



Vaasan yliopisto
UNIVERSITY OF VAASA

OSUVA Open
Science

This is a self-archived – parallel published version of this article in the publication archive of the University of Vaasa. It might differ from the original.

Smart multi-level coordination towards green transformation: GRETA WP2 Report Comparative Analysis

Author(s): Mariussen, Åge; Mäenpää, Antti; Virkkala, Seija; Jääskeläinen, Juuso

Title: Smart multi-level coordination towards green transformation: GRETA WP2 Report Comparative Analysis

Year: 2021

Version: Published version

Copyright ©2021 Interreg Baltic Sea Region, European Union: European regional development fund, GRETA, Vaasan yliopisto.

Please cite the original version:

Mariussen, Å., Mäenpää, A., Virkkala, S. & Jääskeläinen, J. (2021). Smart multi-level coordination towards green transformation: GRETA WP2 Report Comparative Analysis. Vaasa: Interreg Baltic Sea Region, European Union: European regional development fund, GRETA, Vaasan yliopisto. <https://www.lars-project.eu/assets/14/Uploads/WP2-report.final.pdf>

SMART MULTI-LEVEL COORDINATION TOWARDS GREEN TRANSFORMATION

GRETA WP2 Report Comparative Analysis

Åge Mariussen, Antti Mäenpää, Seija Virkkala and Juuso Jääskeläinen

November 2021



EUROPEAN
REGIONAL
DEVELOPMENT
FUND



Vaasan yliopisto
UNIVERSITY OF VAASA

Contents

1 Introduction	3
1.1 What is transformation? Landscapes, regimes, and niches	4
1.2 So what is Green Transformation?	7
1.3 Technology, science, and policy changing the world?	8
1.4 Green Growth: let markets change the world!	12
1.5 Landscape transformation: Green Growth stakeholders	14
1.6 Stakeholder analysis	16
2 The GRETA research process	20
2.1 Introduction	20
2.2 Process of stakeholder analysis	22
2.2.1 Stakeholder saliency	22
2.2.2 Stakeholder’s role for green transformation.....	28
2.2.3 Stakeholder’s level of influence.....	29
2.3 Interview questionnaire and interview process	30
2.3.1 Interview template - Questionnaire	31
2.3.2 Interview process	33
2.3.3 Analysis	34
3 Partner regions and intervention areas	37
3.1 Intervention areas, challenges, by partners	37
3.2 Visions and strategies	41
3.3 Strategies for transformation	44
3.4 Summary	46
4 Stakeholders – Comparative analysis across 6 partners	49
4.1 Stakeholders by helices	49
4.2 Stakeholders by regions	51
4.3 Stakeholder’s urgency, legitimacy and power	53
4.3.1 Companies	53
4.3.2 Universities.....	54
4.3.3 Public organisations.....	56
4.3.4 NGOs	57
4.4 Stakeholder interaction on niche, regime and landscape-level	59
4.4.1 Companies	59
4.4.2 Universities	61

4.4.3 Public organisations.....	62
4.4.4 NGOs	64
4.5 Stakeholder analysis - towards green transformation	65
4.6 Conclusions on stakeholders	68
5 Comparison between green energy and circular economy fields	70
5.1 Stakeholder comparison	70
5.2 Urgency, legitimacy and power	73
5.2.1 Green energy	73
5.2.2 Circular economy.....	74
5.3 Interaction with niche, regime and landscape level	76
5.3.1 Green energy	76
5.3.2 Circular economy.....	77
5.4 Penta helix measurements	79
5.4.1 Green energy	80
5.4.2 Circular economy.....	82
5.5 Conclusions on comparison between green energy and circular economy	85
6 Pathways and roadmaps towards GT	86
6.1 Paths to GT	86
6.1.1 Selected paths by respondents.....	86
6.1.2 The role of technologies and technological substitution in GT.....	89
6.1.3 Do GT need new activities and actors?	90
6.1.4 Risks and uncertainties.....	91
6.2 Opportunities and threats	92
6.3 Mobilisation of stakeholders and suggested policy tools	96
6.4 Role of regions and different stakeholders in GT today and in future	102
6.5 Dynamics in multi-level systems of governance and the challenges on paths towards GT.....	107
6.6 Summary.....	111
7 Green Transition in BSR	113
7.1 Landscapes are changing fast	113
7.2 How does the roadmap look like?.....	114
7.3 The role of the regions.....	116
References	118
Attachment 1. Questionnaire	119

1 Introduction

The GRETA project aims to develop policy tools for sustainable Smart Specialization innovation strategies in Baltic Sea Region (BSR), supporting green transformation (GT) in ways which are aligned with the EU Commission Green Deal (EGD). The EU Commission Green Deal is an attempt to build on the emerging Green Growth strategy aiming at NZE (net zero emissions) at the global level in 2050. There is an on going debate on how to deliver GT. (See European Commission 2021). Achieving net zero emissions is a very complex issue which depends on several factors, at macro, meso and micro levels. Yoichi Kaia, a Japanese economist, summarized the broad debate in this simple formula: (The Economist, 27 October 2021):

$$\text{CO}_2 = \text{population} \times \frac{\text{GDP}}{\text{capita}} \times \frac{\text{energy}}{\text{GDP}} \times \frac{\text{CO}_2}{\text{energy}}$$

Starting from the right, the discussion is often reduced to emissions generated by production of energy, determined by the mix of green and dirty energy technologies, but it also depends on energy efficiency, economic growth, and the growth of the human population. If we are not able to reduce emission created by production, efficiency, and use of energy, we have to look at reduction of production (GDP/ capita) and reduction of birth rates instead. These options are not easy. Very few would vote for politicians who argue in favor of reducing production of goods and services, and most young people want to decide the number of their children themselves.

So far, the focus is on the right-hand side of the formula, where energy production is important.

This strategy has some top-down instruments we will refer to as Landscapes, such as increasing carbon prices, and commitments made between countries to reduce carbon emissions (see below). However, transformation happens in places, regions. GT means multi-level transformation, which also needs clear bottom up or regional level enabling strategies in order to succeed. We refer to the intermediate level as regional regimes.

GRETA is concerned with the contribution of regional and national strategies, better known as Smart Specialization towards GT. Smart Specialization teams up with entrepreneurs, specialists and other actors, who take the lead. At the core of GRETA is a method of stakeholder analysis applied and recommended by the Sevilla S3 platform since 2013, notably in the “Kingdom of Smart” movie. It builds on a method of stakeholder analysis to generate a nuanced picture, where regional specialists and planners teach us how we can improve the world. Below we will explain how we have used this method in GRETA.

A second core element in the multi-level process of GT is coordination of green transformation of technologies, policies, research, and society which opens up for a new relation between humans, energy, and nature.

But there is a risk here: the scale and urgency of the challenge could drive countries toward “efficient” authoritarianism. Already, calls for “war-time” technocratic management are growing louder, and China – which seeks to claim the mantle of environmental leadership – has received praise for its capacity for large-scale mobilization. A sustained response to an existential threat – one that can withstand the pressures of high energy prices and other economic disincentives – cannot be delivered by technocratic

management alone. Intermediate bodies – political parties, trade unions, civil-society organizations, and educational institutions – must help citizens articulate their needs and demands, thereby building support for action over time. (According to an interview by Giulio Boccaletti Nov 2, 2021)

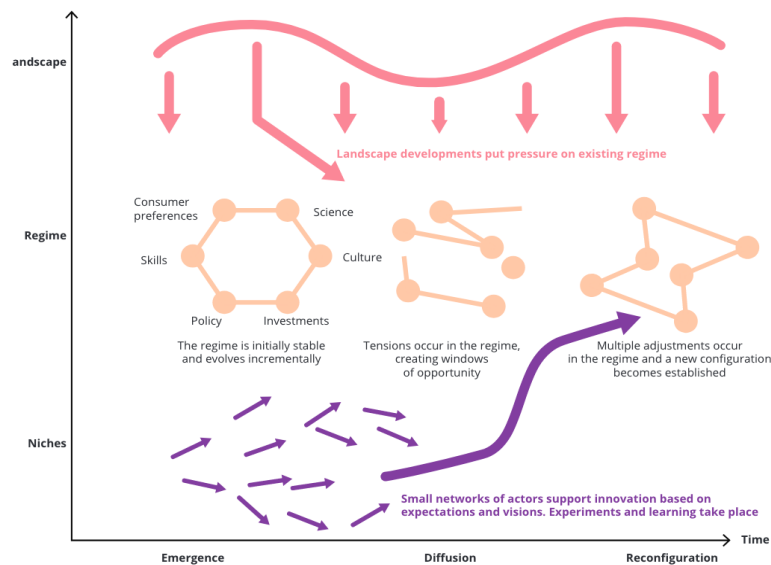
As extensively discussed below, GT can be seen as a complex, multi level, cross sector and long term process of transformation, guided by scenarios produced by different stakeholders, with a 30 year perspective, aiming for net global carbon neutrality in 2050.

Below, with reference to Geels and Schot (2010) we explain how GT may transform the configuration of penta helixes, or technological regimes¹.

1.1 What is transformation? Landscapes, regimes, and niches

What we envision in GRETA is that three related processes involved in a sustainability transition are (see figure 1):

1. The external context, often referred to as landscapes of global and international regulations and markets.
2. At the regional level, the configuration of the regional quadruple helix created by the global landscape, national policies, as well as as regional networks of public sector authorities, economic actors, schools and universities and civil society institutions, referred to as regime.
3. Bottom-up innovation processes with the point of departure in small firms, which tries to form new clusters;



¹ Existing energy, agro-food and mobility systems are stabilized by the alignments between technologies, policies, user patterns, infrastructures, and cultural discourses that have been created in previous decades. System elements are reproduced, maintained and incrementally improved by incumbent actors, such as firms, engineers, users, policy-makers and regulators, and special-interest groups. The perceptions and actions of these social groups are shaped by entrenched shared rules and institutions, which are called socio-technical regimes.

Figure 1. Sustainability transition processes (F. Geels et al., 2019)

The Multi-level-perspective (MLP) suggests that transitions come about through the interplay between processes at niche, system (i.e. regime), and landscape levels. Although transition specifics vary between domains and countries, the general multi-level dynamic is that: (a) niche-innovations gradually build up internal momentum, (b) niche-innovations and landscape changes create pressure on the system and regime, and (c) destabilization of the regime creates windows of opportunity for niche-innovations, which then diffuse and disrupt the existing system (Figure 2). In order for a transition to take place whereby current unsustainable practices, technologies and solutions are replaced by new sustainable ones, the former need to be phased out. Therefore, in parallel to the emergence of niche technologies and practices as the new dominant regime, incumbent solutions need to be destabilised. If this does not happen, i.e. if regime actors identify solutions which maintains the existing regime in a largely unchanged form with a minor change in existing technologies, business models or practices, then a socio-economic transition does not take place.

We are at the beginning of a great transformation.

The diffusion phase is often characterized by struggles between niche-innovations and the existing regime on multiple dimensions. (see figure 1) There is economic competition between new and existing technologies, which is influenced by the institutions that shape markets and economic frame conditions. There are business struggles between new entrants and incumbents, which may lead to the downfall of existing firms. There may be political conflicts and power struggles over agenda setting, problem framing, and adjustments in subsidies, taxes, and regulations. These struggles involve policy actors (bureaucrats, ministers, advisory committees, political parties, parliaments), but also wider interest groups, which often have differential degrees of access to policy networks. Cultural and discursive struggles about the framing of problems and solutions are likely, as social groups have different views and interpretations, which find expression in contested public debates. There is no guarantee that niche-innovations will inevitably win these struggles. Radical innovations may fail to build up sufficient momentum or suffer setbacks. Tensions in existing regimes may be contained, such that ‘windows of opportunity’ for niche-innovations do not (sufficiently) materialize. Or incumbent actors may successfully counter-mobilize and thwart niche-innovations. In the fourth phase, the new socio-technical system replaces (parts of) the old one, and becomes institutionalized and anchored in regulatory programmes, user habits, views of normality, professional standards, and technical capabilities. (Geels 2019)

What does facilitating reconfiguration from niches to new regime, and the phasing out of the old regime mean?

(.....) innovations establish a foothold in one or more market niches, which provides a more reliable flow of resources. The innovation stabilizes into a ‘dominant design’ if sequences of projects build on each other through the circulation of experiences, learning processes, and dedicated aggregation activities such as codification, standardization, and model building,

which articulate best practices, product specifications, and design guidelines. Technical knowledge circulation and aggregation are often done by engineering communities, standardization committees or industry associations that act on behalf of the field as a whole. Energy agencies or innovation agencies can also act as 'intermediary actors' in circulation and aggregation processes, because they engage with multiple projects and can compare projects, extract and codify general lessons, and provide these as inputs for new projects. These socio-cognitive activities help to gradually stabilize innovation trajectories).

Geels and Schot (2010) differentiate four transition pathways depending on temporality and kinds of MLP-alignments:

- I. **Technological substitution** (competing niche-innovation replaces regime, after landscape pressure destabilizes regime),
- II. **Regime transformation** (incumbent actors reorient in response to gradually increasing landscape pressure),
- III. **Regime reconfiguration** (symbiotic niche-innovation is incorporated in regime, followed by knock-on effects and innovation cascades that gradually alter system architecture), and
- IV. **De-alignment and re-alignment** (rapid landscape pressure destabilizes regime, which creates space for multiple emerging niche-innovation, followed by re-alignment of a regime around one of them).

Given the complex nature of GT, GRETA has looked for, and discovered, combinations of these pathways. We summarize our findings in two main outcomes, described in the conclusion.

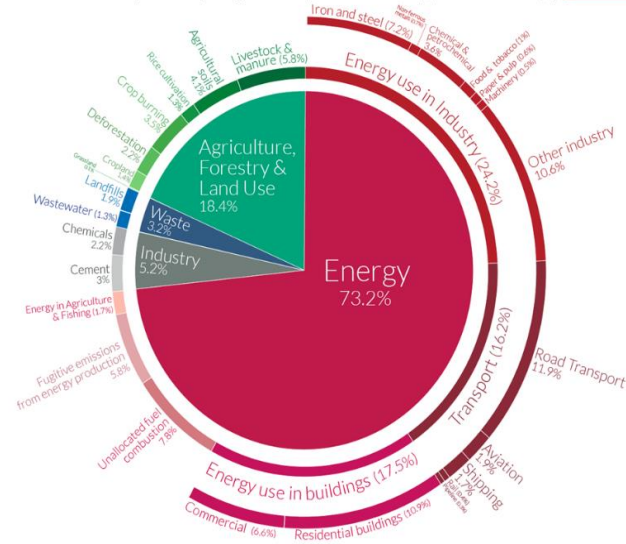
Processes of transition are not smooth and without conflicts. Quite the contrary. In the case of technological substitution, powerful stakeholders who are deeply embedded in and depending on hegemonic technologies may be destroyed by the landscape and marginalized by emerging new clusters created by niches growing stronger. In other trajectories, stakeholders may adapt to a changing world, and change positions.

Successful green transformation means that the regime is changing, because the drivers of the process grows stronger through mobilization of stakeholders who change positions.

1.2 So what is Green Transformation?

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.



OurWorldinData.org – Research and data to make progress against the world's largest problems.
Source: Climate Watch, the World Resources Institute (2020). Licensed under CC-BY by the author Hannah Ritchie (2020).

What are we walking away from?

An easy answer might be CO₂ emissions created by production and use of energy based on coal, oil and gas. This figure below shows it is not that simple. Energy production and use represents a large part of emissions, along with transport and heating of buildings. Agriculture, forestry, and land use made up for 18,4%. Whereas aviation, which has got a lot of attention, represented only 1,9% of emissions, the way farmers use agricultural soils made up for 4,1% and their live stocks made up for 5,8%. (Richie and Roser 2021)

There is a wide variety of transformational strategies which can be applied to reduce CO₂ emissions from agriculture.

Technological substitution in agriculture and forestry?

There is a potential for **technological substitution in agriculture and forestry**. Trees and earth absorb lots of CO₂ through green plants. This CO₂ is carried by plant roots into the upper layer of the soil, where we humans use to grow plants. It is stored in wooden trees. But if, as a part of this cultivation, tractors and ploughs turn this layer of the soil upside down, CO₂ leaks into the atmosphere. Burning of wood release CO₂. So one solution is to stop agricultural use of the soil and stores forest harvesting of trees. We can start to grow vegetables in big factories, applying green energy, water, and technology, and leave the soil in peace. Or we can cultivate the soil in much more careful ways, without use of heavy machinery. We can allow trees to grow in wider areas, without cutting them down. We can also start to grow meat cells in factories, without animals. These suggestions are disruptive for the vested interests who are working the soil today, using traditional agricultural technologies. Today, a deep technological paradigm shift, where humans start to grow their food without using soil, in other words stop doing agriculture, seems to belong to a distant future. By 2050, the best we can hope for is cuts in CO₂ emissions from agriculture, combined with various ways of catching carbon to achieve NZE. These more incremental changes can be described in three steps:

Regime transformation in agriculture, changing the composition of what is produced towards products with lower GHG footprint.

Shifting towards less GHG (Green House Gas) intensive products inevitably implies a reduction in the production of certain commodities with a greater GHG footprint although it does not necessarily entail a reduction in overall production. Whilst this approach can lead to an absolute reduction in agricultural emissions in the EU, in order to avoid simply displacing production to non-EU countries (i.e. emission leakage), it is clear that there is concurrently a need for action beyond agricultural production to change consumption patterns, both in the EU and globally.

Regime reconfiguration in agriculture, changing the way agricultural products are produced to increase the per unit GHG efficiency.

Increased GHG efficiency refers to the reduction of GHG emissions per unit of output, i.e. the same quantity of output can be produced with lower GHG emissions. These positive impacts, however, can in part or in full, be eliminated by increased production levels making the direction of the overall impact more uncertain, which is often referred as rebound effect or Jevons paradox. From an economic perspective, improved GHG efficiency does not necessarily lead to more resource efficient production overall, i.e. it does not imply an increase in yields or overall output. For example, there might be feed additives that help mitigate methane emissions without having an effect, either positive or negative, on production and productivity.

De-alignment and re-alignment in agriculture by increasing the carbon sequestration potential on agricultural land

Unlike the other two approaches, increased carbon sequestration does not reduce the actual level of GHG emissions from the sector but has the potential to lower the net climate impacts of agricultural production by removing and storing carbon in soil and biomass. This could be achieved through, among others, the protection of organic soils, introduction of trees into agricultural production (e.g. agroforestry) and changing tillage practices as well as by converting croplands to grasslands. Converting agricultural land to forest could yield higher mitigation benefits, however it implies a more significant change of land use with implications for agricultural production and farm business models.

So what about energy-related transformations?

1.3 Technology, science, and policy changing the world?

Within the energy sector itself, we are looking at **technological replacement** and **regime reconfiguration** at a global scale. When it comes to oil and gas, one might argue that competing niches started to form during the first crises of the petroleum based global economy. In what was at the time referred to as “the Free World”, Western Europe, USA, Japan and Australia, there was an energy crisis in the early 1970s. At the time, most of the oil available for “the Free World” was produced by third world countries, the some Middle East countries in the lead. They wanted better prices for their product, so they organized OPEC. The formation of OPEC led to the oil crisis in 1972 with a global shortage of oil created a need for emergency

solutions. It triggered a process of niche technological innovations (solar and wind power) to supplement oil with other sources and technologies of energy. Two years later, in 1974, the International Energy Association or IEA was set up to work for a safe energy supply in the world.

The short-term emergency solutions replacing oil in 1972 opened for competing niche alternatives to produce energy, wind and solar power. Windmills were already there, for 100 years sophisticated windmills powered remotely located, but rapidly modernizing farms in Denmark which needed electricity before the grid came. Before 1970, solar power which was converted to electricity by silicon panels was used in toys and watches, and increasingly as a source of energy in satellites. These technologies started to develop, in the beginning based on subsidies.

Today, most green energy technologies we need are at a fairly advanced level of maturity. Efficiency and competitiveness with other sources of energy is good and rapidly improving. When it comes to technologies, green energy is ready to take over the world and replace oil. But we live in a path dependent, coal and oil-based economy with lots of vested interests. It takes science and politics to break its back.

The green energy niches have reached an inflection point. Growth is speeding up.

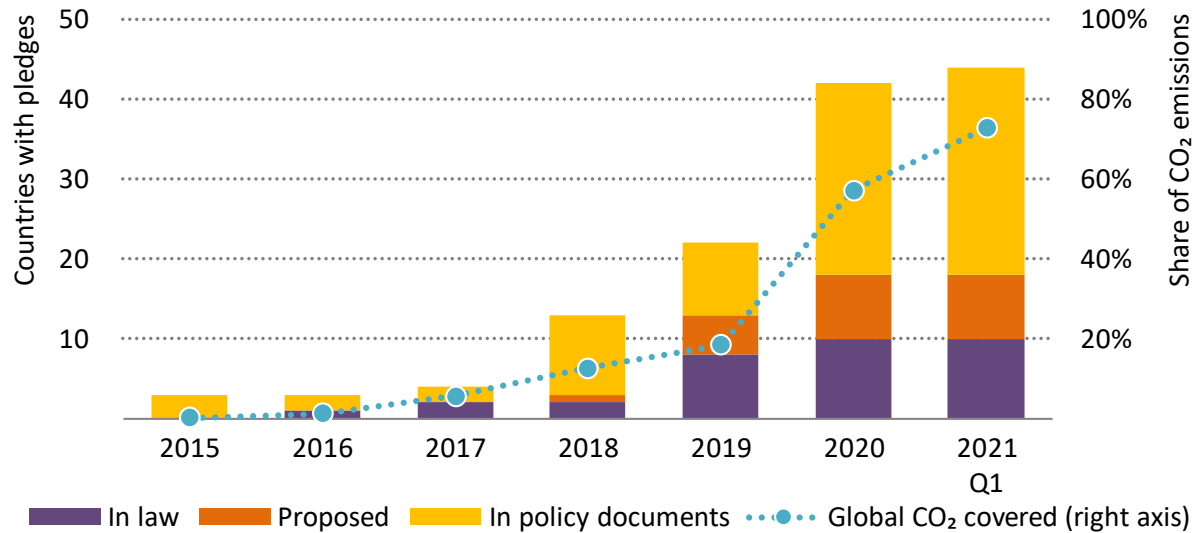
The speeding up of this growth is reinforced through strong positive feedback loops where governments are creating ambitions which motivated investors.

