept in regional development and how it is used as a process in European union. These parts of the paper will be used as a background information as the Green Deal is such a big part of European union's development plans in today's world and even more important in the future when sustainable society is being built even further.

One important part of this study is the multi-level perspective and its connection to green transformation. I will be looking through the theory of multi-level perspective, landscape-, regime- and niche-levels and also the pathways of sociotechnical transition. These theories will be the main core of my study as they are reflected to the green transformation and the chosen research questions of this study.

Theoretical framework of this study will focus on measuring multi-level perspective and its possibilities in green energy and economy. This thesis and project will be including a lot of mentions about smart specialization, quadruple helix-theory and the possibilities of these two theories. Green transfromation will be a big part of the thesis and will be dealt with a big interest.

A lot of literature from Frank Geels, Johan Schot and Dominique Foray will be used when explaining the theory of Multi-level perspective, transition pathways and Smart Specialization. I am also going to reference European Union's own material to support the study. Studies made before about green energy, smart specialization and quadruple helix are going to be used to support the results of the thesis.

After those parts of the paper I will be telling more about the GRETA-project and the discoveries from it. I will open up the background of GRETA, the partners and the structure of the project. The interviews were made as a part of this project so I will be using those results as my results of this paper, as I was part of doing them with the help of the other people working in this project.

In the end is the conclusion part where I will be reflecting the theories of the paper to the research questions and the results of the interviews made. The theory of multi-level perspective and the pathways are the most important aspects of the paper to see how the interviewed experts see them related to the green transformation.

# 2. Green Deal & Smart Specialization

## 2.1 Green Deal as a policy instrument for green transformation

Green Deal in Europe (GD) is a response to environmental and climate challenges such as global warming and pollution. These challenges are the main problems in today's world. Green Deal is a growth strategy that is aiming to transform European Union into environmentally and economically sustainable society which has zero net greenhouse gases in 2050. Green Deal is made to accelerate and support the transition in all sectors. (European commission, 2019). It is a commitment for a long-term transition towards economy with low carbon emissions and it is aligned with 2015 Paris Agreement. The GD says that European Investment Bank should also no longer give money to the projects that have relations to energy production from fossil fuels, and it wants to make investments in the green energy sector much easier. (Pianta & Lucchese, 2020, p. 634-636).

European Union has challenges for the energy transition as they have to get member states to commit to the challenge and they need to be willing to change. Member states are not happy to leave a topic of energy as a responsibility to European Union, as it is a "shared competence". This leads to a situation where there are different speeds in the transition in different member states of the EU. For example, Italy wants to do more state driven approach to energy transitions and Poland and Germany have failed the implementation so far. (Hafner & Raimondi, 2020, p.382).

European Union will not achieve green transformation on its own. It will need support and co-operation from across the borders to be able to create sustainable and green growth. European union can also use its influence, expertise and financial resources to get its neighbors and partners to join in to doing sustainable growth and policies. (European commission, 2019). Green Deal is a great effort to try and change the economy in Europe and also the way Europe consumes. It changes the energy system quite dramatically. It is very high on priority list of European Union agendas. Because of this, it is

changing the relationships between European Union and EU's partners and countries around it. Green Deal has radical geopolitical consequences, as it is a foreign policy development. (Leonard et al., 2021, p.2).

Green Deal is a new growth strategy in Europe and it is a response for achieving sustainable economic growth. European Union is aiming to be one of the frontrunners in building new financial system that is supporting sustainable solutions. This system would enable sustainability and inclusive growth and it will mobilize investors from international markets. GD will accelerate the transition in industries towards sustainability and growth that is inclusive. Tax-reforms will help economic growth and resilience to shocks in climate, when they are designed well. Tax-reforms will also create more fair society. European commission will keep setting new standards to shape sustainable growth to be in line with the EU's climate ambitions. (Eckert & Kovalevska, 2021, p.10).

Green Deal is a part of European commission's strategy to implement the United Nation's 2030 agenda and sustainable development and other policies announced in President Von der Leyen's political guidelines. There are eight elements in transforming European union into a sustainable society. (European commission, 2019).

As a first element is increasing the EU's climate ambition for 2030 and 2050. European union has already started to modernize the economy and transforming towards climate neutrality. Greenhouse gas emissions did go down 23 percent from year 1990 to year 2018. During the same period, the economic growth was 61 percent. With current policies the amount of required emission cuts will go down only by 60 percent until the year 2050, which shows that a lot of work needs to be done. (European commission, 2019)

Commission has introduced a plan, which shows that goal is to reduce greenhouse gas emissions in the EU with 50-55 percent compared to year 1990 emissions until the year

2030. Commission is doing European union a much more ambitious strategy for integration to climate change. Climate change is causing a lot of stress for European union despite the actions towards slowing it and trying to stop it. (European commission, 2019).

As a second element Green Deal introduces “supplying clean, affordable and secure energy”. European energy system must get rid of coal to reach the environmental goals in 2030 and 2050. 75 percent of the union’s greenhouse gas emissions come from energy production and the use of them at different economic sectors. Energy sources need to be changed into renewable and energy sector is being developed towards it. (European commission, 2019).

Smart integration and energy efficiency in renewable energy sources will help sectors to get rid of coal with low costs. Transforming towards climate neutrality requires smart infrastructure. Cross-border and regional co-operation helps to achieve the benefits of clean energy with low costs. (European commission, 2019).

One of the elements is “Mobilizing industry to clean and circular economy”. According to European commission (2019) climate neutral circular economy requires involving industry holistically. It takes a single industry sector 25 years to complete the transformation. Transformation offers an opportunity to practice sustainable economy and create new jobs. Technologies that are low polluting have a massive amount of demand around the world right now. Circular economy also creates an opportunity for new jobs and activities.

European Union has a Circular Economy action plan to create more CE (circular economy) to the region and it’s one of the main corner stones of the Green Deal of Europe. That action plan is made so sustainable products will be made in EU, consumers will be empowered, circularity in different industries would be higher, amount of waste is decreased, circularity will work and that European Union would be leading circular economy region in the world. (European Commission, 2021a). Finland is one the leaders in

circular economy, because it has a big and strong financing system for circular economy and also national program for recycling and many other projects for plastic reduction. Government of Finland has also some taxes on the recycling and circular economy activities. It was also mentioned that some plans to harmonize the European Parliaments criteria for sustainable forestry should be made in collaboration with Finnish forest industry. (Marino & Pariso, 2020, p. 4).

Energy intensive industries like steel, chemicals and cement are crucial for the economy of European union, because they bring raw material to many important value chains. Modernizing those industries and making them coal free is very important. The plan of action for the circular economy is driving the transition at every sector, but the actions are focused on the very resource intensive sectors e.g., textile, building and electronics. Plans for circular economy also includes actions, which will encourage companies to provide reusable, sustainable and mendable products. (European commission, 2019).

“Building and renovating in an energy and resource efficient way” is mentioned as one element for green deal. Building and building usage and renovating uses a lot of energy and minerals. Buildings use 40% of the energy. The renovation rate is nowadays 0.4 to 1.2% in the building stock in the member states. European commission says that this rate needs to be at least doubled if EU wants to reach its energy and climate goals. Rising the renovation rate is challenging but it’s profitable because it reduces energy bill and might reduce energy poverty. (European commission, 2019). Closing the material loop and recycling the waste coming from the buildings is an efficient way to reduce impacts to the environment in the building industry. For this thinking to accelerate, it would be important to advertise and demonstrate the environmental and economic advantages of recycling and circular economy practices in the building and construction industry. (Bonoli et al., 2021, p.12).

European commission is going to control strictly that the legislation about energy efficiency is being complied with. Commission is also starting to include emissions of building into European emission trading as a part of bigger actions, which are made to make sure that different energy source prices are in relation compared to their energy efficiency. There is also a regulation coming that building and renovating planning would meet the needs of the circular economy at all stages and leads to the digitalization of the building stock and climate resilience. (European commission, 2019).

One of the most important elements of European Union's Green Deal is "Accelerating the shift to sustainable and smart mobility", because a quarter of greenhouse emissions comes from transport. To achieve climate neutrality transport emissions must be reduced by 90 per cent until year 2050. Emissions must be reduced in road, rail, aviation and waterborne transport. Sustainable transport requires that users are prioritized, and they will be offered cheaper, easier to use, healthier and cleaner options for existing transporting options. (European commission, 2019). European Commission is pushing people to buying and using electrical vehicles. Also, mining and extraction of metals used in the batteries must be responsible to achieve zero-emissions in mobility. European Battery alliance is created to make sure value chains in battery production for vehicles is sustainable. (Camilleri, 2020, p.1806).

European commission (2019) says that multimodal transport needs to be boosted massively. 75% of the European union's inland freight carried by road should be shifted towards rail and inland waterways. Automated and connected multimodal mobility's role will be increased by the digitalization and smart traffic management systems. Prices of the transport will have to reflect the environmental and health impacts. Commission want support for fossil fuels to end and is considering extension of the emissions trading scheme to maritime sector and reducing the EU Emissions Trading System allowances allocated for free to airlines. (European Commission, 2019). When a price is put on the acts that cause emissions, it reduces their greenhouse gas footprint as it makes the use of unsustainable vehicles, machines etc. more unattractive. If a price on emissions is not

used, other climate policy measures are not effective in reducing emissions. (Claeys et al.,2019, p. 2).

For one element European commission introduces “Farm to Fork: designing a fair, healthy and environmentally-friendly food system”. Commission will offer new chances for every stakeholder of the value chain. Everyone will benefit from the new technologies and inventions. European farmers and fishermen are in a key position in this change. “Farm to Fork”-strategy is used to intensify the actions which farmers and fishermen are trying to slow down climate change, protect the environment and preserve biodiversity (European commission, 2019).

European commission wants to make sure that national strategies linked to agriculture follow strict climate and environmental goals. Plans should lead to the use of sustainable practices. (European commission, 2019). Sustainability in the agri-food sector is wide concept as it covers many issues in the value-chain. From general strategies targeting consumers about sustainable food to technical solutions in the agriculture, communication, retail and distribution. (Riccaboni et al, 2021, p. 110).

Getting climate-neutral is crucially important but forgetting “preserving and restoring ecosystems and biodiversity” would be a big mistake. That is why commission has made it one of the elements in Green Deal. Ecosystems offer important services like food, drinkable water, clean air and shelter. They restrain ecocatastrophes, spreading diseases and help regulating the climate. EU has not met some of its key environmental targets for 2020, such as the Aichi targets under the Convention on Biological Diversity. (European commission, 2019).

European Union’s biodiversity strategy is being done to attack against the main threats to biodiversity in Europe and also in the world. The plan is to for example plant 3 billion trees by 2030 and reverse the decline of pollinators. Biodiversity strategy and Farm to Fork strategy are connected together and these two elements are indisputably linked

together. They are both important building stones for Green Deal and green transformation in the European Union region. (Rinaldi, 2021, p. 3-4).