Landscape transformation, supporting niches

The relation between CO₂ emissions by humans and the climate was known, but not very well understood and not measured in 1972. Since then, in terms of science and policy, there has been substantial breakthroughs in the multi-disciplinary scientific networks studying the relation between man-made CO₂ emissions and global climate change. The science networks were coordinated by geo-physicists. In terms of policy making, the debate was started by “green parties”, but the message soon went mainstream, due to the activism and institution building of the UN based IPCC, and its influence on national governments. A shared global goal laid down in Paris in 2015 was “NZE in 2050”, **zero net emissions on a global scale in 2050**. The major trans-national policy institution enabling that decision was UN.

The NZE strategy is up against powerfor stakeholders defending their positions. A core policy tool is to extract pledges from governments.

There has been a rapid increase over the last year in the number of governments pledging to reduce greenhouse gas emissions to net zero. Net zero pledges to date cover around 70% of global GDP and CO₂ emissions. However, as shown in the figure below, fewer than a quarter of announced net zero pledges are fixed in domestic legislation, and few are yet underpinned by specific measures or policies to deliver them in full and on time. Political progress seems to be slowing down (source, IEA 2021: 33).



June 2021 UK organized a UN Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP 26) with mixed results. An increasing problem is the discussion on transfers between countries which keeps poor countries on board.

It is still an open question whether this political-scientific mobilization will succeed. If it succeeds, we are not just talking about a small niche of green energy production growing somewhat stronger, it is a force which will transform our technological paradigms, markets and sociotechnical regimes.

But this regime reconfiguration is not isolated to the energy sector.

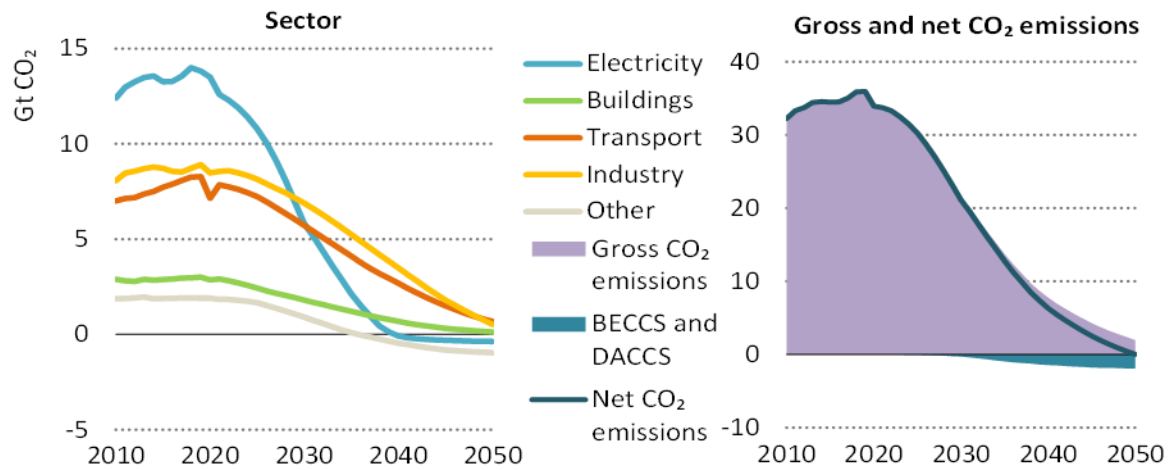
There is a strong relation between energy production and use, and the broader sets of technologies we humans use. The scope of GT may be compared to the great paradigm shifts in human history where first coal, later oil and gas came into the power position they have today. Paradigm shifts starts with a combination of technology, products, energy and global markets. They work their ways and transform the world through related waves of new technologies, networks of communication, and global economic integration, often referred to as globalization. Before the first industrial revolution, globalization was driven by competing European empires colonizing the world, trough sailing boats, slave trade, global migration from Europe to the “New World” in Australia and south and north America, and global trading routes and value chains. The first industrial revolution was born at the heart of the British Empire, with industrial textile production based on Spinning Jenny and the steam engine. The paradigm shift could piggy-back on the ready-made world market structures created by the Empire through coal-based energies driving trains, as well as steamboats built in steel, sending not only English textiles but soon several other industrial products made with coal as the source of energy, Coal as a source of energy led to much more efficient steel and iron production. Steel replaced wood.

The next big shift came with oil as the new and more efficient source of energy, Fordism, mass production of petroleum driven cars with conveyor belts driven by electrical machines and other products, aviation, and the well-known political and institutional dynamics, including the wars, of the 20th Century, with USA as the hegemon. The transformation created by the growth of oil production led to the rapid diffusion of

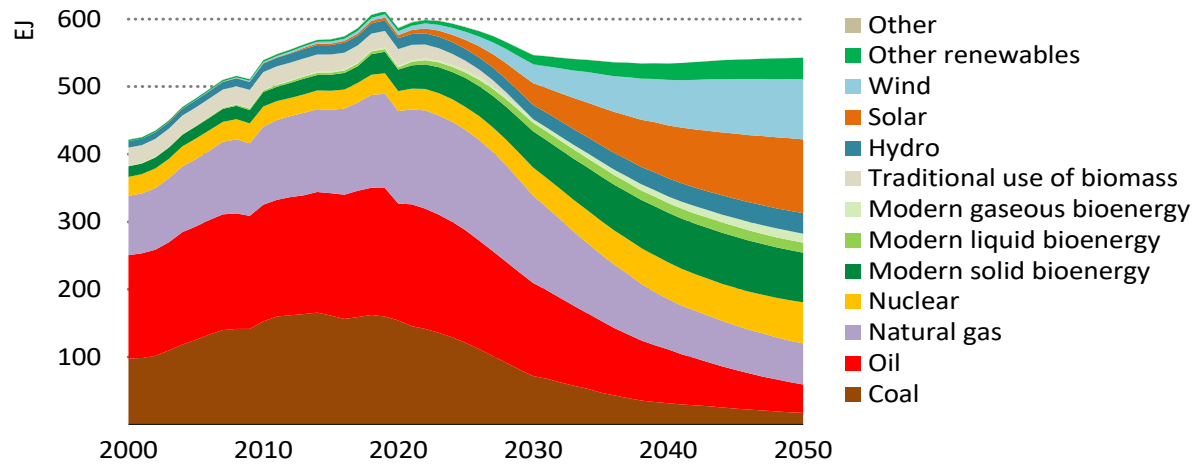
oil as a source of energy, and the transport technologies which were based on oil. In the last part of the 20th Century, the integrated, global oil-based economy opened for and used internet, ICT, and electrification, digitalization and financialization with waves of FDIs, developing the global value chains we have today.

Now something similar is on the table. Going away from oil and coal not just involves energy production, it also generates deep changes in energy use, technologies, and forms of organization across several sectors, in transportation, industrial energy intensive manufacturing, such as metal industry, as well as in agriculture, farming, and forestry.

This connection to other sectors is illustrated in the figure of reduction of CO₂ emissions below. The highest reduction is in production of electricity, but buildings, transport, industry and other sectors also go through huge changes. See figures below (IEA 2020: 55).



Below is the IEA scenario for global use of energy between 2000 and 2050 (IEA 2020: 57). Today, natural gas, coal and oil dominates. In 2050, after a successful transformation wind, solar, various forms of bio-energy and nuclear power will dominate.



There will still be some production of oil, but it will not be used as a source of energy.

This shift will create losers, countries, regions and industries who rely on oil, gas and coal. Just to mention a few is a continent with huge ambitions, capacities and desire for economic growth, Africa, taxi drivers and commuters in Paris, coal miners in Australia, peat farmers in Finland, and countries which today are specializing in oil and gas export.

Driving this transformation, on the other side is a by now a rock-solid internationally embedded and shared scientific knowledge base enabling analysis of the human impacts on nature through CO₂ emissions. This analysis is increasingly confirmed by real-life experiences, such as the rapid warming of Antarctica and the Arctic, changing “freak” weather patterns across the world, forest fires, and emerging evidence that the sea level is starting to rise.

We clearly need a strong world government which is able to do the calculations right, and come up with, and enforce a legitimate plan. Unfortunately, the nearest we get right now is a weak institution, UN. UN has done a crucial job in supporting research and transnational policymaking, and it is driving the national government pledges in favor of NZE in 2050. But it is still just facilitating a dialogue between countries. So if we look at the global level, we have a policy helix which goes through the right motions, but it is quite weak.

This is where the market comes in: green growth!

1.4 Green Growth: let markets change the world!

Policies are shaping strong expectations among powerful economic actors. There is now a new game in town, driven by rational economic actors in big business. The winning team of stakeholders promoting GT is forming, and their strategy is Green Growth. Core actors in defining this concept was the Club of Rome (the Davos network) in 2020. The story is actually very simple. To become a winner in a broad paradigm

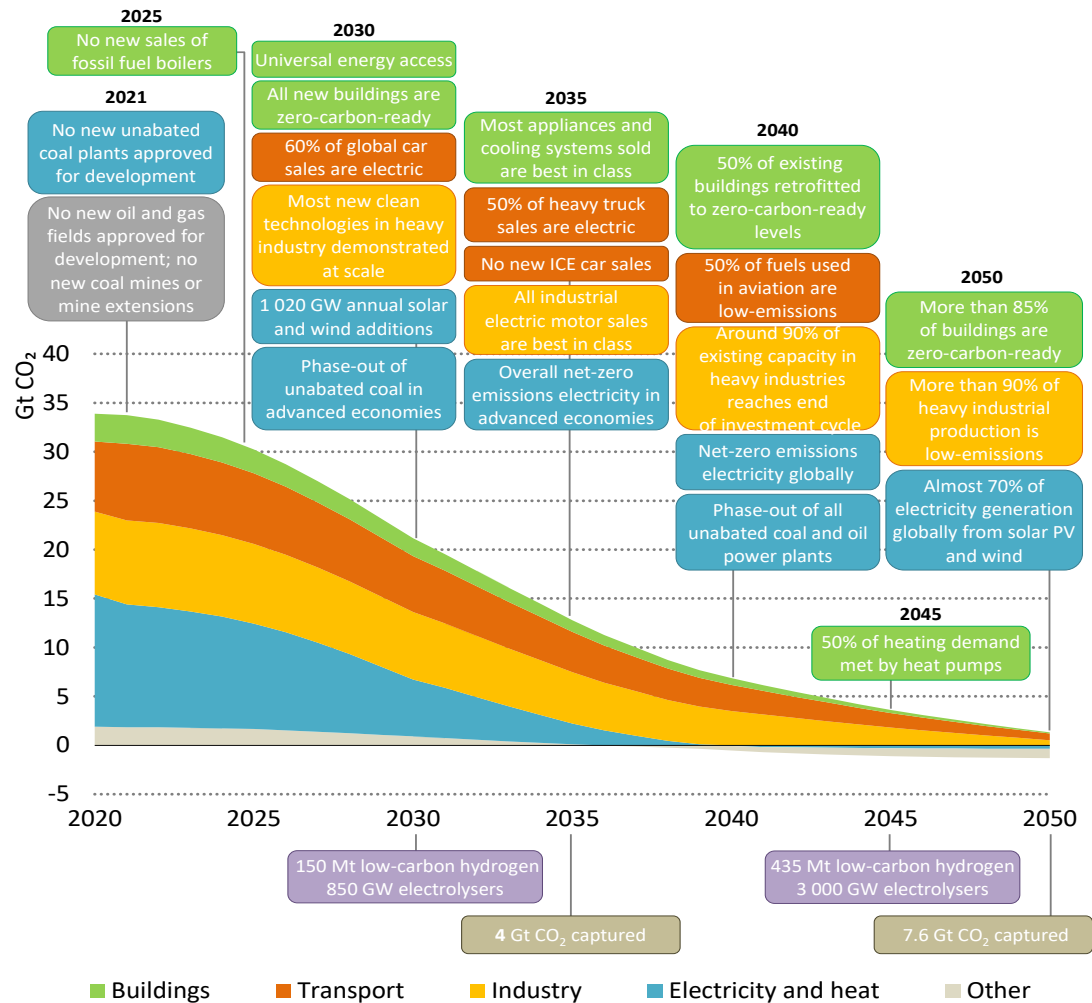
shift, you must take the lead. As oil- and coal-based technologies and economies are closing down, green energy alternatives will grow. All you need to be a winner is money, a strong long-term income stream and an ability to plan long term. Not surprisingly, some of the global stakeholders driving green growth are oil companies, like BP, and their financial investors. One might say this is a paradox, something like an identity crisis of the oil industry. Are they basically oil producers, which is their core technology today, are they energy companies, eager to grow in expanding areas, such as wind energy, and to what extent are they guardians of wealth, with shares which rely on pension funds and other long-term investors?

BP want to survive oil, and in order to do that, they continue to produce oil, and use their oil income for investments in green energy. In this respect, they are aided by financial investors looking for both long term storage of wealth and short-term profits. Another example is ROSATOM, a state-owned Russian monopoly on nuclear power production. According to the Financial Times:

The state-run nuclear monopoly, responsible for 76 per cent of global nuclear technology exports, is looking to become a leader in the global energy transition, first deputy director Kirill Komarov told the Financial Times. The company, which operates 36 reactors in 12 countries, is stepping up development of small-scale nuclear plants, wind energy, energy storage and green hydrogen projects. (Financial Times, 20 June 2021)

IEA published this roadmap to NZE (IEA 2020: 152):

Selected global milestones for policies, infrastructure and technology deployment in the NZE



A competing strategy is to stay within the oil sector when others are leaving and wait to have world monopoly in oil production in 2050. According to IEA, there will still be oil production in 2050, but the oil will not be used as a source of energy, and prices will be low (oil may be used for plastic production or lubricants of machinery). It will be in the direction of a niche product which has lost its hegemony to green energy. There are still people around who know how to make horse-shoes and train horses for leisure use. So maybe in 2050 there will still be people who can repair cars with combustion engines?

1.5 Landscape transformation: Green Growth stakeholders

Powerful stakeholders pushing for green growth is the new industrial policy of Germany, and the European Green Deal. This political support is important, because a successful green growth strategy relies on policy backed market regulations, playing together with the large scale global private actors. What we are talking about is enforcement of labeling of products and services according to their CO₂ footprint, followed by a CO₂ tax on products. This is the silver bullet which is expected to kill oil and coal. These

regulations will force producers of industrial goods and services to use green energy suppliers, it will speed up the destruction of the oil and coal industry, and it will destroy the value of oil resources in the ground.

This is what EU say:

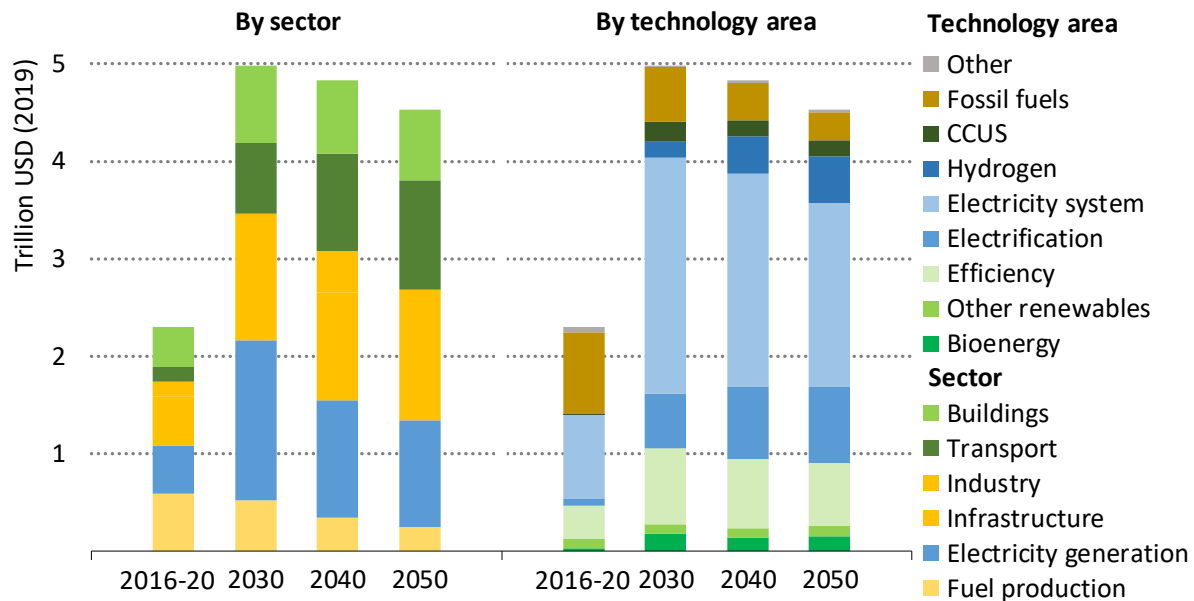
- European Green Deal will support a clean energy transition and will help accelerate the EU's industry transition to a sustainable model of inclusive growth.
- The clean energy transition is an opportunity to increase sustainable and job-creating economic activity.
- A European industry at the forefront of zero-emission technologies, sustainable products and services has a significant potential to increase economic value: developing and deploying them first in the European economy and through expanding presence and sales in global markets.

This is almost identical to the German climate law from 2018, and German industrial policy. The green shift is going to create new conditions for competition.

In 2021 Germany's top constitutional court in Karlsruhe has demanded changes to Germany's climate law, saying it is too slow. It places too much of a burden on future generations to reduce carbon emissions, in a key victory for young climate campaigners. The court said the law "violate[s] the freedoms of the complainants, some of whom are still very young" because it "irreversibly offload[s] major emission reduction burdens on to periods after 2030".

This is the IEA investment strategy in global energy production, in trillion US dollars, leading to 0-2050 (IEA 20210). There is a huge increase in investments in energy from 2020 to 2030. In terms of energy technology. In terms of sectors, the biggest jumps are in electricity generation, industry and transport.

Investments in energy production by sector and energy technology area in NZE (Source: IEA 2020: 81)



Not surprisingly, there are big investments the next 10 years in electricity production and electrification. But there are also big investments in buildings, transport, and industrial manufacturing. The forthcoming regulations are expected to define rules of competition where CO₂ intensive services and products are marginalized. By taking the lead, European industries will be global Green Growth winners, because they are expected to be competitive as leaders in development and use of green energy.

These investments in green electricity creates electricity based on wind and solar cells as the hegemonic form of applied energy, along with hydrogen and biofuel. Today, electrification is expected to drive digitalization, robotization, artificial energy and several other new and emerging niches, like 3 D printing, into hegemonic positions. In other words, we are talking about a shift in energy production which is driving and facilitating innovations all over the world across several core sectors.

1.6 Stakeholder analysis

This is where we will apply the dynamic stakeholder analysis referred to as *salience* of Mitchell et al. (1997). Stakeholder salience theory was based on a discussion of corporate strategies. The classification of a stakeholder was seen from the position of a strategic leader of a company. The strategy is to gather support. In GRETA, the company is GT.

To support a dynamic theory of stakeholder identification and salience, however, we need to consider several additional implications of power, legitimacy, and urgency. First, each attribute is a variable, not a steady state, and can change for any particular entity or stakeholder-manager relationship. Second, the existence (or degree present) of each attribute is a matter of multiple perceptions and is a constructed reality rather than an "objective" one.

Third, an individual or entity may not be "conscious" of possessing the attribute or, if conscious of possession, may not choose to enact any implied behaviors. These features of stakeholder attributes (...) are important to the theory's dynamism; that is, they provide a preliminary framework for understanding how stakeholders can gain or lose salience to a firm's managers:

- 1. Stakeholder attributes are variable, not steady state.*
- 2. Stakeholder attributes are socially constructed, not objective, reality.*
- 3. Consciousness and willful exercise may or may not be present.*

(Mitchell et al. 1997, page 868).

Accordingly, Mitchells makes a distinction between latent, moderate and definitive stakeholders. These categories are important because they open the door to understand how stakeholders can be mobilized to *move* from a *latent* position into a more *moderate*, supporting position, and then into a *core supporter*. This dynamic is measured through stakeholder *salience*.

Stakeholder salience will be low (dormant, discretionary or demanding in the figure below) where only one of the stakeholder attributes-power, legitimacy, and urgency-is perceived by managers to be present.

Low salience means that what they do matters for the corporate leader, but they do not relate to the corporation and its strategy. Dormant stakeholders are often referred to as sleeping giants, they may accidentally destroy or undermine the company, or they may un-intentionally do things which favors the company. They are important, but beyond reach so far.

Stakeholder salience will be moderate where two of the stakeholder attributes-power, legitimacy, and urgency-are perceived by managers to be present (Dangerous, dominant or dependent).