The Conference of the Parties to the Convention on Biological Diversity in Kunming, China, in October 2020 will provide an opportunity for the world to put in place a solid framework to halt biodiversity loss. For the EU to play a key role in this, the Commission has presented a biodiversity strategy by March 2020 and more detailed actions in 2021. The strategy outlines the EU's position for the Conference of the Parties, including global targets for the protection of biodiversity. It commits to tackling the root causes of biodiversity loss in the EU and sets out measurable targets to support this. (European Commission, 2019).

A zero-pollution ambition for toxic- free environment, is also one of the elements. It requires more actions to prevent environmental pollution and to clean the environment and fixing the situation. To protect European citizens and ecosystems, the EU must improve the monitoring, reporting, prevention and remedial action of air, water and soil pollution and consumer product pollution. To achieve this, the EU and member states need to look more systematically at all policies and legislation. To address these interlinked challenges, the Commission intends to adopt in 2021 a Zero Emission Action Plan to protect air, water and soil. (European Commission, 2019). Toxic-free environment is also very much linked to the biodiversity element, as are all the elements in the Green Deal. European Union is approaching the chemical management with more caution and it wants to stop the most dangerous substances to the environment from getting into the European markets. (van Dijk et al, 2021, p. 1106).

As a summary for Green Deal as tool for green transformation it is obvious that it works in many sectors and ways. It concentrates on many different fields that are very important for green transformation and defending against climate change. As the narrative of Green Deal shows, it is basing elements on evidence and it gives framework in which

different sectors have to work towards greener future in Europe. It is important for regions and other actors to know, which way they have to work for and what are the targets and reasoning behind the given goals. If there is not proper deadlines or targets which to aim for, it is very hard to motivate actors to work for common goals.

## 2.2 Smart specialization as a tool for green transformation

The origin of the idea of Smart Specialization comes from the researcher group" Knowledge of Growth", which was founded by Commissioner of Research J. Potocnik in 2005. The concept" Smart Specialization" was born in 2009 by the same researcher group. The basics of the concept have very strongly linked into the conversations between research and development in Europe, and the ways that regions could be more attractive for big international companies. (Foray, 2015, p. 7).

Smart Specialization's original idea was about specializing in research, development and innovations (Ciobotaru 2014, s.7). It is aiming to create economic growth with smart use of public funds. Nation or region chooses intervention area that suits their strengths and comparative advantage. It is also about other innovation solutions than regular research and technology investments. Smart specialization takes to notice for example the regions' geographical location, climate, demographic structure and other matters that affect demand. It encourages regions to using its characteristics and own identity for economic growth. (European commission, 2012, p. 8–9).

In Smart Specialization the idea is not that action is driven from top down, but development has to born in dynamic cooperation between different stakeholders which have common management. Stakeholders in innovation sector have to work together making new ways to create growth. The idea is to get resources for more narrow area and to focus on the comparative advantage, and that way give country or region an opportunity to stand out compared to other regions. (European commission, 2012, p. 9).

The Green Deal (European commission, 2019), represents a view that the focus on the innovation policy should not be in the research and innovation policy process anymore but in the way to find sustainable solutions and ways to accelerate towards sustainability and green future. One way for European Union to make this change is to use smart specialization as a tool for it. EU could actually use this to make the diversity into an asset and not only between countries but use also different local environments to their favor. (McCann & Soete, 2020, p. 9-10).

Smart specialization strategies (S3) have already created a lot of innovation- and entrepreunial-led solutions in local, city and regional level, so it can be turned into a platform of Green Deal pretty easily. Those innovations and entrepreunial ideas ensure that European Union will be scientific, imaginative and creative when Green Deal is put in action and it's driving it forward. Smart Specialization is creating a great and unique platform for Green Deal, as it provides a combination of both widespread bottom-up micro-level, enterprise driven and top-down macro-level directionality, which ensures that Europe can focus their creative energy into medium and long-term Green Deal goals. (McCann & Soete, 2020, p. 16-17).

### 2.2.1 S3 as a tool on regional development

According to Foray (2015, p. 1) smart specialization tells about capability of the economic system to create new areas of specialization by finding domains. It makes innovation policy narrower, which helps stakeholders in certain areas to work together, under a mutual theme. More targeted activities help to take advantage of scale and the possibility for area to use its comparative advantage.

Regional development is a communicative process that needs ongoing co-operation between stakeholders working in the innovation system. Smart Specialization aims to concentrate resources to a smaller area and aims for entrepreneur-driven innovation policy. (Foray, 2015, p. 14–15).

Regional development in smart specialization happens through triple-helix theory in which stakeholders work in cooperation with each other. Triple helix is a model that describes cooperation between academic world and private sector with an intervention from the public sector. (Viale & Etzkowitz, 2010, s. 2–3). In this model the innovations born from the interaction of the stakeholders. For example, university creates research and intellectual capital which is being used by companies or in research. Private sector wants to turn that intellectual capital into physical capital (money and economic growth). Even though role of the universities is not the biggest and the most central in the strategies of Smart Specialization, the local universities and local research organizations have a great responsibility to interact and cooperate with industries and service sector companies in finding new and experimental activities and starting restructure. (Foray, 2015, p. 84–86).

However, nowadays the fourth helix is often added into the triple helix-model. This new model is called quadruple helix, and it breaks the barrier that sources and frameworks of innovation are only restricted to interaction between university, industry and government. Idea of quadruple helix is that it brings civil society into the mix and it supports the idea that innovation is driven by the needs of the user. RIS3 guide is explaining the involvement of civil society as *boosting the innovation potential*. The users of innovation, which are representing the demand-side perspective, are the fourth group of actors in the traditional model of triple helix. (Committee of the Regions, 2016, p. 14-16).

For the Smart Specialization strategies, the Quadruple helix model (see figure 2) is integral part of the strategy as it is fostering knowledge exchanging and creation. Quadruple helix is bringing together firms, researchers, users and independent innovators. (Carayannis & Crigoroudis, 2016, p. 31-42). Civil society and citizens are seen important for social innovations and especially strengthening them. Definition of social innovation is based on development and implementation of new ideas, for example products, services and models, and make them meet social needs and also create social relationships and

collaborations. (Carayannis & Rakhmatullin, 2014, p.212-39; European Commission, 2013; Park, 2014, p.203-207).

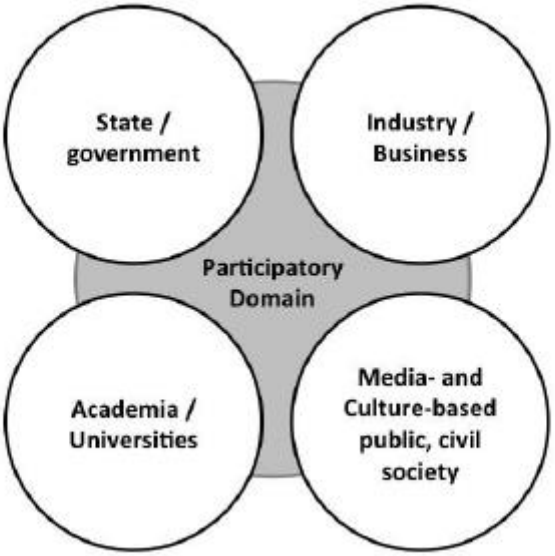


**Figure 2.** Quadruple Helix-model (Harbers et al.,, 2015, p2).

Companies own a lot of power in regional development because they have a huge amount of entrepreneurial knowledge. It is also important to notice that public sector and universities have a lot of entrepreneurial knowledge which can be used. Many times, local actors know the clusters, but not the themes of smart specialization. It is good to know that they are not the same thing. Domains, unlike clusters, include various actors from different sectors and might include several clusters and also, they are more focused on new technology. (Mäenpää & Teräs, 2018, p. 6–7).

Entrepreneurial discovery process is a development process in which country or a region tries to find its own domains in an entrepreur-driven way. Entrepreneurs and companies are in a best position when finding domains and when specialization of the region is considered. Companies have the best knowledge of the markets and abilities which can lead to development. (Foray & Goenaga, 2013, p. 5). Entrepreneurial discovery process is a step before the innovation-step and it is about finding new intervention areas and opening, which can lead to several new innovations and it is meant to lead into smart

specialization strategy. Entrepreneurial discovery process is compulsory step which gives the system a possibility to reconfigurate and renew itself. (Foray, 2017, p. 10–12).

Horizontal politics have been mainstreaming for years in the regional level in European union level. Horizontal procedures have been the main logic in the region- and cohesion policy with few exceptions. This kind of procedures very likely make parts of the regional innovation system better and they minimize the risks naturally in the decision making in which projects are selected for certain areas. (Aranguren,et al., 2016, p.19).

Even though this kind of policy making might work in better developed areas, it might not work as well in the less developed area. In the less developed areas regional innovation system has to aim all its potential expertise to certain sub-area to create innovations. Bigger and more developed areas already have big companies and universities. (Foray, 2017, p. 5–6). It is also noticed that in the areas that have weak entrepreneurship and knowledge, the natural entrepreneurial discovery process is not enough and intervention from government is needed, unlike those areas that have a lot of entrepreneurship and knowledge. (Aranguren et al., 2016, p.19).

Smart Specialization brings a new way to innovation strategies. Vertical policy is what it is all about. It means development is focused on certain industry, for example if some region wants to concentrate on battery industry. At the same time support comes to battery industry itself, but also the industries subcontractors and other research and development organizations like universities. Vertical actions are not intended to completely replace the horizontal policy but to complement its faults and to help less developed areas in their challenges. (Foray & Goenaga, 2013, p. 2–3).

Choosing a certain intervention area and favoring it in the policy making is a very hard decision for decision makers, so smart specialization is made to help them find the areas to specialize for. So, the idea is to find new approaches to utilization of knowledge that already is there. Regions are trying to widen the selection of products which they already

have, to attract interest in the global markets, because the global markets are the place where big success is built. (Foray & Goenaga, 2013, p. 2–3).

Finding new ways and innovations in smart specialization and in general regional development will almost certainly lead into changes in the regional stakeholders. As the result of structural changes is more than one single innovation, it may lead into a complete structural change in the regional economic system. Structural change in regional actors is a cumulative series of events that links the strengths of the current and future regional economy into one domain. (Foray & Goenaga, 2013, p. 6-7).

Smart specialization's goal is to create good and efficient economic growth to region. It is not meant to create one sided technological development or culture. Neither is it meant to destroy other activities by prioritizing others. Concept of smart specialization is built around an idea that region has more than one overpowered stakeholder when research and development is considered. (Foray & Goenaga, 2013, p. 9-10).

Smart specialization is not a magic word for region to become a leading actor at some sector and that is why less developed regions are able to rise with help from a bigger area. Smaller regions can for example support more developed and bigger regions if they can produce materials to help with battery industry. More developed regions usually already have systems and findings which create innovations constantly. Successful regions must keep in mind that success in the past is not a guarantee of success in the future. Those regions have active entrepreneurs finding new domains and they must be supported in the future and that is also a mission for smart specialization. (Foray & Goenaga, 2013, p. 9-10).

Smart specialization strategy is aiming to get two conflicted needs to work together: finding priorities on the vertical level (specialization) and keeping market forces working so domains and industries for prioritizing could be found. (Foray & Goenaga, 2013, p.12).

### 2.2.2 S3 as a process in European Union

Strategies for smart specialization are created so structure and innovation funds could be used more efficiently. RIS3-strategies (Regional research and innovation strategies for smart specialisation) are region-based programs for economic change. Research and innovation strategies based on smart specialization have been a precondition for granting European union's structural funds since 2014. These conditions are linked to Europe 2020-strategy, which says that Europe is wanted to be smart, inclusive and sustainable economy. (European Commission, 2014, p. 2-3).

To help regions to create smart specialization strategies, European commission has developed infrastructure called S3-platform, in which regions can search for help and ideas for their strategies. Platform provides peer review actions for example technical support, shares knowledge and experiences (European Commission, 2021b). It was founded already in 2011 and has grown significantly since (Foray, 2015, p.12-13).

RIS3-strategies have a massive impact in the EU cohesion-policy. They are meant to help more developed and less developed areas changes to grow. Strategies must have scientific evidence and they must be followed with indicators. (European Commission, 2014). National and regional research and innovation strategies can be seen as economic transformation program which have four basic principles. Those principles are: choices and critical compilation, which means critical principles when choosing own strengths and international specialization (Foray, 2017, p.17).

Other principle is competitive advantage, mobilizing talent by uniting research and development for business needs through an entrepreneurial discovery process. The third principle is cohesion and clusters; creating clusters and building a competitive platform for cross-sectoral activities within the region, as well as externally. The fourth and final principle is co-leadership, which seeks efficient innovation systems through public-private partnerships. These four points are leading elements in the development of the RIS3

strategy and include its new main points when compared to old experiences. (Foray, 2017, p.17).

Difference to innovation strategies before smart specialization is not very big. Smart specialization is aiming to strengthen economic views in the regions, finding its attributes and competitive advantage. It is bringing stakeholders together for regions future. Biggest differences to old innovation strategies are the conditions set by the European Union for the region to have a RIS3 strategy in order to receive support from the European Regional Development Fund. (European commission, 2014). Old innovation strategies also had lack of entrepreneurial development and they did not take companies opinions and views into consideration as much. The RIS3 strategies strongly aim for bottom-up decision-making, i.e., solutions are sought from the activities that emerge from entrepreneurs and other regional stakeholders. (Midtkandal & Sörvik, 2012, p.2).

When Green Deal is the background of European transformation towards green future, smart specialization is the process tool to make it happen. They are affecting actors behind all of this. Green Deal is the backbone of all of it with decision making and green transformation policy. Smart specialization is how to make it happen as a process. It makes the decisions and targets of Green Deal to go forward in regional level. In smart specialization different stakeholders work in cooperation to find ways to reach goals set by the Green Deal. The transition itself can be understood in even more detailed way for example through the theory of multi-level perspective, which is told in the next chapter of this study.

# 3. Green transformation through multi-level perspective

## 3.1 Multi-level Perspective

The research questions will be looked through a Multi-level Perspective (MLP) by Frank W. Geels in which innovations rise from niche level to regime and landscape. In the context of green transformation, landscape-level means the European Union level. It is the level of political decisions, culture, demographic trends and it is the level putting pressure on the regime level. Regime level is the one we are living now; technology, user practices and application domains (markets), symbolic meaning of technology, infrastructure, industry structure, policy and techno-scientific knowledge. Niche level is where actors in precarious networks work on radical innovations. Radical innovations might look promising, and they are possibly rising to the regime, they might also fail. (See Figure 3). There is also a possibility for them to become a success and gradually stabilize into a dominant design. (Geels, 2002, p. 1262).

The MLP highlights how the alignment of trajectories inside the levels, but also between levels, will fabricate transitions. The model of MLP includes the already mentioned three levels; technological niches, socio-technological regimes and socio-technological landscape. These levels can be understood as nested hierarchy, which means that regimes are implanted within landscapes and niches within regimes. Also, the multi-level perspective contains concepts of STS (Socio-Technical Systems), evolutionary economics and sociology. (Geels & Schot, 2010, p. 17-18).

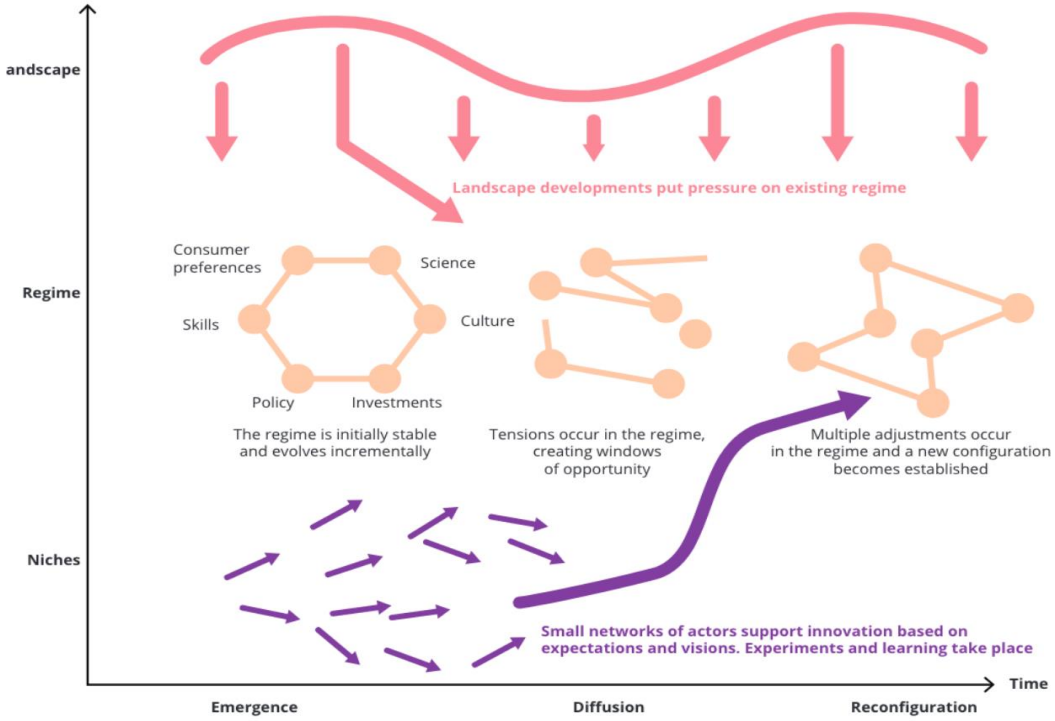


**Figure 1.** The multi-level perspective on sustainable transitions (Geels et al., 2019, p.27).

Every level is actualized as diversified socio-technical configuration. STS is useful for actualizing alignments inside the levels. These three levels (niche, regime, landscape) provide coordination and structuration of different kinds to activities in local operations. These three levels are different in terms of stability. Niches are small with social networks and they are unstable and risky, because entrepreneurs and innovators are taking more risks (Geels & Schot, 2010, p. 17-18).

Actors have to work hard to sustain the niche-level. Regimes are firmer and social networks in regimes are larger and the markets, regulations etc., are revising the level to be more stable. Landscape-level has the broadest background structures that are providing gradient for actions. The alignments between these levels are continuously evolving; niches are creating the platform for the generation of radical variations, but alignments with regime and landscape are needed to provide wider diffusion of these novelties. Multi-level Perspective is considered as abstract analytical framework that identifies relations in general such as theoretical principles and mechanisms. Multi-level perspective

on the other hand does not specify substantive mechanisms of interactions between technology, culture, politics etc. (Geels & Schot, 2010, p. 17-18).

The concept of socio-technological regimes builds on the concept of technological regimes. Technological regimes refer to the cognitive routines shared in a community of engineers. They coordinate and guide R&D to certain directions, leading to innovations. Unlike technological regimes, that build on communities of engineers, socio-technological regimes involve social groups; scientists, users, policy makers etc. Those social groups are creating networks and mutual dependencies. Socio-technological regimes have rules that account for the stability and lock in of socio-technical systems. Routines and rules are moving, for example engineers to look to certain directions, and blinding them to develop things outside their focus. (Geels & Schot, 2010, p. 20-21).

The lock-in mechanisms make the existing socio-technical systems dynamically stable. They are still creating innovations, but it is of an incremental nature, making cumulative technical trajectories. Science, culture, policy, markets and science also involve these predictable trajectories, and those trajectories are carried by social groups with relative autonomy. These groups are sharing information between each other (problems, norms and preferences), which lead up to experiencing their own structuration dynamics leading up to trajectories. These social groups are overlapping each other but do not lose their autonomy, that's why they create different trajectories in socio-technical systems. This overlapping and interacting is crucial to make sure the socio-technical systems are functioning correctly. (Geels & Schot. 2010, p. 20-21).

Niches are born from the experiments made by companies. New technologies are tested and exposed to actors in a protected environment. Dedicated actors are protecting the environment and they want to invest their resources into these new technologies. Niches have three internal processes 1) building of social networks; nurturing, carrying and developing originality 2) learning processes to keep improving socio-technological

configuration 3) articulation of expectations and future sights to lead processes of learning and attracting funders. To turn from invention to innovation might take even three decades, so it can be said that niche phase might last a long time. (Geels & Schot, 2010, p. 22-23).

Exogenous environment that is not directly influenced by regime and niche actors is created by socio-technological landscape-level. Socio-technological landscape can be seen as a metaphor of something that we can travel through and is around us and we are part of. Elaboration of the metaphor of landscape-level includes three types; things that change slowly or not at all i.e. climate, long term changes and thirdly quick and rapid changes and shocks as war. Landscape developments also need a human to occur, but they do also create an external context that actors can't influence on short term. Developments in the landscape-level cannot be influenced by the regime or niche actors. (Geels & Schot, 2010, p. 24).

It should be noted, that in GRETA-project the mindset actually is, that niche-level actions can make changes that affect especially regime, but might also lead to recurrence of the landscape level as well. In GRETA, innovation might be a new way of doing thigs, a new cooperation network etc.

Niches are the birth point of transitions. Multi-level perspective is not about that niches rise directly to regime, and become mainstream technologies. Instead, it highlights interactions between levels and the opportunities that are occurring. A lot of uncertainty is in niche-level, when innovations are born. Regime and landscape levels are influencing the niche-level and its social networks and visions. For niche innovations to break through completely, landscape changes are normally needed and they need to put pressure to existing regimes. Landscape pressure does not mean "mechanical pressure", it is done by perceptions, negotiations and agenda changes. Pressure may open up the existing regime and open possibilities for niche innovations to break up into the regime. If niches can stabilize and experience improvements in performance or price, they might

spread up and diffuse more widely. After that it creates competition in the regime level, which is played out in the markets, regulations etc. If new technology is able to rise up and win the competition, it will create a new socio-technological system, and it might change the landscape level over time. (Geels & Schot, 2010, p.25-26).