Dominant stakeholders have *power and legitimacy* which is important to the company. A wise leader will keep them as close as possible.

Dependent stakeholders may rely on the company and operate within its domain. They might be critical customers or users of company services. They are both a part of a dominant coalition.

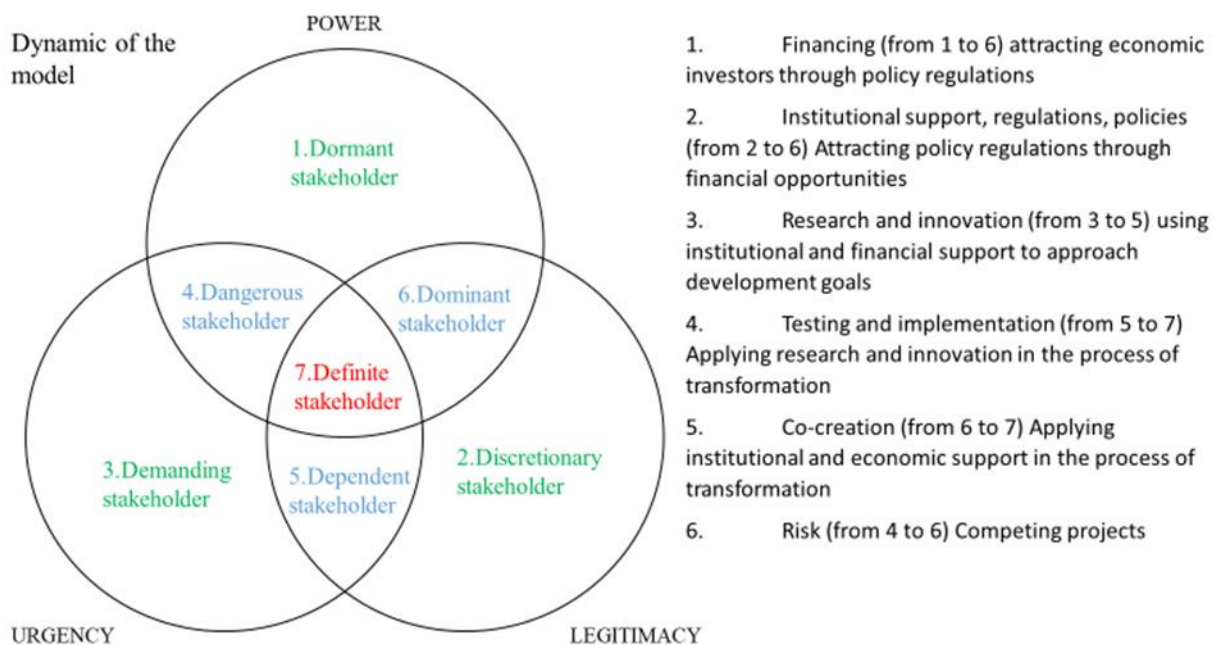
By definition, a stakeholder exhibiting both power and legitimacy already will be a member of a firm's dominant coalition. When such a stakeholder's claim is urgent, managers have a clear and immediate mandate to attend to and give priority to that stakeholder's claim. The most common occurrence is likely to be the movement of a dominant stakeholder into the "definitive" category (position 7 in the figure below).

This is why *stakeholder salience* theory is a good point of departure to understand how established regimes and emerging clusters may compete. One of the examples used by Mitchell et al. is ANC in South Africa:

We can observe an example of stakeholder dynamism in recent events in South Africa. The African National Congress (ANC) began as a group with an urgent claim but not a

legitimate one, given the ruling South African culture and government, and it had no power. At first it was a latent, demanding stakeholder. The ANC next moved into the "dangerous category" by using coercive power. However, this did not lead to definitive status. It was only by acquiring legitimacy while relinquishing the use of coercive power, and thus becoming a dependent stakeholder, that the ANC was able to achieve definitive status, high salience, and eventual success.

Stakeholders may have more or less strong positions inside the existing regime, and they may be mobilized to join the GT transformation, by moving from low to high salinity. Or stakeholders at the core of the GT process may be more or less outside the existing regime, competing with it. Seen in a dynamic perspective we are concerned with 6 flows of stakeholder, from marginal or neutral positions (1, 2 and 3), into the core supporting the GT process (position 7) or promoting competing agendas, illustrated in the figure below.



A strong convergence of Landscape level stakeholders, from positions with low salinity (1, 2 and 3) in the direction of high salinity is likely to indicate that the landscape is changing, in ways which support transformation of regimes.

So what can we discover if we look across green growth, the dynamic between landscapes, regimes and niches? As illustrated in the discussion going on in Glasgow this autumn, the situation is bordering on chaos, there seems to be a real threat that everything may fall apart. But there is still a momentum. On one hand, there are urgent warnings from science indicating that the 1,5 degree goal is getting lost. On

the other side of the fence (in position 4), there are not just anti-science deniers, but also a broad range of resistant stakeholders referring to everything from economic vested interests, and prisoner dilemma based competition between countries. Position 4 is getting stronger. But this strengthening of 4 is a result of the increasing polarization. It means that more and more stakeholders are forced to choose side, and relate to the climate change challenge. In other words, the three positions of low salience (1, 2 and 3) are slowly abandoned.

There is a robust process of co-creation, driving stakeholders in the direction of the definitive position 7, supporting GT.

1. In terms of **definitive stakeholders**, combines urgency, discretion and power and moving into 7, there is a strong macro level (landscape based) interaction between international pledges and commitments from many countries, strong and well organized NGOs, political support, and a stronger and stronger science base, where Mother Earth occasionally let her own voice be heard.
2. In terms of **power and legitimacy**, the political movement has managed to create strong expectations, showing the way for financial capital (flow 1), even inside the oil industry itself. Today several core actors in the carbon-based energy regime starts to build green transformation legitimacy, through ambidextrous strategies. GM has declared that they will not produce petroleum - driven cars after 2035. BP has announced that in the long run (2050) they are moving away from oil and gas and in the direction of green energy as their *core* technology. Norwegian oil producers are developing Carbon Capture and Storage (CCS) technologies which aims to make gas based energy production green.
3. In terms of **testing and legitimacy**, (flow 4) there is a well-developed and by now economically competitive range of green technologies, which are applied rapidly. Most of the technologies we need to replace oil, gas and coal are already here, they are widely used, and they are economically competitive. Several issues remain, such as technologies for long distance aviation, and smart grids which are able to ensure stable energy supplies despite changes in sun, rain and wind, but these issues are possible to solve. The main hurdles in terms of technology are solved.

This means that there are a flow of stakeholders worldwide who transform the global landscape and create green growth opportunities. It is in the context of this strong move in the landscape towards green transformation we must see the emergence of dangerous stakeholders. Some oil producing regions and companies are suddenly trying to go on the offensive and defend their investments in exploration for oil and new oil production. Coal depending regions in China and Australia want to go on firing coal for another decade or so. The discussion gets into conflicts between narrow national interests. Who want to go in front and carry the burdens of others?

One might say that the macro or Landscape level is delivering GT, but it do that in a very divisive way, when it comes to regions, and there is a lot of noise and confusion. Nevertheless, the Landscape creates growth opportunities in regions who are able to seize the moment and speed up the transition, and it opens up for marginalization of regions who are unable to do so and capture green growth. So regions, and nations supporting regions, are core actors.

These core actors in the BSR are the focus of this report. Are they up to the challenge?

- Stakeholder analysis by the partners with 3 tables, according to the template provided by the WP2 leader
- Calculation of the stakeholder tables by the WP2 leader
- Interview questionnaire and the guidance to select environmental experts to be interviewed by the WP2 leader
- Interviews of environmental experts by the partners with the questionnaire
- Reporting of the findings in the template provided by the WP2 leader (WP2 reports)
- Comparative analysis by the WP2 leader: collecting the data and finding, analysing and comparing it.

Selection of intervention areas:

The process of Coordination of Penta helix began with the description of intervention areas by partners. The idea was to identify in what fields GT would have most impact in the region. Partners were describing their selected intervention area, their relations to the respective RIS3 (emerging, mainstream or something else, existing or future priority of RIS3), and their transformative capacity from the point of green transformation. Second, they reported the environmental goals of the intervention area related to climate change policy and emission reduction, effective use of resources and energy, change of ways of produce, consume and/or distribute. Third, the existing achievements of the intervention areas were reported in the terms of GT, as well as the existing products, innovations etc. which have made or have potential to make the region, country, BSR, EU or/and globe greener. Four, the main objectives of the intervention areas in terms of green transformation (green innovations, products, green systems of innovations) were written. They also made preliminary description of the core stakeholders of the intervention from the point of GT, and conflicts and different interests concerning GT among the stakeholders.

The intervention areas are among energy and circular economy. GRETA aims to build on and transform experiences with methods to support green transformation in these two areas. The intervention areas:

Klaipeda (Lithuania) – food and beverage industry (circular economy)

Latgale (Latvia) – metal and mechanical engineering (energy)

Västerbotten (Swe) – hydrogen (energy)

Ostrobothnia (Fin) – energy technology and circular economy

Päijät-Häme (Fin) – grain cluster (circular economy)

Lithuania – biogas from Agri waste (energy and circular economy)

The intervention areas will be described more detailed in the section 3 of the report.

2.2 Process of stakeholder analysis

The aim of stakeholder analysis in the GRETA project is to identify the role of different stakeholders for the process of GT, and mobilise them to support GT of society and economy as a part of smart specialisation strategies in ways which are aligned with the EU Commission Green Deal (EGD). These strategies vary in their scope, depth and level of sophistication across GRETA partner regions. They might be advanced or emerging. Partners made the stakeholder analysis from the point of view of the GT in the intervention areas. GT means transformation towards climate neutral and sustainable society with zero net greenhouse emissions. Partners evaluated, who should be involved in the intervention areas and what is their position in relation to GT.

The process of stakeholder analysis:

1. Partners selected the stakeholders relevant for GT, classified them, gave them scores according to the below forms. The stakeholders of the intervention located in the target region or outside it. They were from regional, national or EU levels. In classification and giving scores to the stakeholders, many partners used relevant informants. Also, short descriptions regarding the selection and evaluation of stakeholders was provided by partners. Primary data was not collected from stakeholders; instead, they were used as first drafts which were then evaluated by environmental experts.
2. Based on the tables (stakeholder analysis) the regional GRETA profiles were calculated by WP2 leader, and they were one part of the questionnaire, which was basis on the environmental expert interviews. The regional profiles were then verified in the environmental expert interviews undertaken by partners. The interviews lead to additions and improvements of the data.
3. The verified regional profiles of the stakeholders towards GT were then analysed and compared. The findings are in the section 4 and 5 of the report.

The most relevant and powerful stakeholders may be driving the green strategy, they may be supporting the green strategy, they may oppose the green strategy, or they may be ignorant or neutral, but they are nonetheless important to future success, because they have power, legitimacy or political influence (urgency).

In order to describe, and analyse the role of stakeholders partners filled three tables:

1. Strength of stakeholders (power/legitimacy/urgency) of making GT
2. Stakeholders way of making GT (sustainable/unsustainable systems)
3. Stakeholders influence on the process (niche/regime/landscape level)

2.2.1 Stakeholder saliency

Stakeholder analysis was used also in project LARS (see Mariussen et al. 2019). We applied salience analysis developed by Mitchell et al. (1997) which is based on a business strategy approach. The point of departure is which stakeholders a firm should consider as important to its strategy, or salience. Salience means who counts. In GRETA, we have adapted this method to relevance of stakeholders in GT.

We are looking the role of stakeholders to GT through the following main dimensions (attributes):

- (1) **the urgency** is the stakeholder's claim on the GT. Urgency calls for immediate attention or pressing action. (Mitchell et al., 1997). This urgency is creating a power game between powerful and less powerful, dependent actors. In GRETA, urgency refers to environmental will and consciousness,
- (2) **the legitimacy** of the stakeholder's relationship towards GT. Legitimacy is, according to Suchman (1995: 574): "a generalised perception that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions." It is socially accepted structures or behaviours. Legitimacy for GT refers to the regulation, for instance.
- (3) the stakeholder's **power** to influence the development towards GT. Power is a relationship among social actors in which one social actor A can get another actor B to do something that B would not have otherwise done. Powerful stakeholders may be companies or institutions, which control money, knowledge, rules, decisions, or other crucial resources.

In project GRETA, we are interested in the pentahelix coordination among the different stakeholders. When the regions are transforming towards GT, the stakeholders and helices should be connected. Stakeholders who are strong in the intervention area in terms of power and legitimacy might be outside or ignorant of GT. Stakeholders who are outside GT might have an urgent need to protect carbon-based solutions. When all the strong stakeholders in the region are in the core of the mobilization for GT, GT is a success.

Table 2.1 Stakeholder relevance in regional regime and in green transformation

GT strategy of mobilization		Stakeholder relevance for GT		
		0 (outside the GT process)	1 GT supporter or enemy	2 GT driver
Role in the intervention area (strength inside the regime)	0	Probably irrelevant (sleeping giant)	Weak supporter or enemy, do not waste time.	GT is weak
	1	Take into consideration, do not waste time	Nice to have as a supporter or partner	GT is struggling/ emerging
	2	Potential future supporter or enemy. Strategic attention. Move from 1 to 2 properties	Strong supporter, potential driver. Establish close day-to-day partnership. Recruit to core.	GT has won! Congratulations!

The stakeholders were evaluated based on their legitimacy, power and urgency (strength) as well as their ability to act as a GT driver (relevance), which consists of two aspects; stakeholders' ability to work in diminishing unsustainable system/promoting sustainable system and their influence in niche, regime and landscape level. Successful GT means that the regime is changing, because the GT process grows stronger. This means that the positions of the stakeholders are expected to be dynamic.

Stakeholders are evaluated similarly as in LARS in order to see how urgent, legitimate and powerful they are in Green transformation. The stakeholders of the intervention area can be located in the target region or outside it. They can be from global, EU or national levels, for instance.

Strength (salience) of stakeholder per helix :

Urgency (Environmental will)

Companies: Change material flows, create new networks and value chains, new products.

Universities: Research, education and dissemination on topics relevant to Green Transformation

Public organisations: Regulations and policies promoting transformation of landscapes and regimes

NGO: Activities enhancing GT

Legitimacy (Regulation)

Companies: The activities are desirable or proper from the green transformation point of view

Universities: The education and research programs of the universities match with green transformation

Public organization: Preparation, decisions and implementation of GT development programs and regulations

NGO: Environmental / GT focus

Power (Funding)

Companies: Able to act independently; make market decisions on its own

Universities: Power to implement education and research activities

Public government: Setting rules and norms for environmental issues

NGO: Ability to actively engage decision makers; active lobbying and wide support-base

In order to find out the how the dynamics of stakeholders are developed, the evaluation regarding the attribute of urgency, legitimacy and power was conducted with a timeline: 5 years ago, now, in 5 years (See table 2.2).

To measure urgency, legitimacy and power of the stakeholder a scale from 0-2 were used in which,

0 = stakeholder with no urgency, stakeholder with no legitimacy, stakeholder with no power,

1 = stakeholder with some urgency, stakeholder with some legitimacy, stakeholder with some power,

2 =stakeholder with high urgency, stakeholder with high legitimacy, powerful stakeholder.

Table 2.2. The saliency and relevancy of stakeholders (template for the partners)

Stakeholder	Stakeholder's strength in intervention area									Stakeholder type in green transformation
	Urgency			Legitimacy			Power			
	5 years ago	now	in 5 years	5 years ago	now	in 5 years	5 years ago	now	in 5 years	
Company 1										
Company 2										
Company 3										
University 1										
University 2										
University 3										
Public org. 1										
Public org. 2										
Public org. 3										
NGO 1										
NGO 2										
NGO 3										

Note: Feel free to add more/remove rows. "Now"-columns are marked, because it is easier to start from those and then think back and forth 5 years

These three main dimensions make it possible to define 7 types of stakeholders: dependent, dominant, dormant, demanding, discretionary, dangerous, or definitive. This typology help us to classify stakeholders in latent (weak), expectant (moderate), and definitive (strong) (Figure 2.2). These categories are important because they open the door to understand how stakeholders can be mobilized to *move* from a *latent* position into a more *moderate*, supporting position, and then into a *core supporter of GT or definitive*. This dynamic is measured through stakeholder *saliency* (Figure 2. 3)

The most relevant and powerful stakeholders may be driving the green strategy, they may be supporting the green strategy, they may oppose the green strategy, or they may be ignorant or neutral, but they are nonetheless important to future success, because they have power, legitimacy or political influence (urgency).

Dependent stakeholders may rely on only one powerful actors, and they may be easy to replace, because the knowledge they apply is easy to access. Dependent actors compete to obtain and maintain their positions, and they may demand attention, legitimacy, and urgency.

Powerful actors, like environmental offices and sometimes multinational companies (MNCs) and other large global, national or regional champions might be **dominant stakeholders**. They have the power and legitimacy to make regulations or green innovations, for instance. The companies define the roles of their subcontractors evaluate their subcontractors and they are able to replace them, if they do not fulfill the requirements of the contract. Their support may be crucial. Dominant stakeholders set standards, allocate

resources and make decisions, providing legitimate rules (like environmental regulations and product standards).

Dormant stakeholders have power, but lack legitimacy and urgency. These may be multinational companies who may not have any interest in GT or in developing the surrounding region but focus more on their core activities. **Demanding stakeholders** on the other hand have urgency but lack power and legitimacy. These stakeholders are eager to be involved but lack the resources and stature to be heard. Smaller companies might be such stakeholders.

Public authorities may be **discretionary**, they may or may not get involved, and they may choose to be neutral and follow general rules. Indeed, this neutral position is often seen as the ideal. Discretionary public authorities may apply rules, regulations and other policies, which create problems. Since they do not care, they might not even know what they are doing.

Different stakeholders may also become **dangerous**. Powerful companies may just move their investments elsewhere, and invest in competitors' area. Dangerous stakeholders are also activists (competing firms, NGOs or regulators) who challenge legitimacy of green growth.

The stakeholders, who are driving GT, are at the core of the intersections between helices. They are the **definitive stakeholders**, able to mobilize some legitimacy and power, and combine it with urgency.

There is also a possibility that a stakeholder has no power, legitimacy or urgency and is a non-stakeholder (Mariussen et al. 2019 Mitchell, Agle & Wood 1997).