Even though technology is important in multi-level perspective, transitions need more involvement from other sectors of environment. Only the internal drivers of niche innovations are not enough, but they are still important. All three levels are influencing local practices differently. Niches and regimes have a lot of similarities, but also differences. They are similar in structure but different in size and stability. They both are about networks in which actors have certain rules and both of them provide structuration to local practices but in different styles. (Geels & Schot, 2010, p. 27).

Niche level networks are unstable and actors are leaving and entering the market pretty easily. There are imprecise rules in niche level and structures in economics and markets are not well developed. Regime level has a lot more stable and structured rules and markets. The actors influencing on the regime level have aligned their activities with the rules. Local actors may deviate from regime rules, but it's not impossible, it just needs a lot of work. Because structures are so strong in the regime, niches might rise up to regime level if the social networks grow larger and rules become more stable. (Geels & Schot, 2010, p. 27).

Socio-technological landscape is different to other levels. Its structure is not working like niche and regime through sociological structuration. Socio-technological landscape does not determine deep structural gradients, but it provides them. It makes some actions easier than others. Landscape level provides a broad context for other levels and it is difficult to deviate from niche-level, only regime is capable of deviate it. (Geels & Schot, 2010, p. 27-28).

The scale levels are not as spatial or geographical levels, they are intended as functional scale levels. They represent functional relationships of the actors, structures and working practices. When the scale level rises higher, more aggregated the relationships and components become and the dynamics are slower between these actors, working practices and structures. When these dynamics come together in certain ways might the mutual reinforcement effect appear to achieve a transition. (Grin et al., 2010, p.7).

## 3.2 Pathways as a way to change regime level

Changes between levels have been described as transformation pathways by Geels and Schot (2010). These pathways will result in transformation and in this context, they will be discussed in the context on green transformation and sustainable future. The pathways where also shown to the experts and they were discussed. They explained their views on the matter by reflecting them to the pathways.

Looking into the details of the pathways, in the *de-alignment and re-alignment path* you may see very sudden and large change in the landscape-level, and the problems in the regime, which are increasing, may cause actors to lose their faith. This will lead regime to de-align. This leads to the question that are the niche-innovations sufficiently developed? If not, then there is no proper and clear substitute. If substitute is not found, it will create great and wide space for multiple other niche innovations to rise up and have a race for attention and resources. This process will create a proper niche-innovation that will become dominant and it will form a core for the re-alignment and create a new regime. (Geels & Schot, 2007, p. 408).

This pathway forms when regime gets under a lot of landscape pressure very rapidly. When landscape pressure comes down like an “avalanche” it might tear the regime level apart and create big gaps. Regime will experience big problems, it will erode, collapse and de-align. Occupants will lose their hope to the potential of regime to get back to-

gether and it will lead up to R&D investments to decline. When regime rules are destabilized, it makes optimizing the dimensions of innovation efforts uncertain. (Geels & Schot, 2007, p. 408).

As an example of this pathway is the way American transitioned horses into automobiles in the 19th century. Massive changes in politics, society and culture created by immigration, electricity getting more common, political movements and middle class having more money, created massive avalanche changes in the regime. Urbanization meant bigger travel distances. It created possibilities for niche-innovations to grow and rise up, which benefitted for example electric trams, bicycles and cars. (Geels & Schot, 2007, p. 408).

In the de-alignment and re-alignment pathway there is not one niche innovation that is ready and stable to fill the gap that the de-alignment creates. The open space that is in the regime after it has teared apart, will be filled with multiple niche innovations. When there are no stable rules in the regime, it will lead up to multiple innovation trajectories and directions. Multiple niche-innovations create more uncertainty, because the products are competing and winner is unclear. Innovations are evolving together and occur in tandem with technological changes. In the end one of the niche-innovations will gain momentum and attention and it will become dominant actor in the regime, and it will be followed by the re-alignment and re-institutionalization of the sociotechnical regime. (Geels & Schot, 2007, p. 408).

*Technological substitution*-pathway forms when there is a lot of landscape pressure, which might be a specific shock or an avalanche change for example, at a moment when niche innovations are properly and sufficiently, they will break through replace the existing regime. Assumption in this pathway is that radical new innovations are born and developed in the niches but they can't break through because the regime is too stable and strong. Some small problems may occur with the regime actors but they are solved

with incremental innovations. Regime actors don't really give attention to niche-innovations, which are developed by the outsiders. (Geels & Schot, 2007, p. 409).

Regime stays as a reproduction process until there becomes pressure from the landscape. Technological substitution-pathway is formed when a "specific shock", "avalanche change" or "disruptive change" occurs in the landscape level and creates a massive amount of pressure to the regime. Regime will be under a major tension and it opens a gap for niche innovations. (Geels & Schot, 2007, p.410).

The difference to de-alignment and re-alignment path is that niche-innovations can use these gaps to rise up, because they have stabilized and gathered internal momentum. Regime actors will defend themselves when niche-innovations are rising up to mainstream markets, they will be doing it by investing in improvements. The fighting between incumbents and newcomers is affected by the competition in the markets and also power struggles. (Berggen et al., 2015, p.1018). In case of innovation replacing old technology, it will lead up to knock-on effects and even wider regime changes. It also affects more than just technology regime, it has more processes that follow this substitution. (Geels & Schot, 2007, p.410).

For technological substitution, an example from British ship-industry can be used. Steamships substituted sailing ships in the 1840's when a lot of Europeans wanted move from Europe to America. This landscape shock lead to faster steam ships to take an advantage. They were faster, could carry more people and stuff and were all around more efficient than sailing ships. (Geels & Schot, 2007, p. 411).

*Reconfiguration pathway* is based on theory that innovations, which are symbiotic, are developed in the niches and will rise up and are adopted to the regime when problems occur in the regime-level. Those niche-innovations also create more and more adjustments in the regime architecture. Innovations do develop in niches and if they have symbiotic relations with regime, they are easy to adopt as replaceable component or even

as add-on. Economic considerations are driving these adoptions and then most rules of the regime are leaved untouched. (Geels & Schot, 2007, p. 411).

When the basic core of the regime is remaining as same, this can be considered as transformation pathway. On the other hand, the innovations that are adopted into regime, might lead up to further actions in the architecture. This might happen when actors learn more about the new novelties and try develop them into a new level. (Berggen et al., 2015, p.1018). This might lead up to even more new technical changes and adjustments when regime actors learn more about the combinations between new and old practices. This might lead up to creating even more new space for innovations to be adopted and over time the pressure of landscape may lead up to major changes in the regime. (Geels & Schot, 2007, p. 411).

Example for reconfiguration pathway is the way Americans changed the traditional factory working into mass production. Factory work has a lot of elements in it and for example in USA in the 1850's and 1860's substituted one element at a time into a more and more efficient factor. Special purposed tools substituted old tools and it led up to other elements substituting to more efficient manners. When learning was happening, it led up to wider reconfiguration of the regime. (Geels & Schot, 2007, p. 411-412).

In the "*regime transformation path",* if moderate landscape pressure is affecting at the time when niche-innovations are not developed enough, the regime actors will change their way of modifying the direction of development and innovation. This pathway is formed in a way that moderate changes on landscape create pressure on the regime-level. This makes regime actors to reorganize. Niche innovations though cannot advantage from the pressure from landscape because they are not developed enough. (Geels & Schot, 2007, p. 406).

If regime actors have acted upon and perceived the pressure from landscape, the landscape level will change the exert pressure. Actors from the outside are important in this

case because they can translate the pressure from landscape and draw attention to negative externalities. Regime insiders don't do that. Professionals from the outside of regime might criticize the technical details of regime and maybe give opinions on the alternative solutions. Companies from outside might develop alternative technologies and practices. These propositions might lead up to reorientation of the innovation actions in regime level. (Geels & Schot, 2007, p. 406).

Criticism and proposed new activities are not affecting the regime-level immediately. Some conflicts, struggles of power and translations are needed for that. Social-institutional actors have a great role in this pathway, with their social groups wanting to change the regime directly. Regime actors use all their adaptivity to change and reorientation for the changes in the environment. When some technical variations appear, which are better fit for the selection environment, it will change the regime within. Evolutionary changes and social-institutional changes reinforce each other. (Geels & Schot, 2007, p.407).

The old regimes are the core of new regimes in this pathway. They grow from cumulative adjustments and reorganizations. Changes in the social networks might occur but the regime actors will survive. Regime actors may even import the knowledge coming from the outside if it's not too far away to reach. So, the niche-innovations will be integrated into regime and they will not interrupt the basic architecture of the regime. (Geels & Schot, 2007, p.407).

As an example, the Dutch hygienic transition can be used. They changed from cesspools to sewer systems. Hygienic doctors were giving criticism in the 1850's because diseases were spreading from the cesspools. The criticism towards regime actors, which took only a little action in the beginning. Doctors had cooperation with the engineers to work towards more hygienic solutions. In the 1890's the hygiene became more of a cultural norm and it started give even more pressure on the regime. With gradual adjustments in the regime, the regime started to change and created the regime transformation path.

Developments in landscape and struggles in the regime were needed to bring out the problems which occurred and were in the end solved. (Geels & Schot, 2007, p.407-408).

Pathways are linked to green transformation in a way that they bring structure to the transformation. Inside those structures the pathways are formed and they show us the different ways of how green transformation in regions might develop. Understanding the structure of the transformation is important when green transformation is being examined. It helps understanding details of transformation and in that way changes on different levels can be made. This leads up to the GRETA-project and the results of it, in which multi-level perspective and pathways were examined in the context of green transformation in Ostrobothnia.

# 4. About GRETA-project

## 4.1 GRETA-Project

The GRETA-project (Green Transformation! A policy tool for regional smart specialization) is part of Interreg Baltic Sea Region Program and runs until the end of year 2021. The project is developing tools supporting the green transformation of society and economy and they are done in a way that they are aligned with the European Union Green Deal. Green transformation in this context means multi-level systemic transformation towards sustainable and climate neutral society with zero net greenhouse emissions. GRETA focuses on two main focus areas in Green Deal: energy production and circular economy. (LARS-Project, 2018; University of Vaasa, 2021).

GRETA-project is continuity to the LARS-project (2017-2020), in which it was researched innovation networks in Baltic Sea Region and good practices of companies, universities, public organizations and non-governmental organizations were analyzed. In GRETA environmental actors are taken to the conversation to analyze, how green transformation is reached with the cooperation of regional actors. (University of Vaasa, 2021).

GRETA has 6 different partner areas around Baltic sea-region. Different partner areas are focusing on their own intervention areas that they have chosen. The other partners beside Ostrobothnia are: Päijät-Häme (Finland), Västerbotten (Sweden), Ministry of Environmental Protection and Regional Development (Latvia), Lithuanian Innovation Centre (Lithuania) and Lithuanian Institute of Agrarian Economics (Lithuania). Päijät-Häme has food and beverage industry, in the perspective of circular economy. Västerbotten is focusing on the sustainable energy production with focus on hydrogen. Latvian region focuses on smart materials and smart technologies and engineering systems in the manufacturing sector. Lithuanian innovation center chose their intervention are to be food and beverage industries transition to circular economy. And finally, the Lithuanian Institute of Agrarian Economics is focusing on the circular bio economy, especially biogas

production from agro wastes. Ostrobothnia has two intervention areas and will focus on the circular economy and green energy technologies.