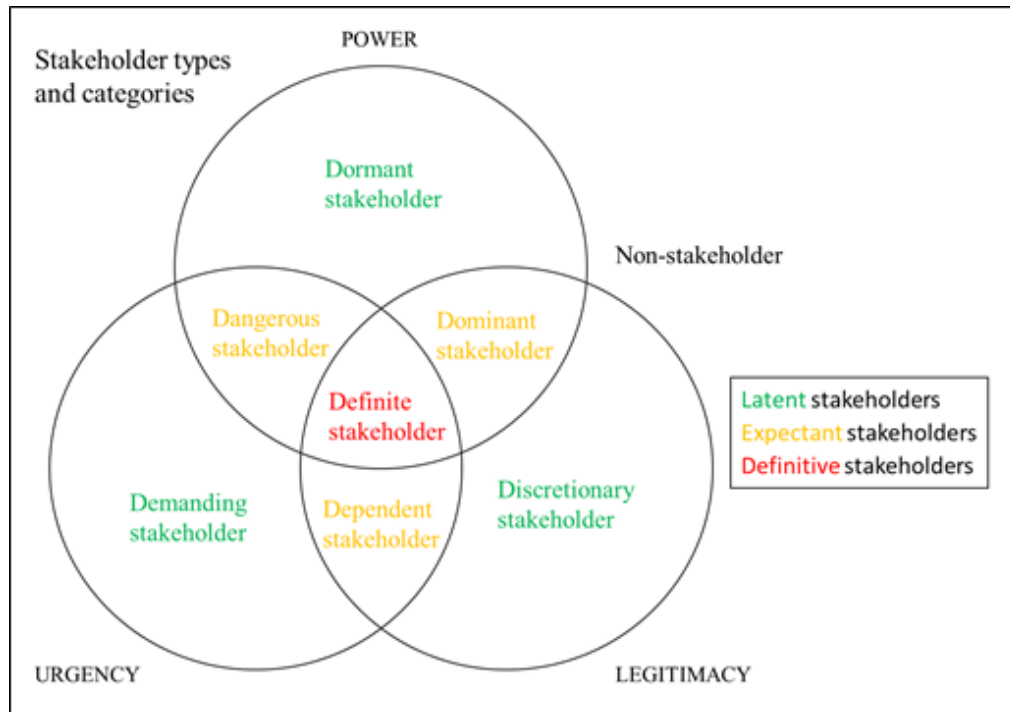


Figure 2.2. Stakeholder typology (based on Mitchell et al. 1997)

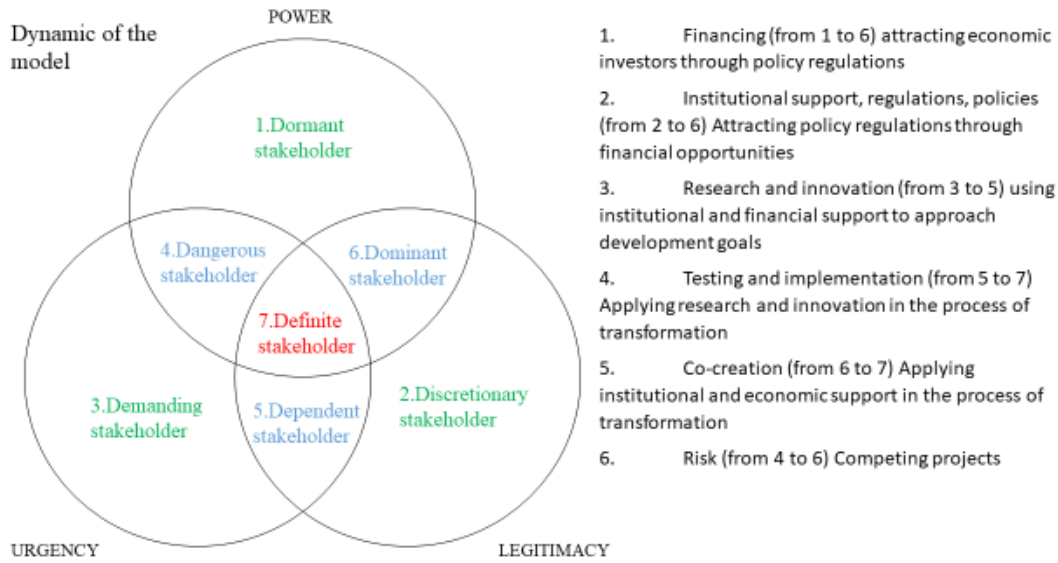


Figure 2.3. Dynamics of the stakeholders: mobilization/saliency

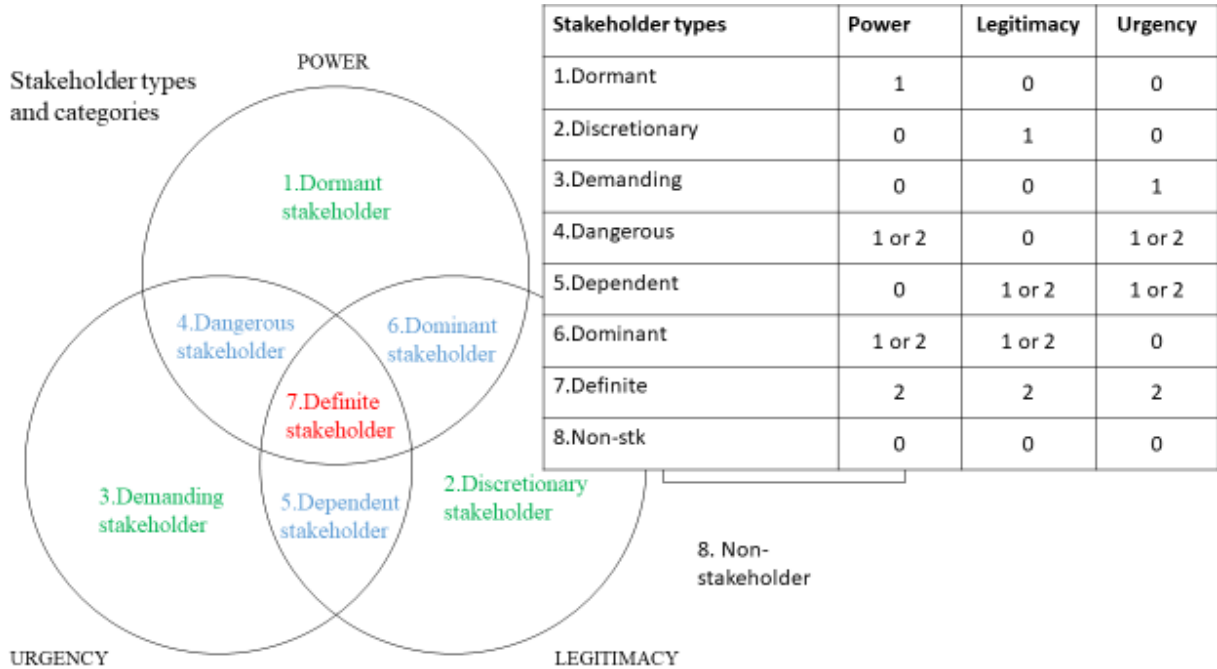


Figure 2.4. Definition of stakeholder salience toward Green transformation

2.2.2 Stakeholder's role for green transformation

One way of looking at stakeholders and their relevance for green transformation is through their activities. It is important to see that green transformation can happen through two main routes: by promoting solutions for more sustainable systems or by diminishing the effects of existing, unsustainable practices. The partners evaluated the role of the chosen stakeholders regarding GT. In what degree the stakeholders:

See GT as opportunity and were actively building/promoting/looking for new, more sustainable solutions. For example new solutions for green energy, or solutions to enhance circular economy OR

Are diminishing unsustainable system (reducing the threat) and are actively trying to remove/act against/solve old, more unsustainable solutions? For example, replace existing processes or products with more sustainable ones?

Sometimes new sustainable solutions were linked with diminishing unsustainable systems; for example, a new type of filter (new opportunity) to remove factory pollution (threat). In this case, both were marked.

The evaluation was also made with a timeline (5 years ago, now, in 5 years) to see how the dynamics between stakeholders. The relevance of the stakeholder was evaluated in the scale from 0-2:

0=Stakeholder is not promoting sustainable systems/diminishing unsustainable systems

1= Stakeholder is promoting sustainable systems/diminishing unsustainable systems

2= Stakeholder is definitely promoting sustainable systems/diminishing unsustainable systems

Table 2. 3 Role of stakeholders in the green transformation

Stakeholders	Promoting sustainable systems			Diminishing unsustainable system		
	5 years ago	now	In 5 years	5 years ago	now	In 5 years
Company 1						
Company 2						
Company 3						
University 1						
University 2						
University 3						
Public org. 1						
Public org. 2						
Public org. 3						
NGO 1						
NGO 2						
NGO 3						

Note: Feel free to add more/remove rows, according to your previous selection of stakeholders.

2.2.3 Stakeholder's level of influence

Different stakeholders operate at different levels. (niche, regime and landscape, see section 1). Some companies may have a good product for green transformation, but they have just started and the product is not well known yet ("niche"). Or the public organization might act more on a regional level ("regime") and be tied by legislation to mostly focus on these activities. On the other hand, the university might be well known in circular economy research and have international recognition ("landscape"). We are interested in the level of influence of the stakeholders in the sustainability transition processes, and therefore partners evaluated whether the selected stakeholders are able to make a difference in limited (niche), regional (regime) or national/EU-level (landscape). It was also related to the influence (combination of urgency, legitimacy and power) the stakeholders actually are; how likely they are to affect the different levels. Partners filled the table 2.4.

Stakeholder is affecting **a niche level** (regional level): Stakeholder is an important actor at regional scene and has networks to other regional stakeholders.

Stakeholder is affecting **regime level** (national level): Stakeholder is an important actor at national scene and has networks to other national stakeholders.

Stakeholder is affecting **landscape level** (EU level): Stakeholder is an important actor at EU (Green deal) scene and has networks to other European stakeholders.

The evaluation was again made in the scale from 0-2:

0=Stakeholder doesn't have influence in niche, regime of landscape -level

1= Stakeholder does have influence in niche, regime of landscape -level

2= Stakeholder does definitely have influence in niche, regime of landscape –level

Table 2.4 Stakeholders' influence on niche, regime and landscape level

Stakeholders	Stakeholder is affecting on niche level (product level)			Stakeholder is affecting regime level (regional level)			Stakeholder is affecting landscape level (national/EU level)		
	5 years ago	now	In 5 years	5 years ago	now	In 5 years	5 years ago	now	In 5 years
Company 1									
Company 2									
Company 3									
University 1									
University 2									
University 3									
Public org. 1									
Public org. 2									
Public org. 3									
NGO 1									
NGO 2									
NGO 3									

Note: Feel free to add more/remove rows, according to your previous selection of stakeholders.

2.3 Interview questionnaire and interview process

During the interviews, regional environmental experts were asked about the situation in which regions are regarding preparations towards green transformation driven by smart specialisation strategies. The idea is to measure what is the current situation and how do the regional experts see the future regarding GT. The aim is also to identify biggest opportunities and challenges for the regional innovation systems by looking at the roles of different helices (companies, universities, public organisations, NGOs) and how well the different regional actors are able to participate in the European goals towards greener future via their innovation activities.

Research process

1. WP2 leader conducted interviews of relevant environmental specialists in order to get the understanding of relevance of the stakeholder analysis and paths to GT, and to verify the interview questionnaire. The findings were used as input in preparing the guide for stakeholder selection and in preparation for the interview template. Interviews with environmental experts by WP

leader to identify the main factors and drivers in GT. How to identify regional green transformation (GT) goals/projects.

2. Partners selected environmental/green transformation experts in their intervention area for the interviews according to the guidance of WP2 leader. The chosen experts had overview and knowledge of the current situation of GT in the respective intervention areas, as well as view of the potential pathway of the area to green transformation (see Chapt 1.) They were also central persons for achieving green transformation (or regional environmental policy). The GT experts represented different helices, but the stratified sample was not required, main criteria was the expertise on GT. It was wished that they could be are either definitive stakeholders or have some power, urgency and/or legitimacy in relation to GT. Respondents were picked according to gender equality, whenever possible. Snowballing strategy in selecting the relevant respondents were used, and at least seven expert interviews were conducted.
3. Questionnaire/interview template was prepared
4. Interviews conducted in March-April 2021 and the partner reports send to WP2 leaders.

Overall idea is to position the regional innovation system in liaison to GT and see whether environmental demands pose a challenge or opportunity for regional smart specialisation activities

2.3.1 Interview template - Questionnaire

The anonymity and following the European General Data Protection Regulation (GDPR) in the data storage and analysis was assured in the template. The questionnaire consisted of questions about 1) the visions and strategies of the region towards GT; 2) the role of niches, regimes and landscape and their connections regarding to GT in the intervention area; 3) the most relevant pathway to GT; 4) and the ideas for mobilization of different stakeholders; how to make them move towards GT?

In addition, the processed information on stakeholder tables were shown to experts. Partners asked their views of the role of stakeholders in regard to GT: "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?"

Do you agree with this transformation of different actors? Example table 2.5

Stakeholder	STK type in GT		
	STK level*		
	5 years ago	now	in 5 years
Company 1	4	5	5
Company 2	4	4	5

Company 3	5	3	5
University 1	4	5	6
University 2	4	5	6
University 3	4	6	6
Public organisation	5	6	6
Public organisaiton	6	6	6
Public organisaiton	1	1	4
NGO	3	3	5
NGO	5	5	6
NGO	4	5	6

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

Table 2.6. 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?

Stakeholder in the interventon area X	How do stakeholders view GT?		
	Yes or no		
	Opportunity	Threat	Green washing
Company 1			
University 1			
Public organisation 1			
NGO 1			

The question of paths to GT is based on Geels (2010), we have added the path on institutional exhaustion. The paths are:

- **Technological transformation.** Existing industries will be closed down and replaced with new economic activities. 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.** Change through adjustments of existing industries, skills, regulations and institutions. The existing networks, value chains and companies will overcome difficulties in adjustments, adapt to new regulations, and discover green growth opportunities
- **Regime reconfiguration.** Existing industries will be radically reorganized, and new actors will take core positions. Loss of some of the 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.** Small niches will become dominant actors and existing industries will disappear. Surviving companies/ technologies, combined with new industries will lead the change. Investors can be attracted 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.** Green transformations will be blocked due to deep conflicts. Industries will react to macro level pressure through protests and slow downscaling. There will be a difficult future with long term decline, unemployment, out-migration and social problems. The region will rely on social policy measures of the Structural Funds, and long-term strategic support for new path creation through foreign direct investments.

2.3.2 Interview process

Altogether 47 environmental experts were interviewed in March-April 2021. All partners had at least one respondent from every helix, even if that was not the requirement. Public organisations were the most common respondents, and NGOs the fewest. The experts in public sector and universities had knowledge on environmental policy and were for instance planners, developers, specialists, researchers, professors, etc. The company experts had knowledge of the environmental consequences of the companies and the role of companies in the GT. NGOs respondents were for instance leaders of respective organization or relevant environmental experts.

Some partners have problems to get interviews from the environmental experts of companies. The serious covid 19-situation made the interviews more difficult for some cases. The stakeholder analysis was improved by environmental experts in every regions, the interviewed experts added more stakeholders and changed some of the values of the roles given by partners.

Table 2.7. Number of respondents per helices

Region/partner/ intervention area	Companies	Public organisations	Universities	NGOs	Altogether
ostrobotnia	3	4	1	1	9
LithuaniaBio	2	1	3	1	7
Latgale/latvia	1	4	1	1	7
Päijät-Häme	1	5	2	2	10
LIC/Klaipeda	3	1	2	1	7
Västerbotten	1	2	2	2	7
Altogether	11	17	11	8	47

The findings were reported in the template by partners consisting of description of the intervention area, updated stakeholder analysis after the verification by the , report on interview process, interview data and its analysis, evaluation of the role of regions and relevant paths, and the reflections.

2.3.3 Analysis

Analysis is collected regarding the importance of different helices and type of stakeholder saliency towards green transformation, and the biggest challenges and opportunities, which the regions might face in the future. In this way there is preliminary data on the situation on the region and what might be the role of the region in the GT. Different partner regions emphasise different topics in their value chains. As an example, if the region is company-driven, as in Ostrobothnia, it was useful to see what the companies are already doing and how they perceive GT challenges, as they are most likely the ones who are able to realise these activities in the wider innovation networks. In the ideal situation, all important stakeholders are moving towards GT, so that their urgency, legitimacy and power in relation to GT is high. There will be a gap between the ideal situation and the current situation, which will be described, compared and analysed more detailed with the help of diagrams and calculation in excel tables in chapters 4 and 5. Comparison of regions/intervention areas, helices and stakeholders is possible since partners have made the stakeholder analysis and expert interviews in similar way with standardised tables and questionnaires. Comparison gives a view of which kind of stakeholders are in the lead of GD, and which type of stakeholders should be mobilised. It also gives view of how well are partner regions prepared for the

implementation of GD and what perhaps should be enhanced or directed efforts to, in order to promote regions in their green shift.

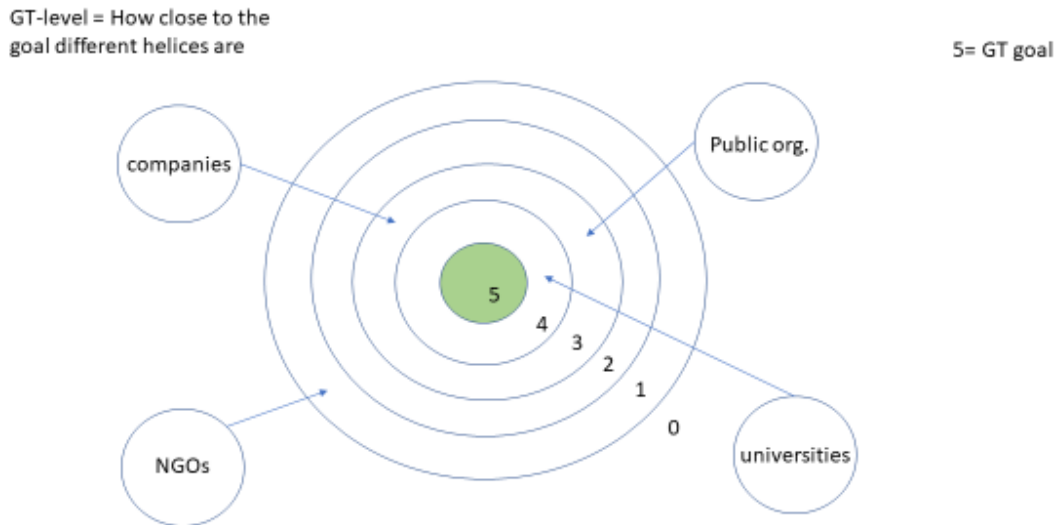


Figure 2.6. Framework of analysis of the helices and the green transformation

In stakeholder analysis we used 14 types in order to draw more detailed penta helix measurements; we have included potentially dependent, -dominant and -discretionary as well as transformative (funding, legislation and environmental will). Se figure 2.7 below.

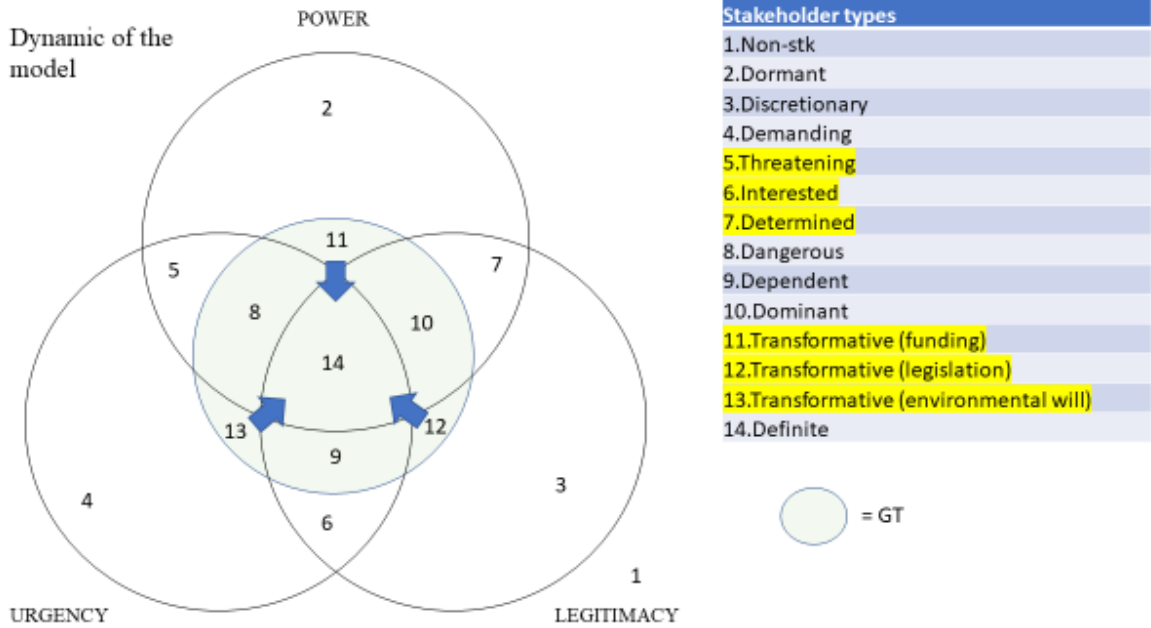


Figure 2.7. Detailed stakeholder analysis

3 Partner regions and intervention areas

3.1 Intervention areas, challenges, by partners

Lithuania- circular bioeconomy (biogas production from agro wastes)

Lithuanian Centre for Social Sciences, Institute of Economics and Rural Development selected area of intervention is circular bioeconomy (biogas production from agro wastes) which relates to both project GRETA fields of interest, i.e. circular economy, as well as green technology. The selected intervention area is part of Lithuanian Centre for Social Sciences, Institute of Economics and Rural development intervention area and it was examined also in the LARS project. Selected area is a part of ongoing Lithuanian Smart Specialization strategy which prioritizes *agro-innovation and food technologies* and especially *Processing of Biological Raw Materials* (biorefinery). The goal is to create valuable insights and recommendations for institutes concerning Lithuanian Smart Specialization Strategy renewal in the selected intervention area, based on the outcomes of GRETA.

Transformative capacity of the circular bioeconomy from the point of green transformation centres on the already implemented spatial practices in Lithuania in the field of energy production from manure and other agricultural wastes. Green transformation would be accelerated in the agricultural sector when practices are multiplied.

Regarding the environmental goals of the intervention area, that biogas production from agro wastes corresponds to the reduced CO₂ emissions from agricultural production, since the collected waste is going into the bioenergy production cycle. It also corresponds to the effective and sustainable way of using resources and energy, because the waste from agricultural production is used to produce green energy by using bioreactors. Biogas production from agro wastes corresponds to the change of ways of production in agriculture when agro processing wastes are collected and used to produce green energy. Energy that is produced might appear in gas and electricity. Those forms might enter the national power lines and gas system and become green energy. It should be stated that for green transformation a national system should be created.

Some achievements have been reached in Lithuania regarding the intervention area in terms of green transformation. The biogas production from agro wastes has already been tested and those results reveal that multiplied and accelerated use of those technologies might accelerate green transformation from both GRETA points of interest; in circular economy biogas production helps to create zero-waste agricultural production practice and the continuous use of agro wastes for energy production ensures the reduced CO₂ emissions from agricultural production and stands for innovative prospective practices towards green transformation.

Biogas production from livestock manure accounts only 7% of the biogas production in the EU, even though it has increased from 4 461 000 tons of oil equivalent to 16 600 000 tons of oil equivalent from year 2006 to 2016. Lithuania has over 20 years of biogas production practices and it has issued a law on renewable energy and started promoting biogas production in 2011 to grow the bio-economy. The first biogas auction winners fixed electricity purchase tariff in January 2013 with an approved 18-megawatt

(MW) approved quota. Further biogas production was however stopped. In 2018 there were 36 biogas plants in Lithuania which included 14 agricultural waste plants (13.3 MW), 9 landfill waste, 8 sewage sludge and 5 biowaste & industrial waste plants. All the 36 plants in Lithuania provide in total capacity of 9.481 MWth (megawatts thermal) and 30.218 MWeI (megawatts electric). In the agricultural sector, biogas plants count up to decade. In the meantime the agricultural sector is the main biogas producer in Lithuania (61.68%). The production in biogas from agricultural, landfill and sewage sludge waste in 2016 exceeds 67.6 million m³, however production in the year 2017 reached only 4.3 percent of all produced energy in Lithuania. Although Lithuania is standing behind biogas producers, because the sector is developing quickly. The development of biogas production from agro wastes has been identified as one of the priorities in Lithuania's Smart Specialization strategy. It's seen that there is a potential to accelerate green transformation in Lithuania in the selected intervention area.