The project is about finding out how green transformation is reached in different regions and with cooperation of different actors. Green transformation is about society and economy transitioning towards carbon neutrality and circular economy, and in which the use of unrenewable natural resources is reduced. It's a multi-level process, in which UN sustainable development goals, EU Green Deal, national policies, regional development programs, companies and other organizations innovation strategies are followed. The goal is to help sustainable innovations to become more mainstream. (University of Vaasa, 2021).

There are different work packages in the project and they all focus on different things. In the first half of the year 2021 work package one and two took place. During summer 2021 work package three started. The interviews of this paper took place during the work package two period and with the help of those interviews, stakeholder analysis was done. In the work package three, results came from DPSIR analysis and all the partner areas worked on their own policy brief-paper. This paper is focusing on the work package two results and the interviews, and especially focusing on the results which came from Ostrobothnia region.

Quadruple helix theory (see Figure 2) was used as a background theory for the GRETA-project. It was used to select the stakeholders and partners to work on with the project. Every sector from the quadruple helix theory was considered when selecting for example the respondents to interviews that were planned and the invitations to the interviews were sent.

## 4.2 Ostrobothnia intervention area in the GRETA-project

Ostrobothnia is a region located in the west coast of Finland (see picture 1). It includes 14 municipalities and the population is about 176 000 people. (Pohjanmaan liitto, 2021a). The biggest city in Ostrobothnia is Vaasa with population of 67 000. (City of Vaasa, 2021b). Ostrobothnia is mostly Swedish speaking region with 49,5% of the people speaking Swedish as their first language, 43,7% are speaking Finnish and other 6,8% are speaking other languages. (Pohjanmaa lukuina, 2019).


**Picture 1.** Municipalities of Ostrobothnia and its location in Finland (Pohjanmaan liitto, 2021b).

In Ostrobothnia there are about 76 500 employed people (2019) and in 2018 about 46,5% of the work positions were located in Vaasa, the second place is held by Pietarsaari with 13,4% of the workplaces of Ostrobothnia economic region. The manufacturing sector is the biggest sector of Ostrobothnia with 18 609 jobs and it is followed by social and health care sector with 14 052 workers. These numbers are also from year 2018. (Pohjanmaa lukuina, 2021). Vaasa has a massive energy cluster, biggest of all Nordic countries. It consists over 160 companies and their mission is to create more sustainable technology to save the world (City of Vaasa, 2021a).

This study is researching green transformation under the European Union Green Deal in Ostrobothnia region. The intervention area in Ostrobothnia was decided to be circular economy and energy technologies, as they are also the key focuses in GRETA-project. The largest energy cluster of the Nordic countries is in Ostrobothnia, so it's a natural choice in that way, and also in a way that it is very relevant to concerning solutions for green transformation. (Mäenpää & Jääskeläinen, 2021, p.1).

Intervention area is partly continuation from the LARS-project, in which focus was only on energy production. Circular economy was added as an additional intervention area because it became obvious that in order to achieve green transformation, circular economy is very much needed addition and also is part of regional smart specialization strategy. In the region there were also quite a few interesting developments regarding circular economy, as local development company has launched regional roadmaps for circular economy. These roadmaps are very concrete papers and will give companies guidelines on how to benefit from circular economy. (Mäenpää & Jääskeläinen, 2021, p.1).

Even though Ostrobothnia does not have a strategy for green transformation, the roadmap for circular economy and regional energy strategy are probably the most relevant strategies at the moment. Region has a few global companies in the area and also universities and other organizations, which all have their own strategies, and also the city of Vaasa has their own environmental strategy to be carbon neutral before 2030.

The national aim in Finland is to be carbon neutral by the year 2035. (Mäenpää & Jääskeläinen, 2021, p.1).

It is a quite high possibility that green transformation strategies will be written in the future, since they may compile many separately developed strategies and environmental plans. It is also possible that green transformation strategies will be included into the smart specialization strategies, as the European funding for regional development comes through the smart specialization strategies. New regional strategy is being written by the regional council of Ostrobothnia, and it will consider environmental issues in it. (Mäenpää & Jääskeläinen, 2021. p. 1).

## 4.3 Interview method and process

Interviews took place between 18th and 26th in March 2021. Interviews were done via Zoom-program, due to the covid-19 pandemic. The experts which were chosen to the interviews had knowledge of the topic of green transformation and worked in management or development positions for the company or organization (see Table 1). Some of them were also specifically experts in circular economy or green energy production. In total 9 experts were interviewed, three of them were from companies, one from university, four from public organization, and one was from non-governmental organization.

**Table 1.** Respondents helixes, expertise and if they are from the region. (Mäenpää & Jääskeläinen, 2021, p. 16).

| Helix | leader | expert | internal | external | Total | Focus |
|---|---|---|---|---|---|---|
| **Company** | 3 | 0 | 2 | 1 | 3 | Green energy production |
| **University** | 0 | 1 | 1 | 0 | 1 | Circular economy |
| **Publ. Org.** | 1 | 3 | 3 | 1 | 4 | Green energy production |
| **NGO** | 0 | 1 | 1 | 0 | 1 | Circular economy |

The respondents were chosen because of their products and ongoing development activities. One important factor when choosing the respondents was that they were environmental experts, as well as persons who are working on green innovation related development work, especially in circular economy and energy technology field.

Respondents were also chosen on ongoing development projects, which focus on Green Transformation. The experts were all working on the sector of energy production or circular economy, or working with that topic and researching it. For example, the expert from university was working in projects with the topics of green energy production and circular economy.

Focused interview was chosen to be an interview method for this qualitative research. In the interviews we asked open-ended questions and were hoping for in-depth answers and responses, about the expert's experiences, feelings, knowledge and perceptions. (Patton, 2015, p. 36). The idea behind focused interview is to get someone to tell what they think of something. In these interviews we asked experts about what they think of green transformation and especially in Ostrobothnia. The most effective way to get to know someone's view on something is to ask about it straight. This time the idea was that it is more effective to ask experts views about green transformation than give them a sheet where they could give answers without possibility to discuss about it freely (Valli & Aarnos, 2018)

Interview process in focused interviews is seen as some kind of discussion about the topic. The interviewer is trying to get respondents to answer questions and problems related to the topic of the research. The difference between normal discussion and the focused interview is the starting point of the conversation. In the interviews the discussion starts with the initiative of the interviewer or the researcher. It is also targeted data collection sessions which is many times recorded (Valli & Aarnos, 2018). In GRETA-project the interviews were recorded for taking notes only.).

Different types of interviews are categorized roughly by how structured the interview is, how tightly the questions are decided beforehand and how much the interviewer is leading the situation of the interview. Focused interview is exactly in the middle between fully structured interview and totally unstructured interview. This way it is different compared to form interview, in which all the questions are the same and in same order for everyone and from open interview in which there might be only one question and then open discussion after that (Valli & Aarnos, 2018).

Focused interview assumes that the respondents have a lot of knowledge about the theme that is dealt in the interviews (Puusa et al, 2020). In this project the respondents were chosen because of their knowledge and experience from the field of green transformation and sustainable technologies. Focused interview is going through the themes that chosen beforehand and the interview itself is quite free flowing and flexible. Choosing the themes does not mean that questions are asked exactly the same way every time, but the flow of the session is determining the way conversation is going ahead. (Puusa et al., 2020).

For focused interview to be successful, it is important to the interviewer to know basic elements of the theme (Puusa et al., 2020). In this case we had a lot of knowledge about the theme, as it was considered in the group of experienced researchers and the theory background of green transformation was familiar to the interviewers.

Sometimes it is good to send the respondents some background information about the themes of the interview (Valli & Aarnos, 2018), but in GRETA-project´s case, it was believed to be unnecessary. The respondents were told briefly about the background of the project in the invitation and also in the beginning of the interviews. They were all experts in the field of green technologies and sustainability, so it was believed to be reliable to ask them about these themes.

The place where the interview takes place is not an irrelevant question at all, because it is about various different social aspects that create the interaction between interviewer and respondent (Valli & Aarnos, 2018). These interviews were held via zoom program, because of the covid-19 pandemic in the world. However, because the interviews took place virtually, it probably gave a better platform to concentrate fully on the given theme and all distractions were minimal. It also gave a good possibility to record the interviews, because zoom has its own recording function.

The interview questionnaire had in total 13 questions and they were all answered by the experts. In this research I'm going to focus on the questions 3, 4, and 6. (see Appendix). Those questions are related to the Geels' multi-level perspective-theory with the link to green transformation.

In the interviews we asked the experts to share their views about the connection between MLP and green transformation. Multi-level perspective on sustainable transitions-figure (see Figure 3) was shown to help them visualize the situation and explain their views.

We asked the experts about their views on questions; How do you see the way forward; how to enhance green transformation? What is the connection between different levels; how do they interact in promoting transformation? What pathway seems most relevant for your region?

We also had some additional questions to help clarify what kind of answers we were looking for; What is the role of these levels in Green transformation: EU and national regulations/support, regional institutions and policies, development of green innovations? And how do those levels interact in promoting green transformation. We also showed the respondents the definitions of the transition pathways; Technological substitution, regime reconfiguration, de-alignment and re-alignment and institutional exhaustion.

# 5. Results

We asked the regional experts about the connection between landscape, regime and niche levels and how they can enhance green transformation in the future. This question was asked with the picture of Geels' (2019) figure of multi-level perspective. All questions were asked concerning Ostrobothnian region specifically, in order to get regional focus.

## 5.1 How to enhance green transformation in Ostrobothnia

According to the respondents, landscape level needs to continue the support of GT and keep offering funding for it. Important thing is to keep supporting the actions which have environmental effects, but also give space for experiments with the possible solutions. Important and interesting thing is that not all the green innovations are always environmentally friendly. One example is battery technology which is not as environmentally friendly as many believes it to be. There needs to be support for climate actions but biodiversity should not be forgotten. One major thing to keep in mind is to help the actors which may be hurt by the green transformation. In Finland one of the sectors is turf production sector which needs to go down gradually, so the major environmental effects are avoided. (Mäenpää & Jääskeläinen, 2021, p. 17).

For regime level, the respondents saw, that it is important to deepen the collaboration between actors. In Finland, which is a small market, this is apparent to keep hopes of business opportunities alive. Co-operation with Swedish actors is seen as important thing in the future, because it is kept as some kind of gateway to the global markets. Also, Ostrobothnia is kind of a similar gateway for Swedish products. The collaboration between companies and the City of Vaasa is increasing and this effort is coming from the companies. This derives from green transformation because the products are not seen as important as before. There is a need for regional solutions. Innovation networks and

collaborations are very important in the future development. (Mäenpää & Jääskeläinen, 2021, p. 17).