There are several objectives in the intervention area in terms of Green Transformation. First of them is Green Innovations; to revitalize the already built but fully unexploited biogas plants for green transformation, i.e. energy production from agro wastes (manure, carcass, cereals etc.). Also, by creating innovation networks in the field to spread the know-how of implemented green innovation good practices and success stories. Second is green products to accelerate the use of green energy, produced from agro wastes. Third objective is the green system of innovations which is to revitalize and improve the already created innovation system in the field of energy production from agro wastes at national level via networking among stakeholders to reach the expected effect of green transformation. Other objectives are to reach public effort for the public funds spent for building biogas plants in Lithuania during the 20-year period of the biogas plant building support scheme.

In the center of the intervention area are the stakeholders who play a significant role in the biogas production value chain. Every level of the value chain is supposed to be represented in GRETA by environmental stakeholders in Lithuania who hold power, interest and legitimacy in the intervention area. Selected stakeholders in Lithuanian intervention area for the biogas sector are high or some urgency, with high or some legitimacy and with high or some power. The center of the intervention area are the stakeholders from the government, for example responsible for the development of selected area public organizations (Ministry of Environment of the Republic of Lithuania, Ministry of Energy of the Republic of Lithuania, Ministry of Innovation of the Republic of Lithuania and Ministry of Agriculture of the Republic of Lithuania); science (Lithuanian Energy Institute, Institute of Economics and Rural Development, Alanta School of Technology and Business), companies (livestock growing business, supplies of bio wastes and side materials to biogas producers, and NGOs (Association of Rural Communities of Lithuania, Renewable Energy Producers Association, Association of Local Authorities in Lithuania, Lithuanian pig producers association, Lithuanian cattle producers association, Lithuanian grain association).

Core role is played by the public organizations in creating and ensuring the favorable environment for spreading green innovation. Innovation boosters are playing a vital role, they are the ones that implement innovative technologies in their farms (i.e. livestock and cereal growers). One of them is for example JSC 'Cesta'. Moderate support is needed from science stakeholders and further development might be accelerated by the joint interests of strengthened NGOs in the field. Conflicts and different interests concerning the green transformation had been eliminated by uniting them into one round table discussion panel,

whose main concerns is the prosperous green transformation in general and particularly in the selected intervention area i.e. circular bioeconomy.

Klaipeda (Lithuania) Lithuanian Innovation Centre

Lithuanian Innovation Centre decided to choose the topic of Food and Beverage industry as an area of intervention, with regard to the recent studies which identified regional strengths, resources and capacity to achieve breakthrough by applying innovative practices, in addition to the already chosen strategic directions in the region.

Small and medium-sized enterprises (SMEs) are dominating the landscape in Klaipeda as well as in the whole Lithuania. More than 75% of the 119 companies have less than ten employees and 99,9% of the companies are SMEs according to the EU definition. Cooperation between different companies is very important in order to achieve technological advancement and innovations, because only a few companies have their own resources and competencies to constantly create and implement new materials, processes or business models. In this regard, the stakeholders that are involved in clusters, associations or other network structures are significant for this research. In the Klaipeda region there are NGOs that could help to foster innovative collaborations activities in the area of Food and Beverage manufacturing industry.

Global economic challenges such as growing population, waste management and climate changes are the main drivers that influence the transition to circular methods in the manufacturing industry. Newest studies that analyze the impact of urbanization indicate that even though cities are growing and becoming the major engine for economic growth, the fast growth of the population has its downsides: the growth puts a big pressure on urban resources, carrying capacities and has a massive impact on the waste generated. The amount of waste generated in production and other economic activities has been increasing over the years in Lithuania together with capacity of the industry. Even though 87,8% waste from production and other economic activities (excluding phosphogypsum waste) is being recycled or treated for further utilization, 38 % of municipal waste still ends up in a landfill or in incineration plants of which food waste and food packaging compose a significant amount of all waste flow. Food sector, paper and wood industries have the highest turnover associated with waste resources. Circular economy has a huge potential to solve these problems especially in the urban areas.

Klaipeda region is focusing on sustainable environment as their primary direction thus circular transition of the food and beverage would be helpful to achieve this goal by developing new business process management models focused on the creation of added value in production, by integration of biorefinery technologies, by prioritizing sustainable biomass for food production and implementing cooperation models with producers of sustainable packaging, waste management companies and energy suppliers. These activities are reflected in the Klaipeda region Smart Specialization areas: bio-economics, innovative agriculture and advanced industrial economics.

Latgale region and Ministry of Environmental Protection and Regional Development of Latvia (MoEPRD)

MoEPRD is a responsible institution for regional development and for the period of 2021-2027 will be one of the institutions responsible for implementation of Just Transition Fund (JTF) in Latvia. European Commission recommends Latvia as one of main directions for activities investment in technologies and infrastructure for use of clean energy, and to reduce greenhouse emission, energy efficiency and renewable

energy, as well as investment in small and medium-sized enterprises which contribute to economic diversification and transformation. The recommendation is based on European Commission report from 2020.

The chosen focus area is the area of smart materials, smart technologies and engineering systems. Even though manufacturing sector is quite small in Latvia, it is seen to have a lot of potential for regional development. Manufacturing sector made only 12,2% of the gross domestic product in 2020. The sector had to make 20% of the GDP in 2020, according National Development plan for 2014-2020. In the GRETA project MoEPRD will focus on the manufacturing sector in Latgale sector since it is considered as a less developed region in Latgale. Mechanical engineering and metal industry is with high energy consumption and with low added value according to feasibility study results of JTF.

Päijät-Häme

The Päijät-Häme region in Finland has chosen the intervention area to be circular economy and more precisely beverage and food industry in relation to the green transformation. Bio-circular economy and side stream innovations, sustainable and clean beverage and food industry were the perspectives. In the identifying process of challenges in green transformation the following bottlenecks in the regional innovation system are considered: funding, legislation and regulation, resources, lack of company-university cooperation in RDI activities or low cooperation with companies and educational organizations and academia.

The intervention area is closely linked to the LARS-project, which investigated the challenges of the innovation cooperation in the Päijät-Häme Grain Cluster in utilizing biological side streams from production and new circular economy innovations. Also, the region's smart specialization main theme circular economy and the region's strong emerging RIS3 area of beverage and food are strongly related to the selected intervention area. It is also linked to the strategic objectives of the Regional Program, such as increasing value added and to increase attraction of the region. The selected theme also gets support from the Päijät-Häme's climate work and Climate Road Map.

Bigger companies can serve as an example for smaller companies and the transformative capacity of the intervention area can be compelling. Many of the companies already work with sustainable development and climate goals in mind and operate resource efficiency and in accordance with the principles of the circular economy.

Ostrobothnia

Ostrobothnia has chosen the intervention area to be a circular economy and green energy technologies. Ostrobothnia has the largest energy technology cluster in the Nordic countries, and in many ways, it is a very relevant region concerning Green Transformation.

As in some other regions, also in Ostrobothnia the Intervention area is similar as in the former LARS-project. The difference is that in LARS it was energy technology alone. When conducting the environmental experts in the preliminary interviews it became evident that circular economy is also really relevant in order to achieve GT. Because of those interview results, it was decided to also look at the circular economy in the Ostrobothnia area. Some interesting developments in the area are rising concerning the circular economy in the region.; a local development company has launched regional circular economy

roadmaps. These roadmaps are more concrete than some policy-papers and focus on highlighting what are concrete steps, which SMEs could do in order to benefit from a circular economy.

Västerbotten

The selected intervention area for the Västerbotten region is Sustainable energy with a focus on hydrogen. The ability of hydrogen to store energy thus gives it a special role in the more integrated energy system of the future and can, through its various areas of use, contribute to a more robust and flexible energy system. Hydrogen also has other positive attributes to its name; its storage has a large-scale effect i.e. the cost per stored unit decreases with increasing size.

Hydrogen energy systems must be integrated into places where there are good enough technical and economic conditions. For different countries conditions may vary, but Sweden is distinguished here by its current electricity system with a high proportion of renewable energy sources in the energy system, working electricity market and unique storage resources in the form of hydropower. Also, it has to be said that there is a lack of national distribution infrastructure for gas. The driving force for the production and use of hydrogen in Sweden differs from countries with a high proportion of fossil electricity production and existing natural gas pipelines.

3.2 Visions and strategies

Regions may have different visions and strategies regarding Green Transformation and these might occur on national level, regional level or they might come up from higher levels like for example European Union. There also might be several different visions in the region and they might be conflicting with each other.

In Lithuania there has been a vision for green transformation for a long time before the European Union Green Deal. A lot of different strategies, programs and supportive measures have been continuously proposed, implemented and measured since the start of the 21st century and earlier. First it was climate change, then sustainability issues, after that came smart specialization and lastly the Green Deal that has accelerated the green transformation.

Mostly in Lithuania the visions that are followed come from upper level Like the United Nations or similar. Lithuania has also created their own national sustainable development strategy which is called Lithuanian National Strategy for Sustainable Development. It was the first official sustainable idea-driven strategy in Lithuania and it was published in 2003 and it has been developed further since. Sustainable Development strategy has set the initial vision for Lithuania elucidating the pathway for green transformation. The Lithuanian sustainable Development strategy has been continuously fulfilled with other topical strategies, programs and implementation plans etc.

For the very first green transformation strategy, the legitimacy was given by the parliament of the Republic of Lithuania and the Ministry of Environmental Protection of the Republic of Lithuania was given the implementation process to handle. Even though it was the overall implementation and monitoring process was given to an expert group. Aiming to legally ensure the monitoring of strategy implementation and to keep on the change and causal links analysis, the Minister of Environment of the Republic of

Lithuania established an expert group for the assessment of the progress in implementation of the Lithuanian National Sustainable Development Strategy and for the Development of the Respective Guidelines. The order has not been changed since. The expert group includes the most important stakeholders and includes representatives from all relevant stakeholder groups i.e. government, science, business and society.

These principles are relevant in the Lithuanian bio-economy sector as well as Klaipeda-region, which focuses on the food and beverage production and the circular economy transition in that. Unlike the Bio-economic sector, the Klaipeda (LIC) has one region that it is focused on, and because of that, it mentions regional development plan. Regional development plan for 2014-2020 is outdated, but it did have a goal to implement environmental improvement and environmental protection measures, increase energy efficiency, and use of renewable resources. However, the regional development plan did not have connection to the food and beverage industry in the Klaipeda region. Klaipeda city municipality strategy strategic development plan 2021-2030 includes a task to promote energy saving, the use of renewable energy sources, but the plan is to make changes to the municipality owned entities and does not really affect the food and beverage industry which does not have environmental plans.

MoEPRD mentions EU level and more global international level as the level which sets the vision for green transformation and it is identified by different sectors. International agencies are providing the vision and the innovations are the engine and force to move towards new climate related technology development. The Green deal is seen as a great way to motivate people to think about how to organize the activities and energy efficiency is one of the most important green transformation activities. Green Deal is becoming more and more important for businesses all the time and many experts see that Green Deal will be the main vector for the next 7 years in Latvia. Since ideas of green transformation have been integrated in different policy planning devices, EU funds.

It is seen by some that the Green Deal comes together with funds, which the region wants to use, therefore the Green Deal is their commitment to achieve those goals. Therefore, vision is national level, goal is national level and all involved in this process are moving towards it. Municipality level and business level have done a lot of acts towards by implementing energy efficiency measures and technology replacement measures. Municipalities have their own programs and they have acknowledged to reduce carbon gas emissions. Those programs involve energy efficiency for municipality buildings, effective street lighting etc.

Also, some businesses say that customers have expressed their concerns about sustainability issues and some of them postulate it as one of their main values and goals. That means that in Latvia some producers have to take new demands into account. Also, the regulations are moving activities towards green transformation but if there is a vision of Green Deal, it is not informed to businesses well enough. Even though strategies are mostly done by national level, and other stakeholders are involved, the decisions on what kind of strategies should be done come from the EU level and national level has the task to justify the need for them and give the vision and legitimacy. MoEPRD reports that experts have pointed out that some stakeholders' vision and legitimacy come together with EU support. It is also widely seen that EU support is the main driving force which supports vision and legitimacy.

Päijät-Häme visions are in that way similar to other ones that they mostly come from EU level such as Green Deal initiative, climate and carbon neutrality goals, EU circular economy package and action plan, EU sustainable growth strategy, UN's 2030 sustainable development goals, Farm to fork-strategy and Common agriculture policy, and it is important to remember that they guide all the EU nations and they guide national and regional visions in all regions. In Finland there is also national programs and road maps that support the green deal, and they are done by ministries. The Ministry of Environment has a strategic Program to Promote Circular Economy and it has a target to be carbon neutral by 2025 and zero waste city and curbing over-consumption by 2040. The Government of Finland has a climate target to be carbon neutral by 2035. Finland has an agenda for Sustainable development 2030, which is a guiding vision for regional operation planning. In the smart specialization strategy for Päijät-Häme one of the priorities is Circular economy and regional road maps for Circular Economy and for Climate both include visions that show directions for development actions.

Ostrobothnia has a similar vision to Päijät-Häme and many other regions when talking about visions as such. The EU and other international institutions give guidelines for green development and regions are implementing them. In the Ostrobothnian case there is Finland's vision for carbon neutrality for 2035 but the city of Vaasa has a vision for a carbon neutral city in 202x. For many companies it can be tough to follow national and regional visions and aims, and EU's goals are seen as more realistic. Those tough goals from national and regional level are also seen as an opportunity to develop the business and get ready for upcoming markets.

In Ostrobothnia there is the Carbon Neutral city of Vaasa for 202x and Vaasa has a vision to become a "The energy capital of the Nordics", which relies on key words as energicity, agility. historicity and well-being. It means that the use of fossil-based energy will be stopped and renewable energy will take its place. Also, all pollution will be compensated using carbon capturing mechanisms.

The Västerbotten strategy vision for sustainable development says that Västerbotten should be a Predecessor in transition. It also has a vision to be the world's permanent world exhibition for sustainability. Many of the visions are linked to national and regional strategies that exist for energy and climate. The focus on the vision might change depending on the stakeholder, but mainly all the visions go in the same direction as the national one. Conflicts can be seen in prioritizing the implementation. Also, in Västerbotten it is important to remember that the EU level is controlling the direction of the visions with their legislation and strategies.

When talking about the stakeholders that are giving the vision legitimacy, all the regions mention, that EU and national level decision makers, who have political power and legitimacy. When it comes to national and regional level decision making and vision, more actors are considered and visions are created with help of government, municipalities, companies and also citizens. Those actors are needed to make vision possible, since actors with high legitimacy and power still have limitations to influence the direction of the vision.

3.3 Strategies for transformation

Lithuania mentions few programs and various supportive measures, related and supporting green transformation. First of all is the *Operational program for the EU structural funds investment for Lithuania for 2014-2020*. It brings together several key EU investment funds aimed at helping Lithuania's economic development as well as tackling social exclusion, unemployment and issues as energy security. It reflects the goals of the Europe 2020 strategy with an emphasis on boosting research and innovation, SME competitiveness, shift to a low carbon economy, the promotion of human capital and the fight against poverty. The second program, that is mentioned, is *The Common Agricultural Policy (CAP)*, which supports agriculture and without it each Member State of the European Union would implement their own national policies, and their scope and public intervention across various countries would differ. Common policy for agriculture provides general requirements for sustainable agriculture and helps to find solutions and tools to address challenges related to market instability. It is helping to achieve greater competitiveness of the European agriculture.

The fourth strategy that is mentioned in Lithuania is *The Rural Development Programme (the RDP)*. It is funded under the European Agricultural Fund for Rural Development (EAFRD) and national contributions. The RDP sets out priority approaches and actions to meet the needs of the specific geographical area it covers. Rural development funding is part of a broader framework of European Structural and Investment Funds (ESI funds), including also Regional Development, Social Cohesion and Fisheries Funds. Sustainable growth, sustainable use of energy, preservation of ecosystems and promotion of agro innovations have been significant aspects of the RDP. Current EU strategies (European Green Deal, Circular Economy etc.) are paying more attention to the green transformation towards climate neutral and sustainable society with zero net greenhouse emissions and Lithuanian RDP for 2021-2027 has to meet these standards as well. *European Green Deal* is mentioned as one of the big strategies that almost every other strategy has to follow. The implementation of the EDG has been started in many sectors in Lithuania, from environment, economy, transportation and agriculture to education and many others.

In the Klaipeda region in Lithuania, the strategies and decisions are based on the European level trends and strategic documents. The Development Council of Klaipeda has released a development plan for 2021, which is the regional strategic document that indicates the main challenges and opportunities in sustainability and environment. The strategy includes an action plan to promote bioeconomy in Klaipeda region. The goals of the strategy are related to goals indicated in the European Union's bioeconomy strategy and are based on the European Green Deal. Action plan has three goals: 1. Applying methods of circular economy; applying the methods of circular economy to while developing the bioeconomy in the region. 2. Clusterization in food and agro industry; In order to have a successful model of industrial symbiosis and to promote cross-sectoral collaboration, the creation of clusters related to food, beverage and agro sectors should be facilitated in the Klaipeda region. 3. Initiation of new R&D projects; Support of research, development and entrepreneurship in the area of circular economy especially in the sector of industrial economy.

MoEPRD mentions their own National Energy and Climate plan 2021-2030 in Latvia which at first was a mandatory communication to the EU. It has some problems because it was developed before the European Green Deal came to the agenda and experts have informed their concerns about the softness of the

activities. Also, it's seen that the strategy measures were just mechanically compiled from sectoral ministries and other institutions and there was no intention to understand the long-term impact of the measures. But some positive feedback has also come about the wideness of the strategy. It is critical for this strategy that institutions ensure climate neutrality is understood and accepted by all sides. Measures for the strategy are:

1. Improving the energy efficiency of buildings;
2. Improving energy efficiency and promoting the use of renewable energy source (RES) technologies in heating and cooling and industry;
3. Promoting the use of non-emission technologies in electricity generation;
4. Promotion of economically justified self-production and self-consumption of energy;
5. Improving energy efficiency, promoting the use of alternative fuels and RES technologies in transport;
6. Energy security, reduction of energy dependency, full integration of energy markets and modernization of infrastructure; Improving the efficiency of waste and wastewater management and reducing greenhouse gas (GHG) emissions;
7. Resource efficiency and reduction of GHG emissions in agriculture;
8. Sustainable use of resources and reduction of GHG emissions and increasing CO₂ sequestration in the land use, land use change and forestry sectors;
9. Promoting the reduction of the use of fluorinated greenhouse gases (F-gases);
10. Improving the "greening" of the tax system and its attractiveness for energy efficiency and RES technologies;
11. Public information, education and awareness raising.

Päijät-Häme has mentioned national and regional roadmaps for Circular Economy and Bio-Circular economy as a strategy that compiles measures objectives and is to some extent responsible actors who take things forward. Ostrobothnia however has a climate programme, but no strategy. City climate programme is part of the city strategy and can be considered as a strategy. For both Finnish regions, the National strategy for energy and climate is coming soon, but it is not finalized yet.

Västerbotten has their own Regional development strategy that is setting their own broad vision, they also have many regional subject area strategies such as Regional innovation strategy, S3, climate and energy strategy, forest strategy etc. The EU has introduced a hydrogen strategy with an announced investment of up to 430 billion euros by 2030 to stimulate both production and use of hydrogen. Sweden has signed the hydrogen declaration that Austria presented during its presidency in the EU. Many countries are developing their own strategies for using hydrogen and Sweden will present its own strategy on 31st of July 2021.

All of the regions also mention their Smart Specialization strategies (RIS3) as their implemented strategies for green transformation. RIS3 strategies are also seen as very much related to the Green Deal and green

transformation projects, as can be seen from the intervention areas that regions have selected. When asked about who is involved in the implementation of the strategies, all the regions have similar answers to the question, that all the quadruple helix actors are involved in the process. Public sector, as ministries etc. are mainly seen as main actors in implementing the strategies, but other sectors (municipalities, cities, development organizations, universities etc.) have to be involved too.

3.4 Summary

Three of the intervention areas represent agriculture: in food value chain (grain cluster I Pääjät-Häme and food and beverage industry in Klaipeda) or biogas from agriwaste for energy purpose (Lithuania bio). Three other intervention areas represent industry: metal industry and mechanical engineering in Latgale, energy technology in Ostrobothnia and hydrogen in energy system especially for industry.

Västerbotten and Ostrobothnia emphasized regional strategies and development programs, in other regions national strategies and development programs including regional innovation strategies.