For the niche-level, it is important to keep finding new solutions. Important thing however is, that if competing technologies are found, those technologies should not be bought, but public organizations should stay vigilant regarding this type of activities and start to look if this kind of activity is found from their region as well. Also, the citizens could get bigger role when enhancing green transformation, perhaps even more than as a customer. Some ideas that could thought about is “Green Cash”. Idea of Green Cash is important notion, because circular economy will save money, if it is done right and it needs to be taught, especially for SME’s that might not know the importance of it yet. (Mäenpää & Jääskeläinen, 2021, p. 17-18).

When green innovations are developed, the important question that rises is; what is profitable for the companies to keep developing in the long run. At the moment the technology for green transformation already exists, it only needs to be adjusted to work properly. Entrepreneurs and niches are in the key position in green transformation, but they need a lot of support from other levels (Mäenpää & Jääskeläinen, 2021, p. 21).

From European Union level there needs to be support for research and finances, regional level needs to support more pilot-projects and try new things even if they might fail. Testing and trying different things is a way to find solutions and value for green transformation from unorthodox places. Co-operation between levels is seen as the most important thing for making green transformation possible. Companies are important also in a way that they promote their products for the consumers. Consumers are getting more and more aware of the environmental side of their consuming behavior and it will also place pressure on the companies to work more environmentally friendly. (Mäenpää & Jääskeläinen, 2021, p. 21).

## 5.2 Connections of the MLP levels in green transformation in Ostrobothnia

Landscape level is setting the direction and law, funds and regulations which are important for guiding actors towards sustainable goals. It's seen that in Finland this is not always the case, because European union does not always understand the national conditions, which creates challenges when implementing the actions. Political parties also create a problem, because they don't always base their opinion on facts, but do political compromises. These things might be dangerous to environment. Sharing of knowledge would be important and useful, even if nowadays "facts" might be harder to separate from the false. (Mäenpää & Jääskeläinen, 2021, p. 19).

Regime level is where the actions from landscape level is transformed into actions for niche level. Regime has an important role for providing knowledge and sending it back to the landscape level. This the reason why regions are seen as important in green transformation. Regime is also useful for establishing and maintaining innovation networks and offer platforms to go through the problems and issues of green transformation, and also helping to solve them. (Mäenpää & Jääskeläinen, 2021, p. 19).

Niche level interacts mostly with regular people, for example through their role as consumers. Actors in the niche level might be in a bit difficult situation right now as the knowledge of environmental issues and climate challenges are increasing and customers are more demanding all the time. This on the other hand gives them a possibility to offer new products and solutions, which may lead to a system change. Supporting experimentation is crucial, because it may help new green innovations to rise up. (Mäenpää & Jääskeläinen, 2021, p. 19).

EU is trying to become the leader in the war against climate change. This is important for the companies that are able to create solutions to change the world. Experts saw the actions from EU as crucial steps towards green transformation, Green Deal being one of the most important. Funding instrument was also mentioned as important combination

to have, because companies need penalty and reward to get them to change their ways. Legislation also makes the market mutual and concise, so the free riders fall off and fair competition is granted. (Mäenpää & Jääskeläinen, 2021, p. 19).

Experts think that there are some conflicts between sectors regarding green transformation. For example, many believe that European Union does not understand Finnish agriculture. European union wants farmers to be environmentally friendly, but their actions are favoring bigger farmers, which makes it difficult to try out different solutions for example for biogas (Mäenpää & Jääskeläinen, 2021, p. 19).

Production for biogas works well locally, but it requires a steady amount of fuel to work optimally, and it is difficult to organize if farmers are too far away. Other example is carbon neutrality in which Green Deal focuses. Because everyone is focusing in reducing their carbon emissions, biodiversity is often forgotten. Some innovations that are considered green, are not actually that green; battery cars might be more harmful to environment than they are useful. (Mäenpää & Jääskeläinen, 2021, p. 19).

National level also has a lot of power, legitimacy and urgency when doing decisions about actions towards green transformation. They are able to do legislation and offer funds to guide actors towards the goals of sustainability. Finland has a goal to be carbon neutral in 2035, and it's seen as a huge challenge, but also as a really big opportunity for some companies, as they have to develop their products faster. National level has similar problems as European Union level in the understanding of regional solutions. (Mäenpää & Jääskeläinen, 2021, p. 19-20).

One example of these problems is turf producers that are wanted to be shut down, but the thing that is not understood is that this procedure needs some time to minimize the negative effects to the environment that might follow. Regional actors were expecting a big support for Ostrobothnia, because the regional actors are offering solutions to battle climate crisis, but they were afraid that Finnish government is continuing to offer more

support to other regions such as Eastern and Northern Finland (Mäenpää & Jääskeläinen, 2021, p. 19-20).

The actors in the region are hoping that funds of Green Deal are only allocated to acts that are helping environment, but also feel that they are going to be allocated as previously. (Mäenpää & Jääskeläinen, 2021, p. 19-20). In the end the funds were allocated based on previous basis, so Eastern and Northern Finland got most of the EU´s regional development funds (Valtioneuvosto, 2021b).

## 5.3 Which pathway seems most relevant for Ostrobothnia

One of the questions in the interviews was a question about the pathways (Geels & Schot, 2010, p. 63-70). Respondents were asked about how they see the way forward, when given their choice of pathway. This question also answers one of the research questions of this paper. The list of the pathways was shown to the experts; de-alignment and re-alignment, technological substitution, regime reconfiguration, regime transformation and institutional exhaustion which is pathway invented by GRETA-project (see Appendix).

When shown the pathways, the experts saw them as pretty useful descriptions, but not too comprehensive and also, they said that both technological substitution and transformation of regime is already in effect. Nonetheless, many of the experts also said that companies are very vital for the green transformation and will not probably fade away, but they will be the companies that the future will be built on. It was also highlighted by one respondent that, many times if promising niche innovation appears, the big companies buy those innovations to their own collection of knowledge. Companies were seen as pretty steady actors regarding future. (Mäenpää & Jääskeläinen, 2021, p.28).

Regime level on the other hand was pointed out. Regime change is needed at least regarding circular economy, because it will no function properly without an ecosystem between actors in the region. Circular economy needs wider customer base to work

properly and this is creating possibilities for new, niche companies to look at specific recycling activities. Because Finnish market is pretty narrow and limited, it might be useful to look over to Swedish markets for cooperation regarding this subject. (Mäenpää & Jääskeläinen, 2021, p.28).

The role of citizens was highlighted during the interviews. The distribution of knowledge being the keyword for this. Citizens are affecting the landscape level (political decision makers) and they are also acting as new niche level actors if they do establish new circular economy-based based SME's. Universities are important in this case, because they are the ones spreading useful knowledge and they are attracting young people to the region, who then may create new niche activities. Help in establishing start-up companies might be useful in enabling this kind of gradual change. (Mäenpää & Jääskeläinen, 2021, p.28).

However, it might be possible for regime to reconfigure because new battery manufacturers are coming to Ostrobothnia. Fragmentation was also mentioned as one possibility for future pathway, but it was also mentioned being a possible threat. One of the experts explained that in Japan new activities and businesses develop, when new companies put focus on certain parts of existing businesses; its processes, markets, products or business model and develop new businesses based on improvement and this observation. This might happen in Ostrobothnia as well. (Mäenpää & Jääskeläinen, 2021, p.28).

Technological substitutions are going forward all the time and it will do the reconfiguration of regime that way, according to the experts. Old technologies are being substituted by the new ones. These substitutions are seen as pretty important pathway for future, but it was not the most important one when asked from the experts. Technology for carbon free environment already exists, but one needs to know how to apply them. Hydrogen based technologies are important technologies for the future according the experts. (Mäenpää & Jääskeläinen, 2021, p.28).

Pathways are based on both ways; top-down (landscape) and bottom-up (niches). Finances and legislation are making a framework for stakeholders to work on and it is top down action in many cases. Companies are giving birth to innovations and they are defined by pressure from landscape and from the consumers. (Mäenpää & Jääskeläinen, 2021, p.28).

Regional level has a role in a way that in circular economy the region is the basis for sustainable actions and also the recycling is organized regionally. Finland however is a small market and it might be helpful to create a common ecosystem with Sweden to help the industry to grow. Energy technology uses region as a platform for cooperation and a laboratory, where companies are able to test solutions and see the processes which are required to match strict Finnish climate goals. Regional level is also important when trying to engage citizens and collaboration in general. Knowledge producing in universities might be helpful for regional development and understanding future issues and opportunities. (Mäenpää & Jääskeläinen, 2021, p.29).

## 5.4 Validity and reliability of the study

This study is qualitative study and the results of it are coming from the interviews made with the questionnaire. The first and a very important task was to choose right respondents to answer our questionnaire. Respondents were all some kind of experts in the field of energy production and circular economy. It was important to get respondents from every helix of the quadruple-helix model.

Because the respondents were asked to tell their view on the phenomenon of this study, it can be called a qualitive research. This paper has two research questions which can be stated as a principle for a well-staged research. The numbers and facts in the survey were checked and verified from the respondents. (Hirsjärvi & Hurme, 2008). Validity of the study comes from the right methods used in the research of the background theories and in the interview format. Also, the quality can be seen from the structure of this study,

as it goes from general to particular, which means that this study goes from telling about the general backgrounds of different theories and concepts (Green Deal, Smart Specialization) to particular problems, questions and answers (GRETA, the interview and answering the research questions). (Patton, 2015, p. 682).

Qualitative research has basically two phases; solving the mystery or the question and simplification of the observations. Solving the mystery means that theory background is being told and introduced to the reader of the paper. In this study it means the theoretical framework (Multi-level perspective, Green Deal and Smart Specialization). In the simplification phase the theory and the results are being combined and they are referred to old researches and theories. Simplifying and developing the observations means that results are being opened and explained and raw-data is combined into results and analyses. (Alasuutari, 2011).

Some ways of literature review were used in the background and theory section of this paper. It's a way to demonstrate to the reader how EU Green Deal, multi-level perspective and smart specialization are related to the broader context and the results of the research. The idea for this is to identify the main subjects and themes of the GRETA-project and this study. Without those sections it would impossible to understand the idea behind choosing those theories and why are they related to this context. (Oliver, 2021, p. 6-7).

When doing the background research for the paper I started using the search engines in the library of Vaasa University and the all the databases of it, the online-search of Finna and also the Google Scholar. My main search words were "European Green Deal", "Multi-level perspective", "smart specialization" and other combinations that come from those words.

The validity of the survey comes from the way it was formed. (Tuomi & Sarajärvi, 2018). Focused interview is good method to choose for researching green transformation, as it

is a very wide theme. It gives respondents more room to open their views on the subjects and their opinion becomes clear. Such widespread concept as green transformation is very hard to process if the interview is too structured. The questions were discussed in a meeting when planning about what is wanted from the respondents and what is the main goal of the project. I was one of the interviewers when the interviews took place. Every other respondent was interviewed by me and the other by assistant professor Antti Mäenpää. When not interviewing, the other was taking notes and also the interview was recorded via zoom-program.