Table 3.1. comparison of intervention areas, visions to greentransformation and strategies

Region	Intervention areas	Vision to GT	Main strategies for GT
Lithuania Bio-sector	Circular bioeconomy (biogas production from agro wastes). Circular bioeconomy centers on the already implemented spatial practices in Lithuania in the field of energy production from manure and other agricultural wastes. Development of biogas production from agro wastes has been identified as one of the priorities in Lithuania's Smart Specialization Strategy.	Sustainable Development strategy has set the initial vision for Lithuania and driving it towards Green Transformation, which at that time was driven by climate change and sustainability ideas, principles, and implementation measures. Sustainable Development strategy has been continuously fulfilled with other strategies, programs and implementation plans, supporting measures and relevant documents.	<ul style="list-style-type: none"> -Operational Programme for the EU structural funds investment for Lithuania for 2014-2020 -The Common Agricultural Policy (CAP) -The Rural Development Programme -European Green Deal - Roadmap for Lithuania's Industrial Transition to a Circular Economy - RIS3 strategy for Lithuania 2014-2020
Klaipeda (LIC)	Food and Beverage industry transition to Circular Economy. The main drivers that influence the transition to the circular economy methods in manufacturing industry are global economic challenges related to growing population, waste management and climate changes. Circular economy has potential to solve these problems	Klaipeda wants to focus on sustainable environment as primary direction thus circular transition of the food and beverage could help to achieve green transition goals by development of new business process management models focused on the creation of added value in production, by integration of biofinery technologies, prioritizing sustainable	<ul style="list-style-type: none"> -EU Green Deal -EU CE Action Plan -EU Industrial strategy -EU Strategy from Farm to Fork -EU's biodiversity strategy for 2030 -Regional development plan for 2021-2030 -RIS3

	especially in the growing urban areas.	biomass and implementing cooperation models	
MoEPDR	Smart materials and smart technologies and engineering systems. MoEPRD will focus on the manufacturing sector in Latgale Region since it's considered as less developed region in Latgale. Mechanical engineering and metal industry is with high energy consumption and with low added value	Vision comes from more global international level; international agencies and institutions and they point out that countries need to strive for climate neutrality. Innovations are essential for climate development. Vision and goals are also national level, because EGD comes with funds that everyone want to use and it commits actors for Green Deal.	-National Energy and Climate Plan -RIS3
Päijät-Häme	Food and Beverage industry in relation to the green transition. Perspectives are bio-circular economy and side stream innovations, sustainable and clean food industry. Transformative capacity of the intervention can be seen as significant.	EU visions such as EU Green Deal. Also many national programs and road maps to promote circular economy, carbon neutrality 2025, and zero waste city and curbing over consumption by 2040. Finland's 2030 Agenda for Sustainable Development were also recognized as a guiding vision and it is cross cutting principle in Regional Operation Plan 2018 – 2021.	-National and Regional roadmaps for Circular Economy and Bio-Circular Economy -Regional Programme -Smart Specialization strategy
Ostrobothnia	Circular economy and green energy technologies. Ostrobothnia has the largest energy technology cluster in the Nordic countries, so it is relevant region concerning GT. Circular economy is also relevant for GT and in the region, there is a lot of interesting developments concerning circular economy.	To be able to grow, sustainable growth is seen as the main vision for progress in the area. Finland has its own carbon neutrality vision for the year 2035 and Vaasa its own for the year 202x. National and regional visions and aims are widely followed in the region. Stakeholders see tight national schedules as possibility to develop themselves for future markets.	-Vaasa has a climate programme, but no strategy -Finland is preparing strategy for energy and climate. -RIS3
Västerbotten	Sustainable energy with focus on hydrogen. The hydrogens ability to store energy gives it a special role in the system for the future and it can be used in a various area due its flexibility. Integration of hydrogen must take place in the place where there are economic and technical conditions for it. Sweden is distinguished here by its current electricity system with a high proportion of	Regional development strategy vision says that Västerbotten should be a predecessor in transition. Västerbotten has the vision to be world's permanent exhibition for sustainability. Many of the actor's visions are linked to the national and regional strategies that exist for energy and climate.	-Regional Development Strategy -Regional innovation strategy -RIS3 -Climate and energy strategy -Forest strategy -Working on Strategy for hydrogen.

	renewable energy sources in the energy system, a well-functioning electricity market and unique storage resources in the form of hydropower.		
--	--	--	--

4 Stakeholders – Comparative analysis across 6 partners

In this section we look at the 6 cases and identify the types of stakeholders and how they are positioned based on the regions as well as helices. The stakeholder typology has been done by regional partners, who have used local experts to evaluate stakeholders, which are relevant concerning the intervention area and its future GT transition.

4.1 Stakeholders by helices

We begin by inspecting on what types of stakeholders there are in different helices. From the Figure 4.1 one can see that dependent, as well as dominant stakeholders were most typical among all cases. Universities were often dependent towards GT, whereas companies were quite evenly shared between dependent and dominant actors. Definite stakeholders were most often public organisations, which would indicate that they are in a key role in GT.

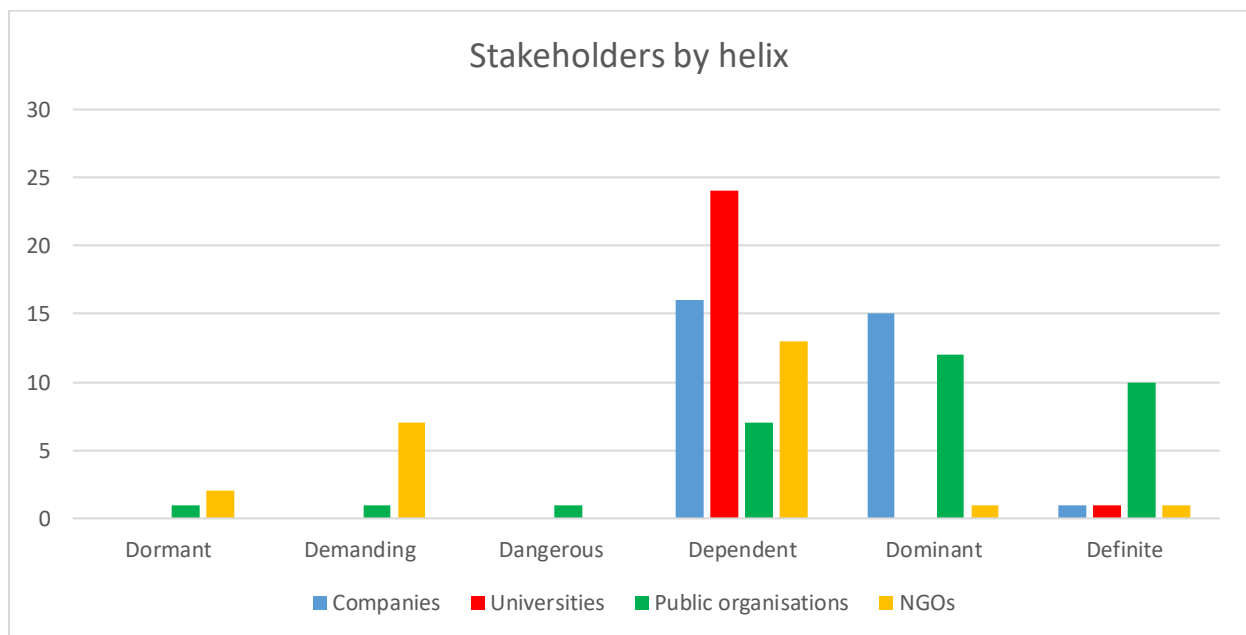


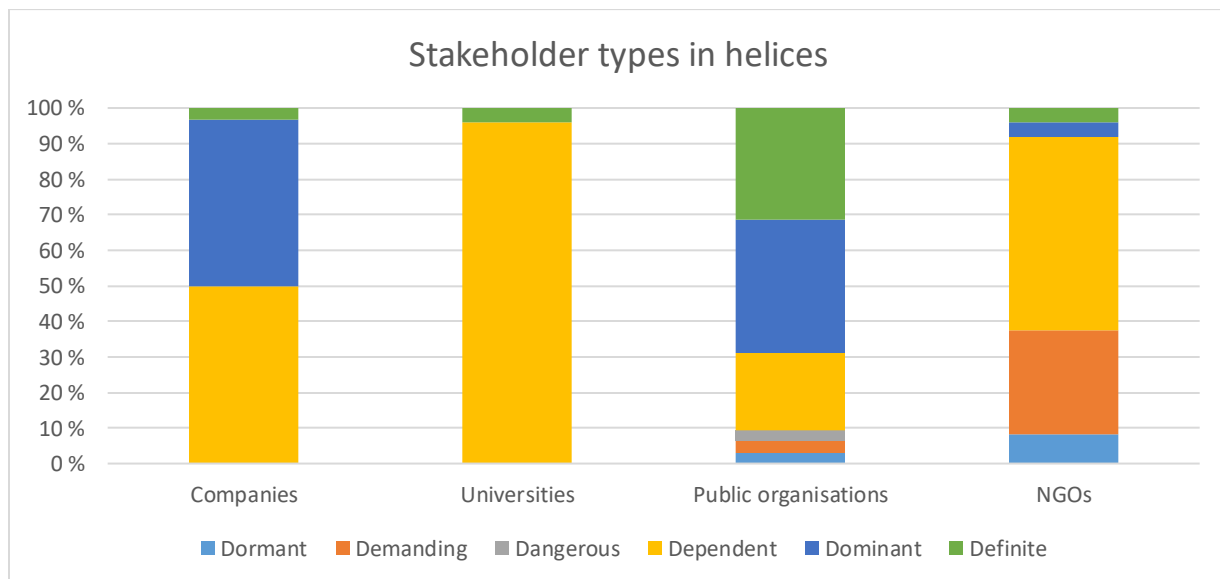
Figure 4.1. Number of stakeholders by helix.

When one inspects the total amount of stakeholders per helix (see Table 4.1) it is notable that the number of dependent stakeholders is over twice as big as that of dominant stakeholders. There is also very little dormant, demanding or dangerous stakeholders and this is most likely due to the reason that focus was on green energy and circular economy stakeholders, who are generally very positive towards GT and see economic value in it.

Table 4.1 Number of stakeholders per helix

Stakeholders per helix	Dormant	Demanding	Dangerous	Dependent	Dominant	Definite
Companies	0	0	0	16	15	1
Universities	0	0	0	24	0	1
Public organisations	1	1	1	7	12	10
NGOs	2	7	0	13	1	1
Total	3	8	1	60	28	13

When inspecting the share of stakeholder types per helix (see Figure 4.2), it is notable that universities seem to have most dependent stakeholders. Companies are almost an equal share of dependent and dominant stakeholders, but have a little of definite stakeholders as well. Public organisations have most of definite stakeholders, but also include other types of stakeholders as well, with a large amount of dominant stakeholders. NGOs have mostly dependent and demanding stakeholders, which may be due to having less resources than the other helices.

**Figure 4.2.** Share of stakeholder types per helix.

In total, dependent and dominant stakeholders formed a majority of all stakeholders. Interestingly, after these stakeholder types there already is definite stakeholders and in total there were 13 definite

stakeholders, of which 10 are public organisations. This can be seen as an indicator regarding the active role of public organisations in GT.

4.2 Stakeholders by regions

When inspecting the stakeholders per regions, it is interesting, that there seems to be almost identical pattern on the number of dependent, dominant and definitive stakeholders (see Figure 4.3). Indeed, dependent stakeholders are clearly most common in every region, and the number of the dominant stakeholders is the second largest in other regions except Biogas-sector in Lithuania, in which the number of definite stakeholders is second largest. In other regions, roughly one tenth of stakeholders are definite. In Biogas-sector in Lithuania, number of dominant and demanding stakeholders is the same, so it follows somewhat different pattern. Päijät-Häme has most dominant stakeholders. In Päijät-Häme and Västerbotten, there is no demanding stakeholders. Ostrobothnia is only region to have all types of stakeholders and has a notable number of definite stakeholders, although Biogas-sector from Lithuania has relative more of them.

It should be noted that these stakeholders are not necessarily located at the region itself. For example many definite stakeholders were mentioned to be national ministries and EU organisations. The stakeholder types do however show what types of stakeholders are relevant for the regions on their chosen intervention areas.

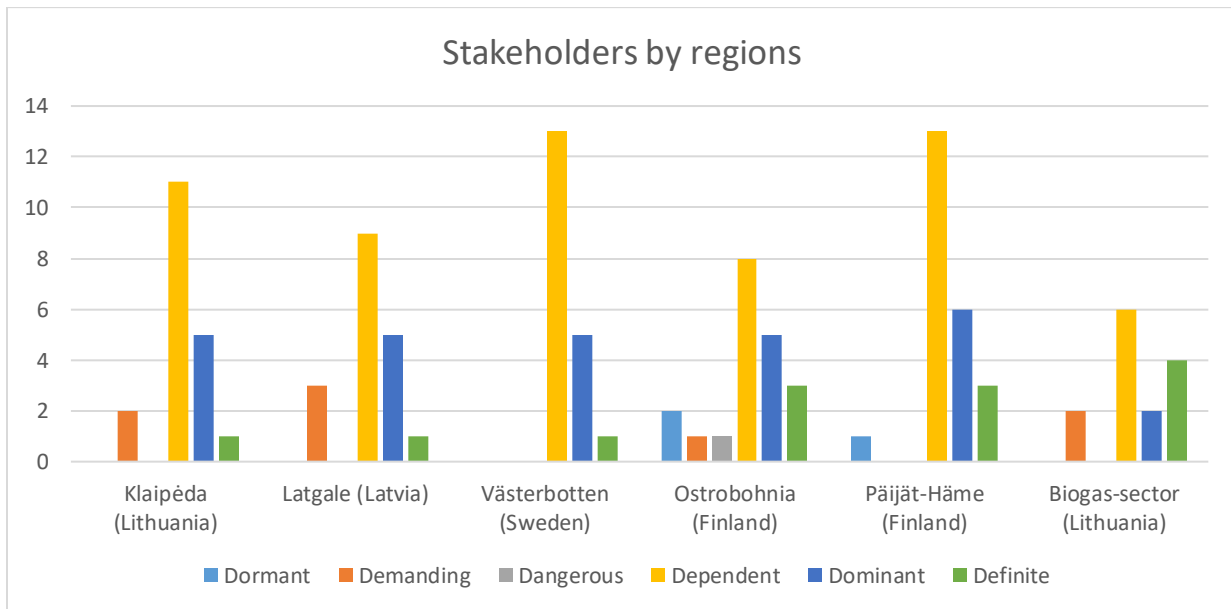


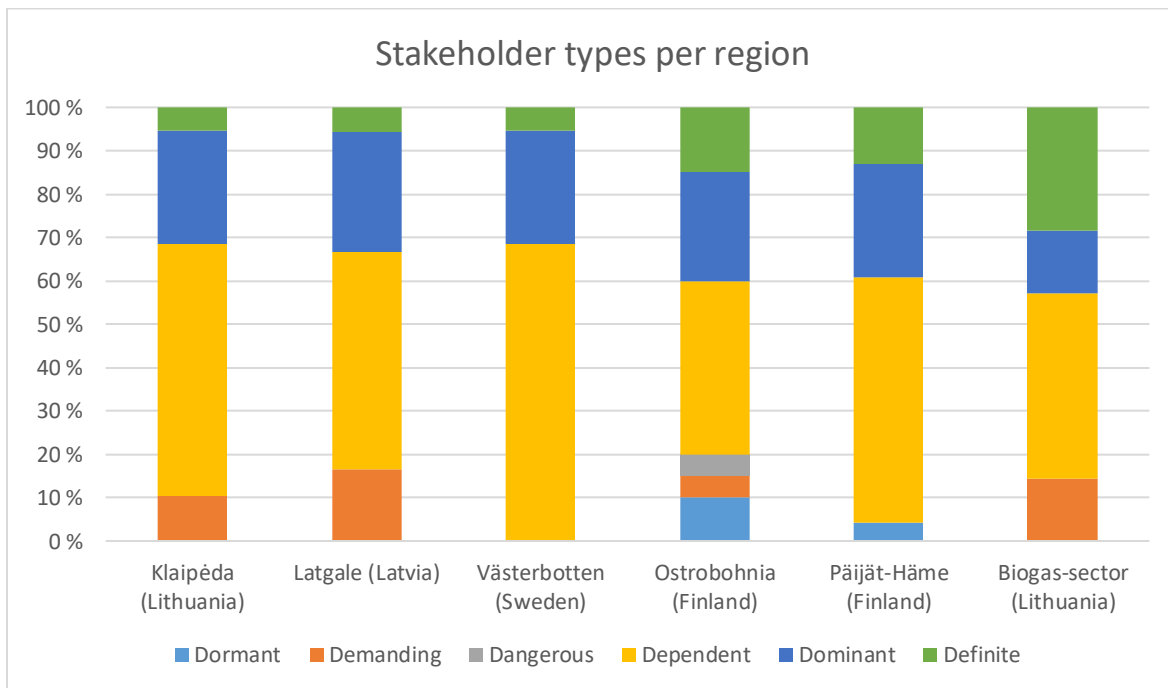
Figure 4.3. Number of stakeholders by regions

In Table 4.2 we can see how many stakeholders' individual regions have identified. Most of the regions have identified roughly 20 important stakeholders, but Biogas-sector in Lithuania had 14 stakeholders.

Table 4.2. Number of stakeholders per region.

Regions	Dormant	Demanding	Dangerous	Dependent	Dominant	Definite	Total
Klaipėda (Lithuania)	0	2	0	11	5	1	19
Latgale (Latvia)	0	3	0	9	5	1	18
Västerbotten (Sweden)	0	0	0	13	5	1	19
Ostrobohnia (Finland)	2	1	1	8	5	3	20
Päijät-Häme (Finland)	1	0	0	13	6	3	23
Biogas-sector (Lithuania)	0	2	0	6	2	4	14

When inspecting the shares of stakeholders per region, one can see that the previous statement concerning the ratio between dependant, dominant and definitive stakeholders seems to be similar in all cases, except on Biogas-sector in Lithuania (Figure 4.4). All other regions have mostly dependent and dominant stakeholders and small amount of definite and other stakeholders. We can also see the almost 50-50 ratio between dependent and dominant stakeholders in Päijät-Häme.

**Figure 4.4.** Share of stakeholder types per regions.

Based on the stakeholder analysis it seems to be that all regions did involve all four helices and public organisations seem to have most of definite stakeholders regarding GT. However, a majority of all stakeholders are dependent and the second common are the dominant stakeholders. Therefore, there is a need

to look for pathways for these types of stakeholders especially. Out of all helices, universities and NGOs are most often dependent, but there are also some companies (SMEs) which are looking for leadership in order to act upon GT. However, there are also dominant companies and public organisations especially, who themselves are active towards GT and the pathways for dominant stakeholders are important to consider regarding these helices.

The number of dangerous stakeholders was small, which is partly due to the reason that focus is on industries directed to GT, but this fact should still be considered. This might also indicate that the same categorisation can also be used on a little less positively linked intervention areas or industries in the future.

4.3 Stakeholder's urgency, legitimacy and power

4.3.1 Companies

Inspection of Figures 4.5-4.7 indicates that changes to urgency, legitimacy and power will happen fast. Interestingly there are also regions, where urgency has diminished, like Klaipėda region in Lithuania. In Ostrobothnia region from Finland urgency is already high. In general it seems that urgency rises first and legitimacy follows. Changes in power are not that radical, even if they do rise up to some extent. Development of in Latgale region in Latvia is especially noticeable, as well as development of Västerbotten in Sweden. This would indicate that the companies are willing to invest in GT.