Asking about the cooperation in the innovation field and green transformation might be a challenge for various reasons. The different backgrounds of the respondents are setting a challenge because it means they might have different understandings and views of the concepts of innovations and development. Also, the respondent's answers might vary depending on the day the interview takes place. This risk was taken care of by trying to choose many respondents and from various fields and different helices.

The respondents were able to answer to questions anonymously and they did not have to show their faces to the camera if they did not want. In the name of the GDPR (General Data Protection Regulation), respondents were able to change their answers whenever they want, even after the interviews were made. They also had possibility to delete the answers they gave us, if they felt like it was not what they wanted to answer. No personal data of the respondents were shown to third parties or other respondents and all of this information was told to the respondents at the start of the interviews. They were also asked for permission for the interview to be recorded for making notes only. (European Union, 2021).

The most important part of the project and this paper was the part of interviews. Quality of the questions and their nature make the results more valid and reliable. The accuracy of the study results will be increased if the respondents are able to fully answer to the questions given to them. The number of answers also helps to increase the reliability of

the study. Also, signs of saturation were shown in the answers. Same kind of answers were answered and that makes the answers reliable, and makes it credible that if these interviews were made again, the same results would come.

The reason behind asking about green transformation in Ostrobothnia region is that climate change is a proper crisis at the moment. GRETA-project is one tool to respond to it and it has valid points towards sustainable future. The respondent's various backgrounds are helping to find solutions and points, because they are working with the same problems and questions as this survey is dealing with. All the experts that answered to the survey were given an opportunity to openly explain their views. Also, the interviews were very much done in a way, that they were a lot more like conversation-like situation than an interview with strict questions and answers.

The analyzing of the results from the interviews were made in the GRETA-project group. All the interviews were discussed in the meeting and the answers were transcribed into the projects WP2 disposition. That disposition was written by me and Antti Mäenpää. I've done the analyzing for the conclusion part of this paper, where I conclude the results of the interviews in relation to green deal, multi-level perspective and smart specialization in Ostrobothnia.

# 6. Conclusion

## 6.1 Role of the different levels and pathways in green transformation

This part of the paper is when all the background, theories and results from the interviews is combined and concluded. The research questions will be answered and looked through the theory of multi-level perspective in Green Transformation. The first research question in this research is: “What is the role of different levels and pathways in Green Transformation”, and it will be answered with literature and also with experts’ views from the interviews. The second question is: “How the region of Ostrobothnia is managing Green Transformation process in multi-level perspective?”, and it will be answered by the results from the expert interviews. In the end there will be some analyzing about the role of the region regarding green transformation, since it ties up both the levels and their interaction as well as pathways and regional aspects, which were shown through the case from Ostrobothnia

As it is pointed out in the theory of multi-level perspective (Geels, 2002, p. 1262). the landscape-level is stable and not changed easily. It needs shocks or bigger influences to change it and it cannot be influenced by the niche-level. The landscape level does not provide structures to change the regime level, it creates framework and possibilities to do so. In green transformation and in green deal the landscape level is the European union level, and its member state governments. European Union is setting up the goals and ambitions to reach certain levels of Co2 emissions in the EU-area and leaving it up to the regime-level to implement.

The supranational and national goals set by the European Union, national governments and possible regional governments, are the ones that are making the regime level change and work to reach those goals. Possible taxes or fines are set by the landscape and they might hurt the companies and actors working on the regime-level. Finland has

set a goal to be climate neutral by the year 2035. This goal is getting companies and other actors to work for it and change their way of working and thinking.

The experts in the interviews said that the role of the landscape-level in green transformation is big, but it's not only done by it. The biggest weaknesses in the cooperation between levels in Finland and in Ostrobothnia in particular are the ambitions of the landscape-level and the reachability of the goals they are setting. Many actors in the region say, that it is difficult to reach the targets by the year they are set for, but also it is giving them pressure to work towards it. Also, the role of landscape-level can be said to create pressure, but it also should give possibilities to regime-level.

Role of the regime level in green transformation is big and crucial. Pressure from landscape is modifying the regime by setting the framework they have to follow. When European Union, national government or regional government is giving some targets for companies and other actors to work for, they also give some feedback back up to landscape about how legislation, targets or goals are working. For example, about green deal, the European union gets feedback all the time about how it is working and how the emissions are going down, if they are going. Regime level has actually many roles regarding green transformation. It is getting the role of implementor when it comes to green deal, but it also gets impacts from the niche-level and it can give feedback to niche level too.

Regime turns the pressure coming from upper level into knowledge and actions, which turns into information for niche-level actors and innovations. Actions in the regime are crucial for niche-innovations to get information what to do, and how to get innovation rising up to mainstream regime. The pathways are always based on both ways, as legislation and finances coming from top-down make new frameworks and possibilities. Innovation comes from companies which are born from pressure coming from landscape and consumers. Problems between levels are the lack of understanding. As mentioned in the results-section of this paper, in Finland big problem is that European Union does

not understand Finnish agricultural regime. For example, it has too ambitious goals and wants to turn Finnish forests into “museums”, when Finland wants to use forests more efficiently (Valtioneuvosto.fi, 2021a).

Green innovations are crucial for green transformation to keep going forward. Bigger companies, smaller companies and also the citizens are working on the niche level, in this perspective. Niche actors themselves have a great possibility to rise up to global success as new green innovations are searched for all the time. Green deal is distributing a lot of restrictions and legislations to regime actors to work for and this is also creating possibilities to niche-innovations to show their capabilities and their worth in green transformation.

Experts in the interviews said that innovations must keep coming and they are born in the cooperation between actors. This is an example of interaction between different levels. Landscape-level (European union), has set an innovation strategy-concept, smart specialization, where regime actors are working together in the entrepreneurial discovery process to find niche innovations that can set their region into global success. Regime actors might copy the ideas from niche actors or even buy the concept of some innovation that they see might be successful in the future.

To be successful in green transformation, it is widely seen that cooperation is the key. For many companies the technology is already there, but it needs little adjustments or help from decision makers so they can be more experimental with the innovations. Landscape-level in national governments needs to be far-sighted and open-minded towards new experiments. This is also one reason why smart specialization is a useful tool for green transformation. Different levels have different roles, but it cannot be surely said that one of them is more important than other, when it comes to Green Transformation.

The pathways of sociotechnical transitions are also a way to look through Green Transformation. De-alignment and re-alignment path (see chapter 3.2), is one possible pathway as it is formed when there is a shock or a big and sudden impact to the landscape levels. It can be argued if climate change really is a sudden shock but at least it is a massive impact that affects the world. In a way one can think that climate change is making a big impact on the landscape level, and it is tearing regime open with massive gap opening for green niche innovations. But this is happening only if the substitutional technology to fight against climate change does not already exist in regime.

In some sectors the substitutional technology does exist already, and the re-alignment is already in action. For example, if you look at the car-industry, the electric vehicles were invented and were mainstream even before the gas-powered cars came to markets. So, the other technology is already existing in that sector, so the niche innovations do not have that much space to rise. (Energy.gov, 2021). In the other sectors this pathway might still be a possibility, so it cannot be calculated out of the question.

Technological substitution pathway (see chapter 3.2) is also very relevant pathway when it comes to green transformation. It happens when there is a lot of landscape pressure coming to regime level, regime is tearing up and leaving gaps for niche-innovations. Well stabilized and formed niches are coming up to the regime level, and creating a new regime. Other actors in the regime might want to learn from the new actors and that might lead up to massive change in the regime. This pathway is already happening in the world and it has a big role in green transformation. Everyone is trying to find possibilities to change their actions sustainable and if someone else is already doing it, they want to learn from it. This pathway seems more convincing than de-alignment and re-alignment, but both ways are possible and they are happening in some way.

When problems occur at the regime level and niche-innovations rise up to help regime to fix them up, it is called reconfiguration pathway. (see chapter 3.2). This pathway is very plausible and has a big role in green transformation. When European Union is giving

a lot of new requirements for different sectors about the emissions, regime actors might want to replace the unsustainable and problematic systems with new green innovative ones. Because the successful innovation might lead up to new innovations, this is very important pathway to consider.

As the experts said in the interviews, it's not really possible to choose one pathway as the absolute way to go forward. The respondents mentioned that reconfiguration of regime and technological substitution are maybe the most important ones. Because different sectors have different nature, one pathway does not work for everyone.

For example, car industry is going through different pathway than some other industry, because the niche innovations are on different level already. In Ostrobothnia the energy technology cluster is dealing with completely different problems than the other intervention area, circular economy. Also, circular economy can be used in different industries in different ways. Institutional exhaustion was not mentioned in the interviews as the possible pathway, and it seems kind of impossible scenario because all of the actors are trying very much to turn their actions more sustainable and also see potential in doing so.

To conclude the research question "what is the role of different levels and pathways in Green Transformation?"; they all have a big but different role. European Union and national policy makers are giving a lot of pressure for the actors in the regime and niche levels, but they can't solve the problems by themselves alone. Green innovations are crucial and they will probably make a difference, but niche can't directly change the landscape level, so it cannot be said that green transformation will rise straight up from the niches.

The landscape level needs feedback from regime, and regime needs new actors from niches to rise up to fill landscapes expectations. For example, Green Deal sets restrictions for regimes with emission targets, and it supervises regime about how well they can

make their Co2-targets. If regime can't reach the goals with current technology, it can take innovations from niche-actors to make things work, and at the same time sends feedback back to landscape-level about the reachability of the targets and how the niche level solutions work on the regime level. This may ultimately help niche level to reach landscape level.

## 6.2 Managing green transformation in Ostrobothnia

This section will be about how Ostrobothnia is managing green transformation, as it was one of the research questions of the study. Green transformation in Ostrobothnia region is taken really seriously. City of Vaasa has its own climate neutrality goal of being climate neutral before 2030 (City of Vaasa, 2021c). It is ambitious target, even for Finnish standards as Finland has national goal for climate neutrality in 2035. (Ministry of the Environment, 2021). Vaasa has an energy cluster that is working hard to reach those goals, and they are trying to invent more and more innovations for example in wind-energy, solar-energy production and hydrogen technology.

Actors in Ostrobothnia are hoping for more financial support from the government to regional development, as they feel like Ostrobothnia is very innovative and creative region with their many projects in the field of energy production and circular economy. Multi-level perspective in the Ostrobothnia region is working in a way that landscape-level is giving pressure with climate neutrality demands and with green deal, as it is affecting the whole European Union. Green niche innovations are developed in the region as well and they are rising up to the regime. Couple of examples of these innovations are the most environmentally friendly passenger vessel Aurora Bothnia (Wasaline, 2021), hydrogen facility project called Power to X (Gigavaasa, 2021) and also the battery factory that is going to be built and is going to be a new sustainable industry in Ostrobothnia (YLE, 2021).