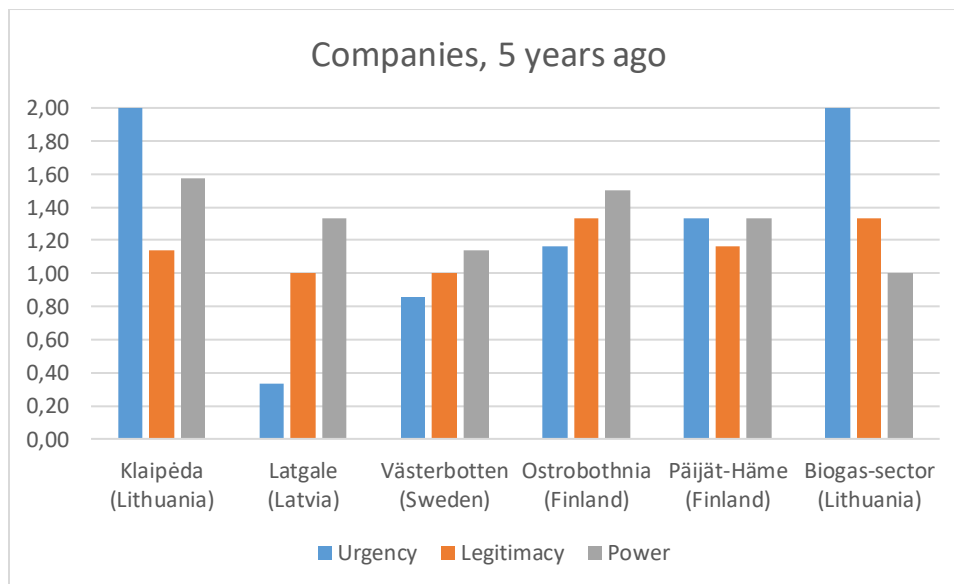


Figure 4.5. Companies' urgency, legitimacy and power 5 years ago across regions

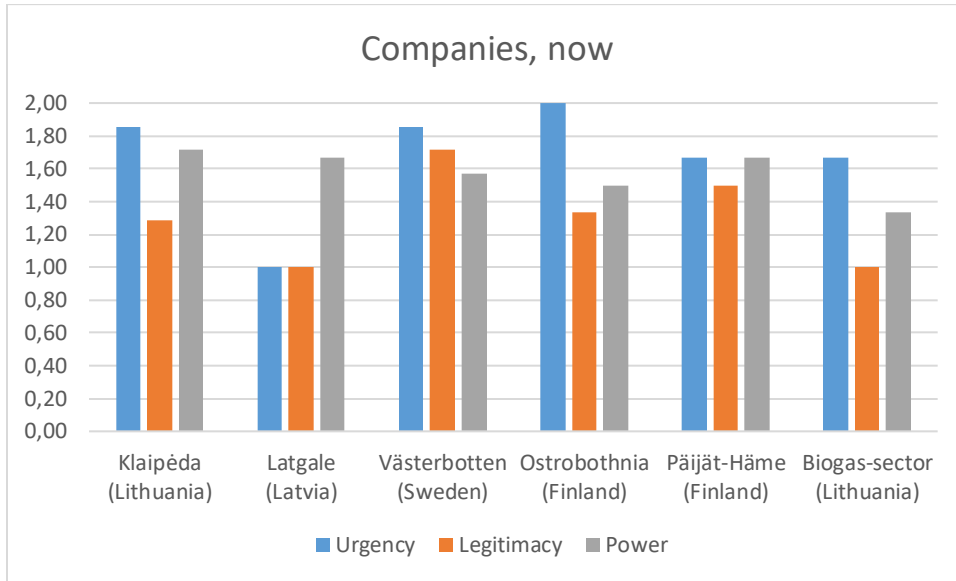


Figure 4.6. Companies urgency, legitimacy and power now

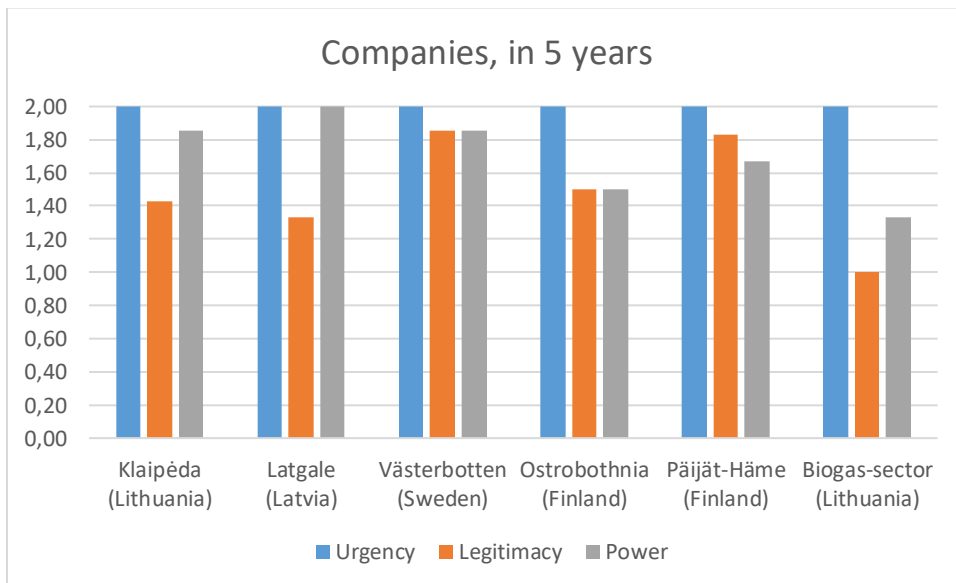


Figure 4.7. Companies urgency, legitimacy and power in 5 years

4.3.2 Universities

Urgency, legitimacy and power for universities shows quite similar as companies (see Figures 4.8-4.10). There has been rapid development on all regions within the last 5 years. Latgale region from Latvia also shows rapid growth and Klaipėda region in Lithuania shows slight decrease on urgency through the time periods. Lithuanian biogas sector's universities are all expected to reach definite stakeholder status in the next 5 years.

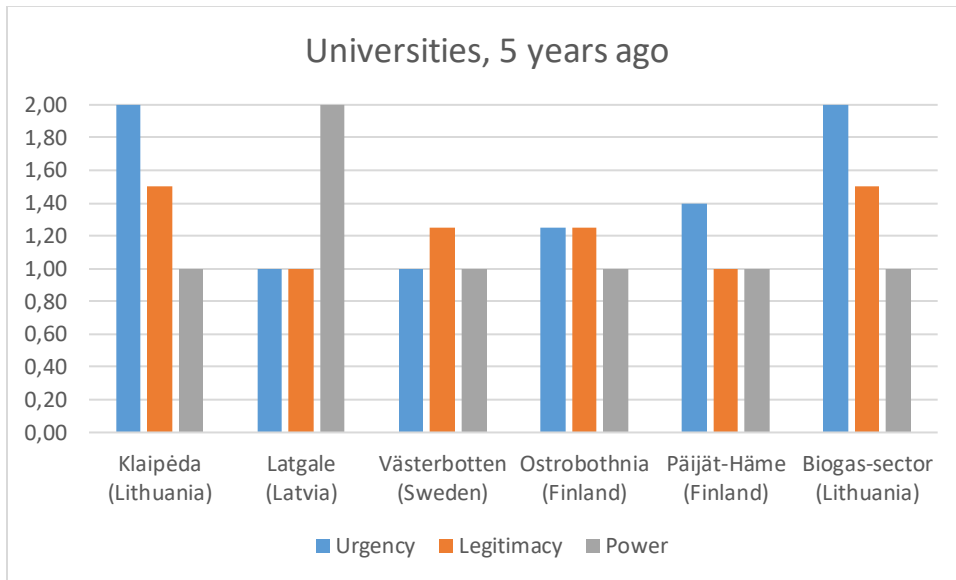


Figure 4.8. Universities urgency, legitimacy and power 5 years ago

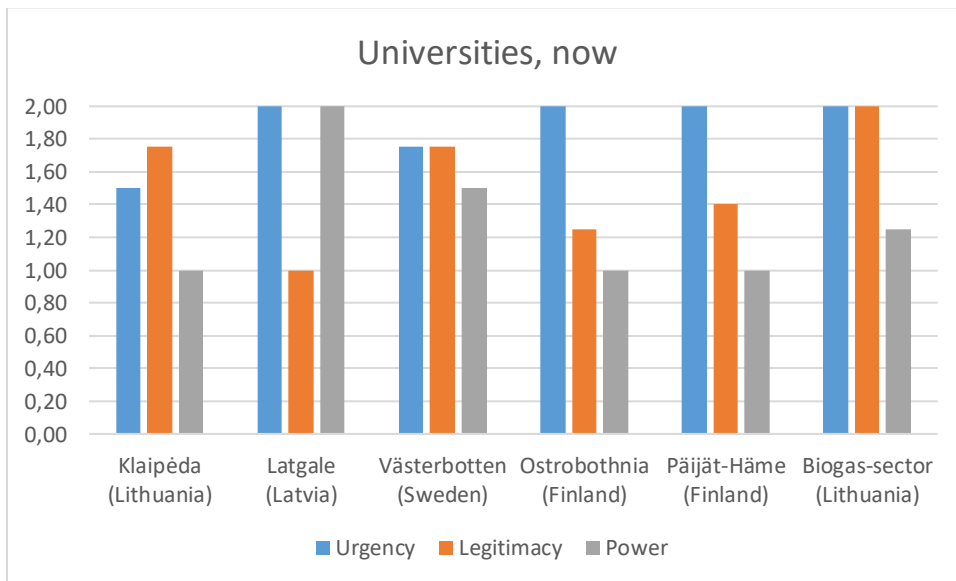


Figure 4.9. Universities urgency, legitimacy and power now

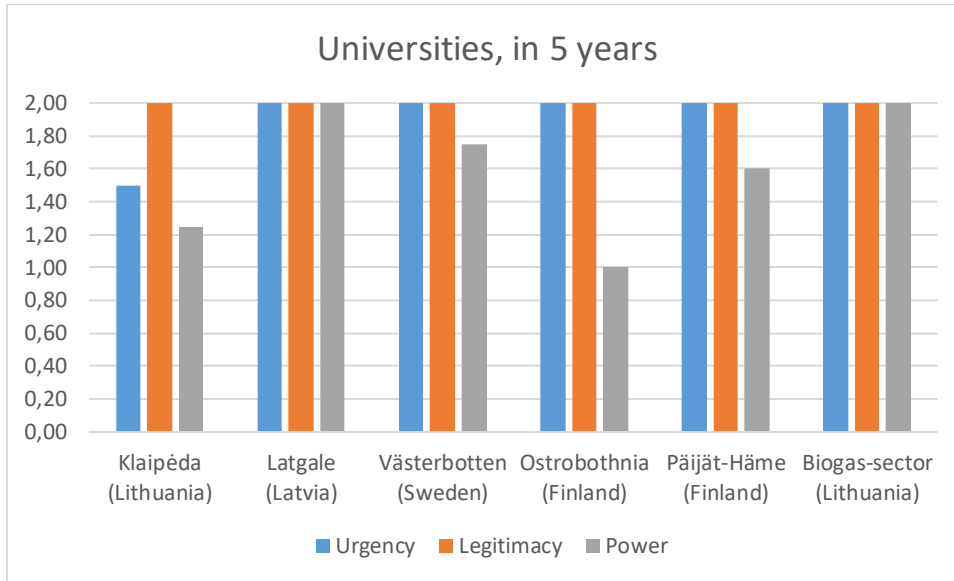


Figure 4.10. Universities urgency, legitimacy and power in 5 years

4.3.3 Public organisations

Public organisations already show definite stakeholder elements now (See Figures 4.11-4.13). Overall the development of public organisations has been fast and they also have managed and will manage to add legitimacy and power in the future. Latgale shows fast growth, whereas Västerbotten and Biogas sector from Lithuania expect all of their public organisations to become definite stakeholders in the future.

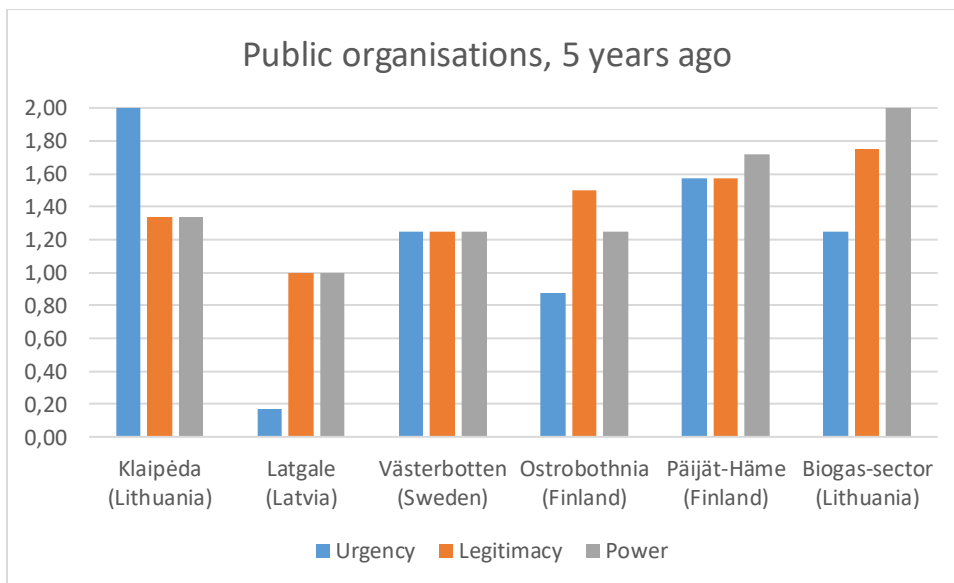


Figure 4.11. Public organisations urgency, legitimacy and power 5 years ago

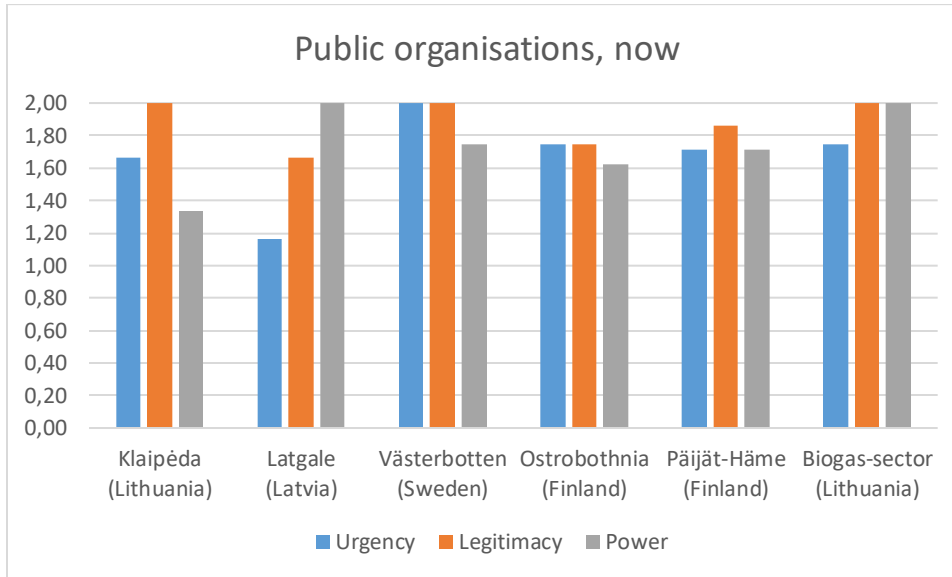


Figure 4.12. Public organisations urgency, legitimacy and power now

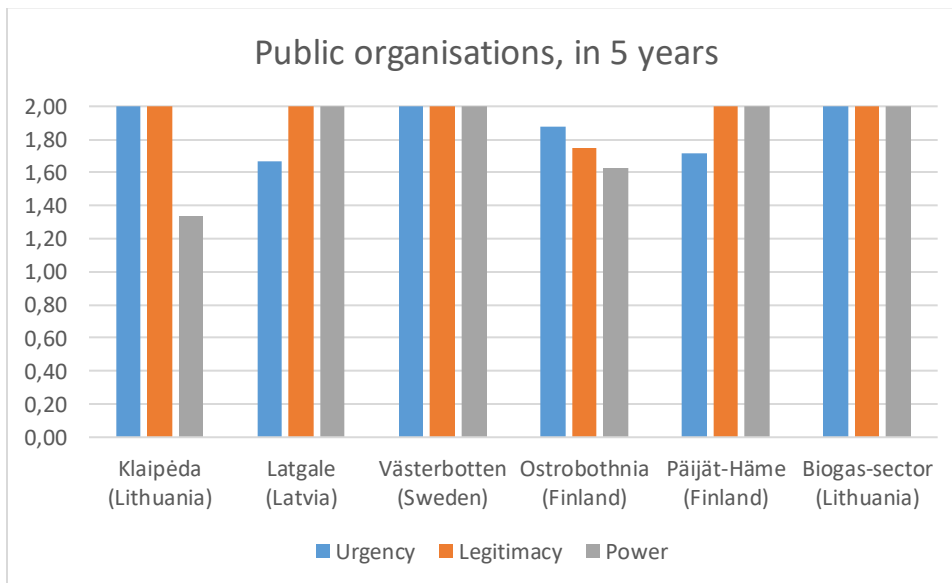


Figure 4.13. Public organisations urgency, legitimacy and power in 5 years

4.3.4 NGOs

NGOs have quite high urgency, but they lack with legitimacy and especially power (see Figure 4. 14-4.16). NGOs had quite high urgency in Klaipeda, Västerbotten and Ostrobothnia 5 years ago, but lacked power. In Ostrobothnia, NGOs still have low power now, and in 5 years, whereas in Klaipeda and Västerbotten NGOs have gained more power. In Latgale, the NGOs had low urgency 5 years ago, which has now grown,

and in future also their legitimacy and power will grow. In Päijät-Häme, urgency and power of NGOs are growing more than their legitimacy. Compared to other cases, the NGOs in Lithuania-biogas had relatively high power 5 years ago, but average now and in 5 years. Västerbotten and Lithuanian biogas-sector seem to reach almost definite stakeholder level in 5 years, lacking only some power.

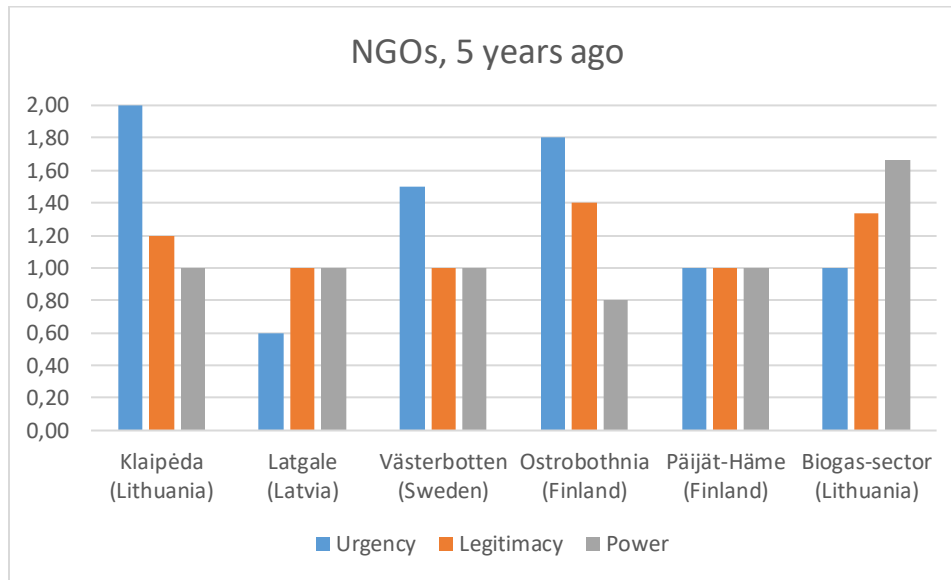


Figure 4.14. NGOs urgency, legitimacy and power 5 years ago

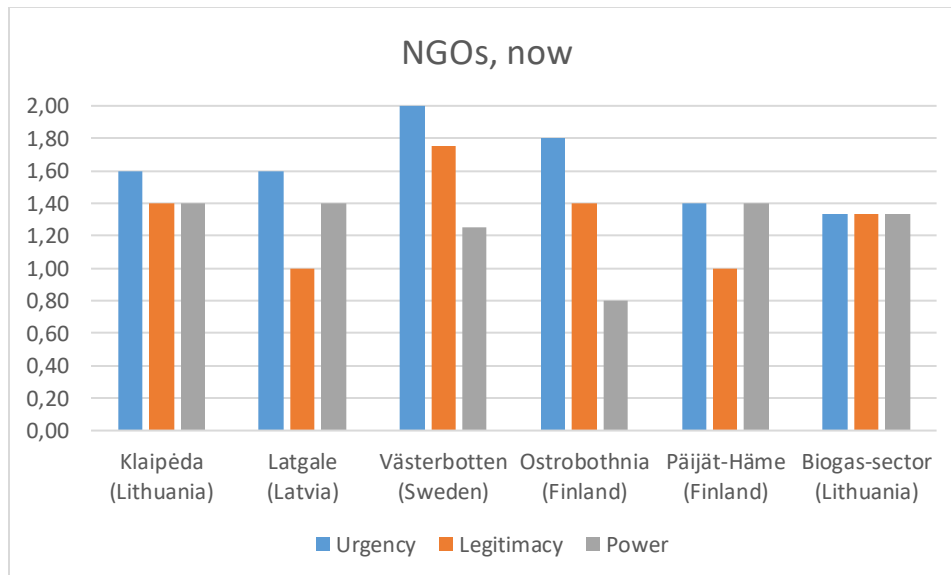


Figure 4.15. NGOs urgency, legitimacy and power now

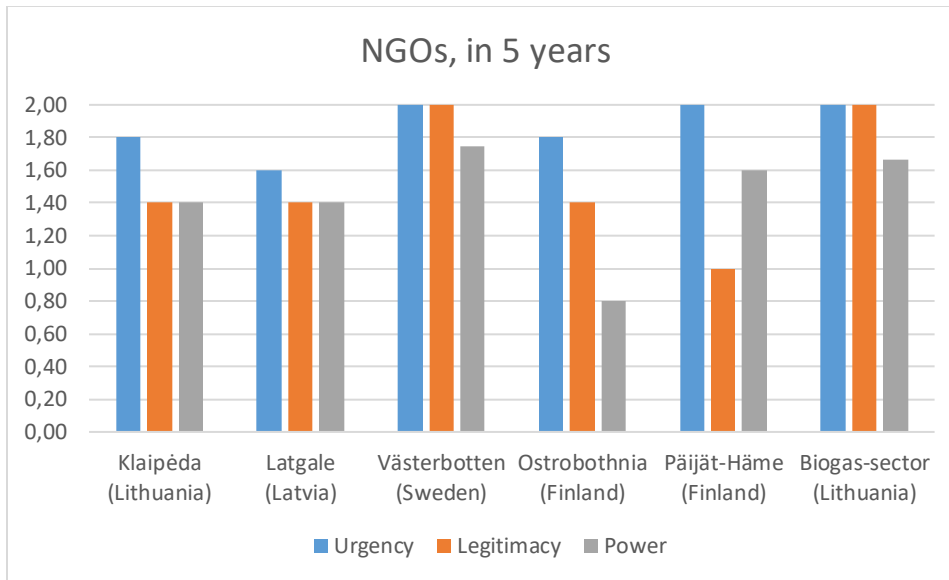


Figure 4.16. NGOs urgency, legitimacy and power in 5 years

4.4 Stakeholder interaction on niche, regime and landscape-level

4.4.1 Companies

If one inspects the interaction of companies (see Figures 4.17-4.19) it seems evident that niche level is most popular forum for their interaction. Interactions are growing in almost all cases, but in Lithuanian biogas sector on landscape level there has been a slight nod in influence. Ostrobothnia and Klaipėda companies are the strongest on niche level, Västerbotten and Päijät-Häme from Finland are the strongest in regime level and Västerbotten will also become strong in landscape level.