However, companies and other actors related to them are frustrated, because sometimes the multi-level perspective does not work perfectly in both ways. Landscape is able to provide pressure and the companies are able to push their niche products to regime level, but help would be needed to lift regime level solutions to landscape level and in this public support would be important. However, development funds are not distributed based only on this, as national funds are also distributed based on regional disparities. (Mäenpää & Jääskeläinen, 2021, p. 20.)

Ostrobothnia has a lot of action in the niche-level as mentioned above. Universities, companies and public organizations are working well together and with the focus on the green transformation, it might end up being very good for the region in the future. However, there is a need for more financial support for the green innovations and green regional development. There is a will to do big changes in the region and work against climate change. Cities have their own strategies and they have companies included in the strategy work, but the biggest problem they mention about the Green Deal, is the lack of financial aids coming from national level and also the problem of European Union not understanding Finnish operating environment.

## 6.3 Role of the region

The results concerning the role of the region will be used as an end discussion for the whole study. The question is good because at the same time it answers to the question about the connection between levels in Ostrobothnia region and about the actual role of the regional-level itself.

The role of the region in green transformation is seen as very important. Regions are great forums for collaborating and working together with different types of people and they offer interaction between niche and regime levels. Regions also help establishing the innovation network which are especially important for circular economy, in which

the bigger the network is, the bigger opportunities it offers for new businesses and solutions. For large companies region is a good way to test their solutions for energy technology systems. This is also important because regional solutions are now more important than individual products in order to diminish carbon and pollution. (Mäenpää & Jääskeläinen, 2021, p. 18).

Ostrobothnia itself is recognized as really important for the general development of future solutions and the interviewed experts were really hopeful that Ostrobothnia can become global phenomenon with their work regarding green transformation. The region has to improve carbon footprint and the regional companies need to benefit from this new market, which offers them lots of possibilities. It was also mentioned that Ostrobothnia already is pretty good example of green transformation, but national level has to notice this and it needs improvement. (Mäenpää & Jääskeläinen, 2021, p. 18).

Region of Ostrobothnia offers solutions for future energy production, and those solutions might have a great effect. Ostrobothnia is branded as the Nordic capital of Energy, and it has some global energy companies working in the area. There has been some news recently about the new battery factory opening in the area and more and more collaborations between companies and other actors in the region which might be creating some kind of ecosystem in the area for green transformation. Vaasa has a climate program that is pushing companies in the region for finding solutions prior the national goal of 2035. This faster development in the actions towards green transformation might mean that region is advancing global battle against the climate change. Due to this it might be possible for the region to have an impact on the global level as well, if they can create big solutions, like for example Aurora Bothnia (the most environmentally friendly passenger vessel in the world). (Mäenpää & Jääskeläinen, 2021, p. 17).

Key aspect for going through the process of green transformation is to work together in the region. Green transformation might be a big possibility and a change to develop the industry of energy production and the entire region of Ostrobothnia. When stakeholders

are working together, region has much better changes of succeeding well in the process of green transformation. (Mäenpää & Jääskeläinen, 2021, p. 21).

More new things should be tested and regions should be open for trying new types of pilot projects. It is really hard to know what works if you don't try it first. The big role in this transformation is on shoulders of regional councils and other financial organizations, because they can offer funds and eventually decide the actions and research which are utilized. Rules and framework come from European Union and national level, but local level has the implementing role. For example, the targets like CO2 emission target is set by regional level. Vaasa region is widely seen as dynamic and experimental. For cities, the surrounding countryside and for circular economy, it would be really important to find solutions for local food production. Ostrobothnia is also a great place for wind and solar energy, it has as much sun as in Germany and coast is a great place for producing wind energy. (Mäenpää & Jääskeläinen, 2021, p. 21).

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# Appendix

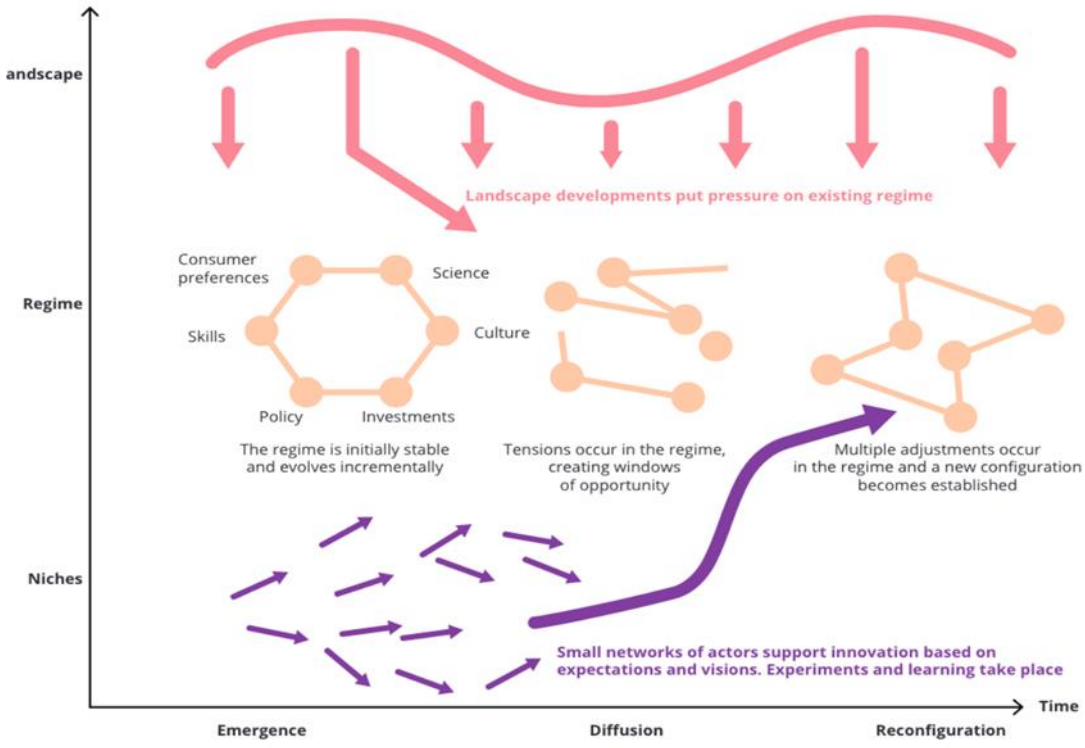
## **Appendix 1.** Questionnaire

**Questions**

Background:

1. **Vision for future**; Green Deal, but is there something else?
   - Who share this vision? What kinds of institutions?
   - National, regional or EU-level, or multi-level?

2. **Strategy**; is there a green innovation strategy or environmental strategy? Regional plan? Are there several strategies? Decided by whom?



3. How do you see the way forward; how to enhance green transformation?

- What is the role of these levels in Green transformation:
- EU and national regulations/support
- Regional institutions and policies
- Development of green innovations

4. What is the connection between these levels; how do they interact in promoting transformation?

- EU and national regulations/support
- Regional institutions and policies
- Development of green innovations

5. What is the role of the region in this change?

6. What pathway seems most relevant for your region?

**1. Technological substitution**

Existing industries will be closed down and replaced with new economic activities

**2. Regime transformation**

Change through adjustments of existing industries, skills, regulations and institutions

**3. Regime reconfiguration**

Existing industries will be radically reorganized, and new actors will take core positions

**4. De-alignment and re-alignment**

Small niches will become dominant actors and existing industries will disappear. Surviving companies/ technologies, combined with new industries will lead the change

**5. Institutional exhaustion**

Green transformations will be blocked due to deep conflicts. Industries will react to macro level pressure through protests and slow down-scaling

7. Stakeholders; who are involved in the strategy/strategies?

8. Do you agree with this list of relevant stakeholders for Green transformation?* Would you add/remove some actors? Do you agree with this transformation of different actors?

| Actor | STK type in GT | | |
|---|---|---|---|
| | STK level* | | |
| | 5 years ago | now | in 5 years |
| Company 1 | 4 | 5 | 5 |
| Company 2 | 4 | 5 | 5 |
| Company 3 | 4 | 5 | 5 |
| Company 4 | 5 | 5 | 5 |
| Company 5 | 3 | 4 | 5 |
| University 1 | 3 | 4 | 5 |
| University 2 | 3 | 4 | 5 |
| University 3 | 5 | 5 | 5 |
| University 4 | 3 | 4 | 5 |
| Public organization 1 | 3 | 5 | 5 |
| Public organization 2 | 4 | 6 | 6 |
| Public organization 2 | 3 | 5 | 6 |
| Public organization 3 | 2 | 3 | 3 |
| Public organization 4 | 5 | 6 | 6 |
| Public organization 5 | 3 | 4 | 4 |
| Public organization 6 | 4 | 6 | 6 |
| NGO 1 | 4 | 4 | 4 |
| NGO 2 | 4 | 4 | 4 |
| NGO 3 | 3 | 3 | 3 |
| NGO 4 | 4 | 4 | 4 |

Colours: Red (1-3) means that partners are not very interested in GT, yellow (4) means potential to be more active in GT, green (5-6) means that they are drivers of GT

* original table had company and organization names listed

9. How do you see that different stakeholders view green transformation in your region; mostly as a opportunity or as a threat or opportunity for green washing?*

| Actor | How do actors see green transformation? | | |
|---|---|---|---|
| | Yes or no | | |
| | Possibility | Threat | Green washing |
| Company 1 | | | |
| Company 2 | | | |
| Company 3 | | | |
| Company 4 | | | |
| Company 5 | | | |
| University 1 | | | |
| University 2 | | | |
| University 3 | | | |
| University 4 | | | |
| Public organization 1 | | | |
| Public organization 2 | | | |
| Public organization 2 | | | |
| Public organization 3 | | | |
| Public organization 4 | | | |
| Public organization 5 | | | |
| Public organization 6 | | | |
| NGO 1 | | | |
| NGO 2 | | | |
| NGO 3 | | | |
| NGO 4 | | | |

* original table had company and organization names listed

10. What are potential opportunities? What are potential threats?

11. How to prevent green washing or “green diversion”?

12. If GT is a threat, how to change it into opportunity? Could the pathways help?

• **Technological transformation**. When existing industries disappear, they will leave behind factors of production (nature, clever people, empty buildings, infrastructure etc.) which can be used in new ways in new, green industries.

• **Transformation of existing regime**. Our existing networks, value chains and companies will overcome difficulties in adjustments, adapt to new regulations, and discover green growth opportunities

• **Regime reconfiguration**. Loss of some of our existing companies will leave behind factors of production which can be used by small, green companies who can start to grow and replace them within our modified existing networks.

• **De-alignment and re-alignment**. We will attract investors and enable growth from below of niche companies. They will re-shape the region and create new networks and value chains, partly based on our existing strengths and some of our existing companies.

• **Institutional exhaustion**. We face a difficult future with long term decline, unemployment, out-migration and social problems. We will rely on social policy measures of the Structural Funds, and long-term strategic support for new path creation through foreign direct investments.

13. What are your ideas for mobilization of different stakeholders; how to make them move towards GT?