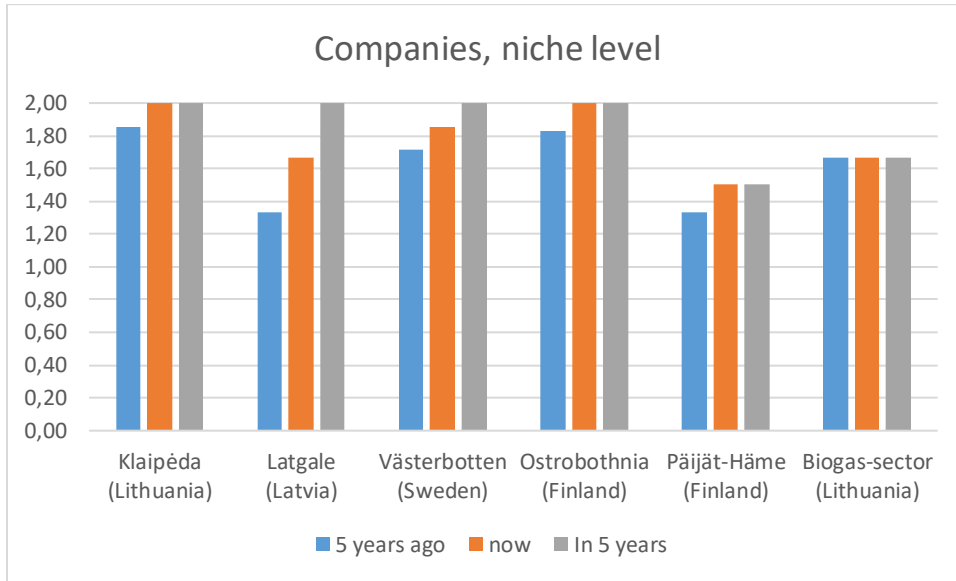


Figure 4.17. Company interaction on niche level

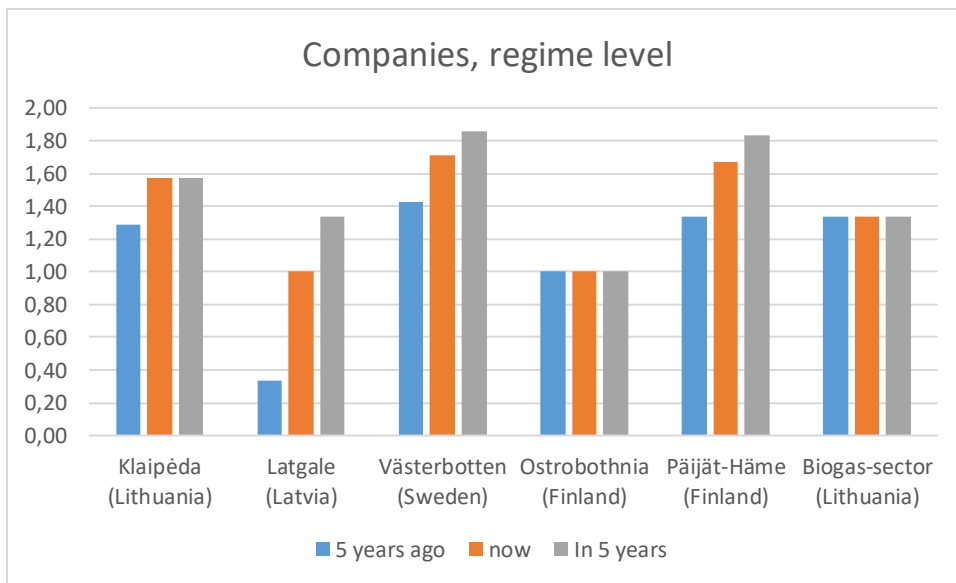


Figure 4.18. Company interaction on regime level

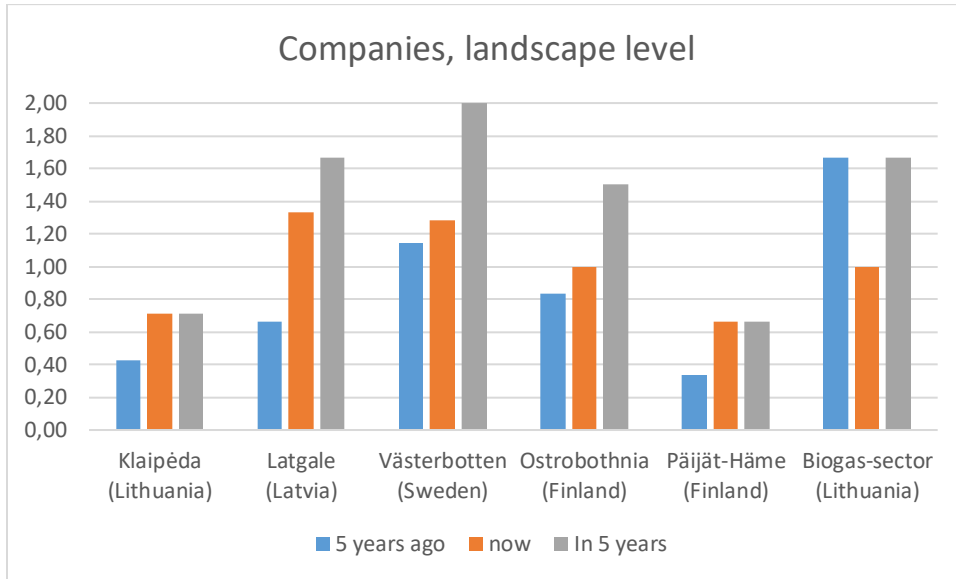


Figure 4.19. Company interaction on landscape level

4.4.2 Universities

Ostrobothnia has strongest universities in niche level, Lithuanian biogas-sector on regime level and Latgale region on landscape level (see Figures 4.20-4.22). Ostrobothnian and Lithuanian biogas sector universities are also expected to become influential in the future. Klaipėda region seems to lack landscape level interaction with universities altogether, which seems odd. There are also many instances where interaction remains the same, so there is no improvement in 5 years.

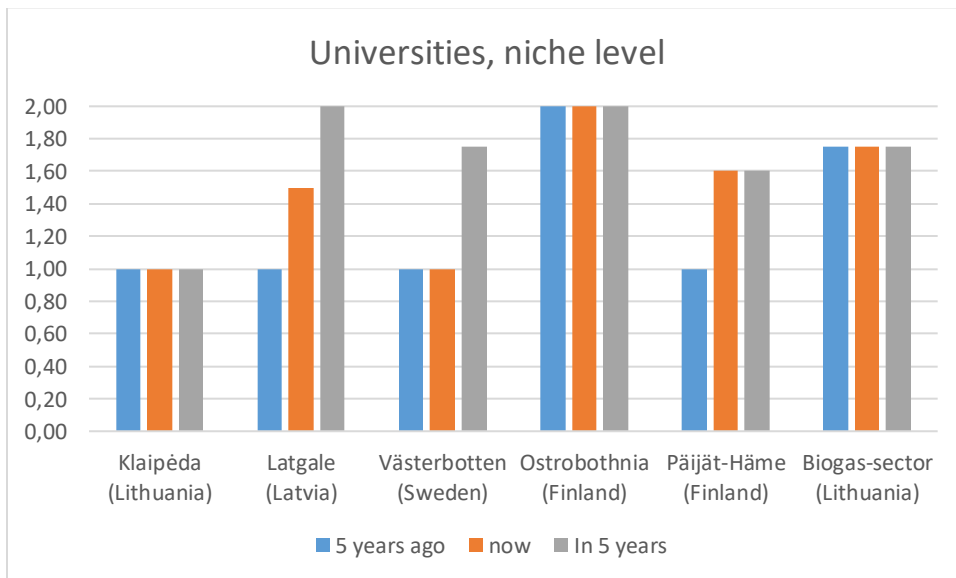


Figure 4.20. University interaction on niche level

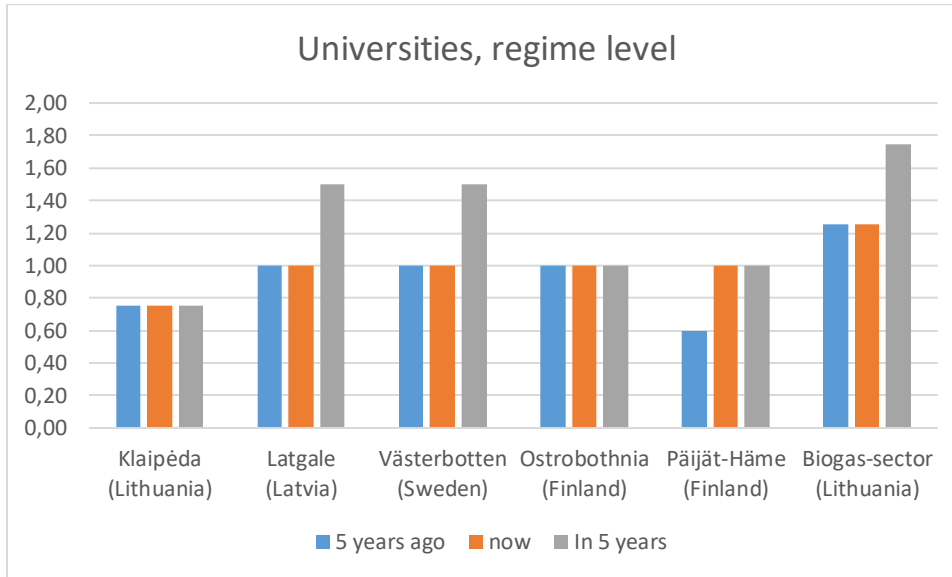


Figure 4.21. University interaction on regime level

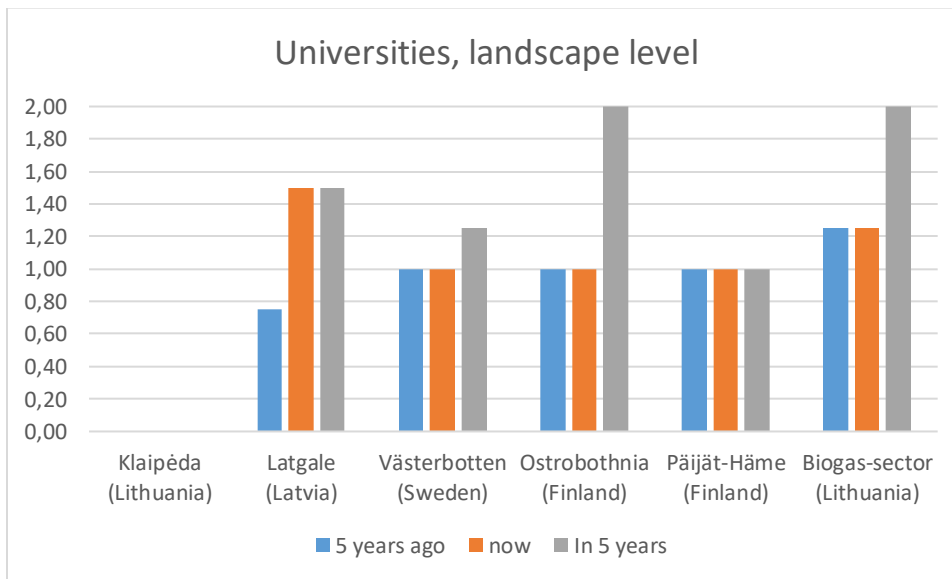


Figure 4.22. University interaction on landscape level

4.4.3 Public organisations

Public organisations seem to be strongest on regime level regarding their influence, which is understandable, as most of the officials and partners represent these regional administrative units (see Figures 4.23-4.25). However, public organisations seem to be also active on niche level and Klaipėda region and Västerbotten are already strong in this field. Västerbotten and Päijät-Häme are the strongest on regime level regarding public organisations and Biogas-sector will also develop in the future. Landscape level shows

only some development, Biogas -sector and Latgale seem to be growing, whereas other regions remain the same. One reason for this might be the official roles of public organisations, as this may indicate that things will go as they have been for the past 5 years and there are no major changes on sight.

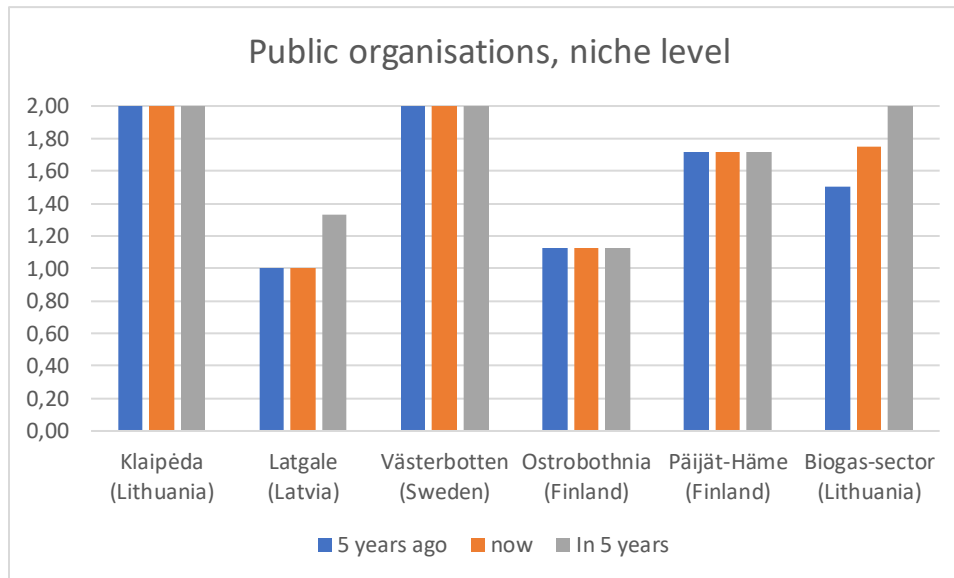


Figure 4.23. Public organisation interaction on niche level

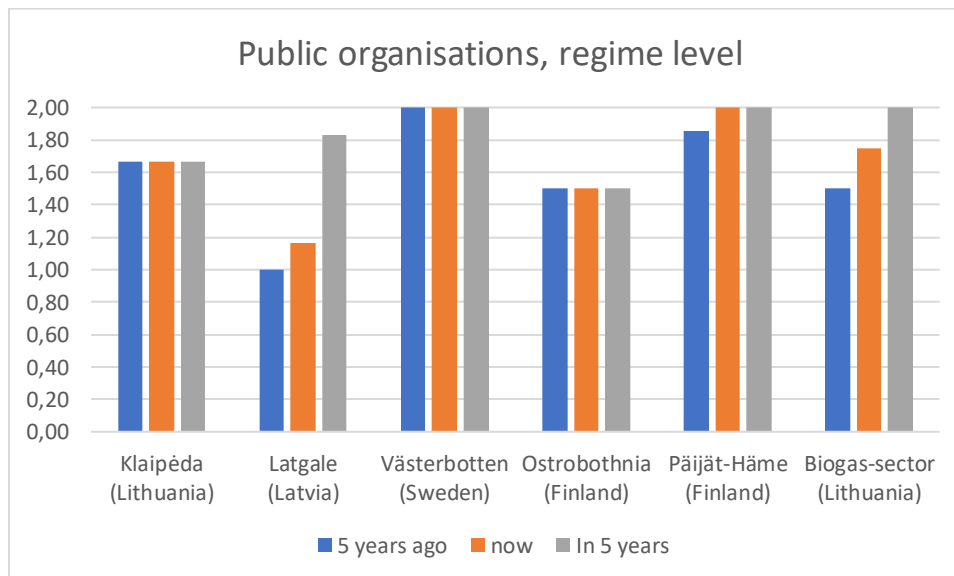


Figure 4.24. Public organisation interaction on regime level

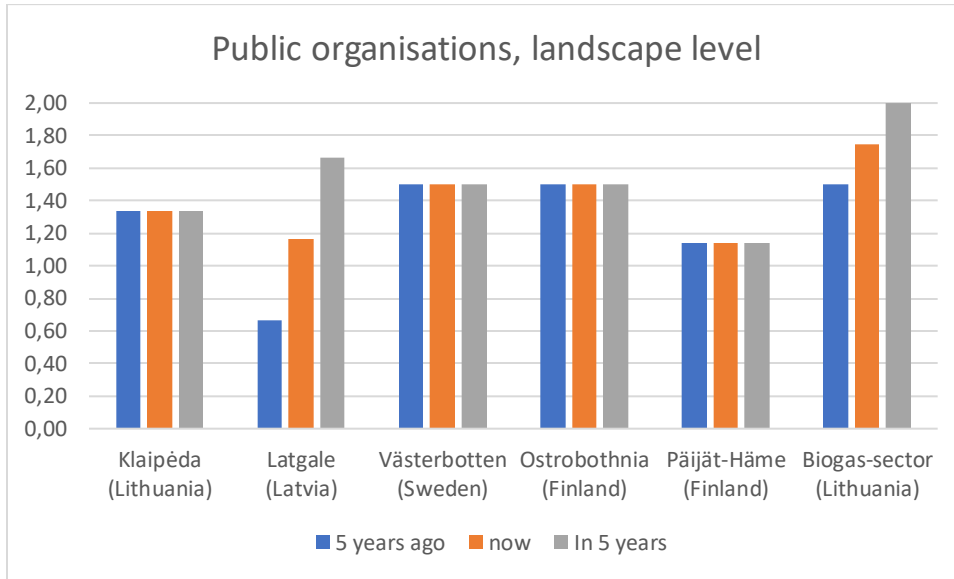


Figure 4.25. Public organisation interaction on landscape level

4.4.4 NGOs

Inspection of NGOs shows how they are mostly operating on local level (Figures 4.26-4.28). NGOs have most of their interactions at niche level, where Västerbotten, Päijät-Häme and Lithuanian biogas-sector are strong. On regime level there are only few changes, most notably in Västerbotten. Landscape level on the other hand is not very strong level for NGOs in general and Ostrobothnian NGOs have no interaction at that level. Västerbotten is the only region to show growth on landscape level.

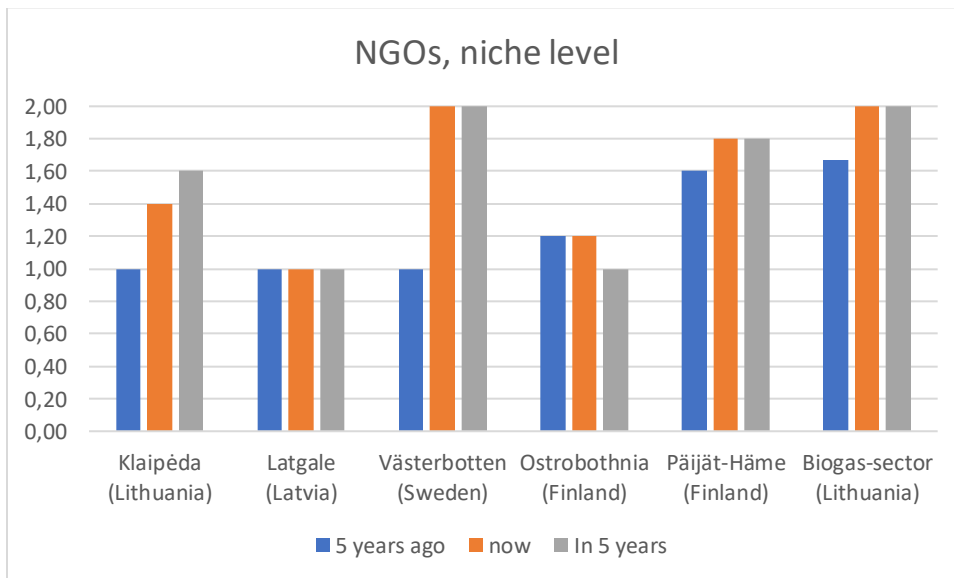


Figure 4.26. NGO interaction on niche level

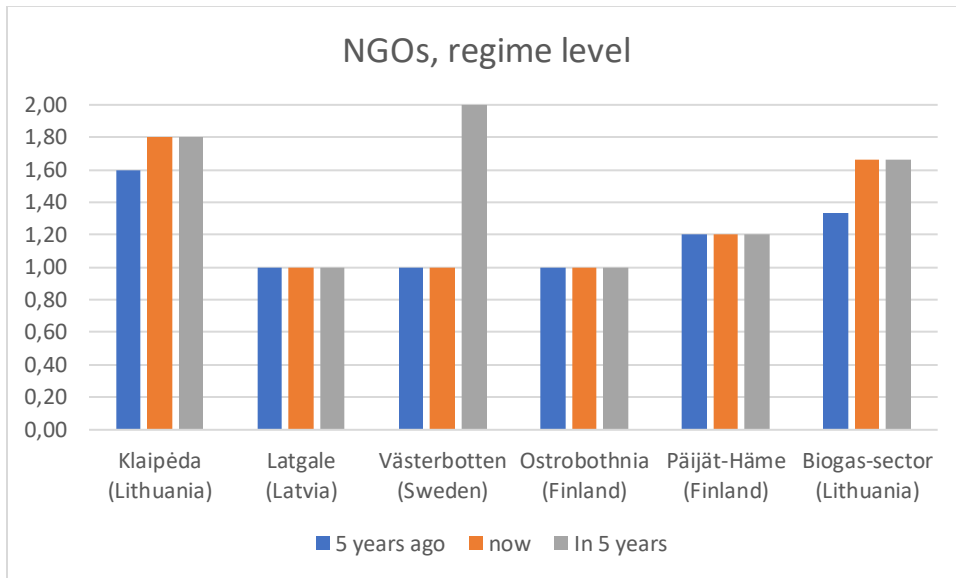


Figure 4.27. NGO interaction on regime level

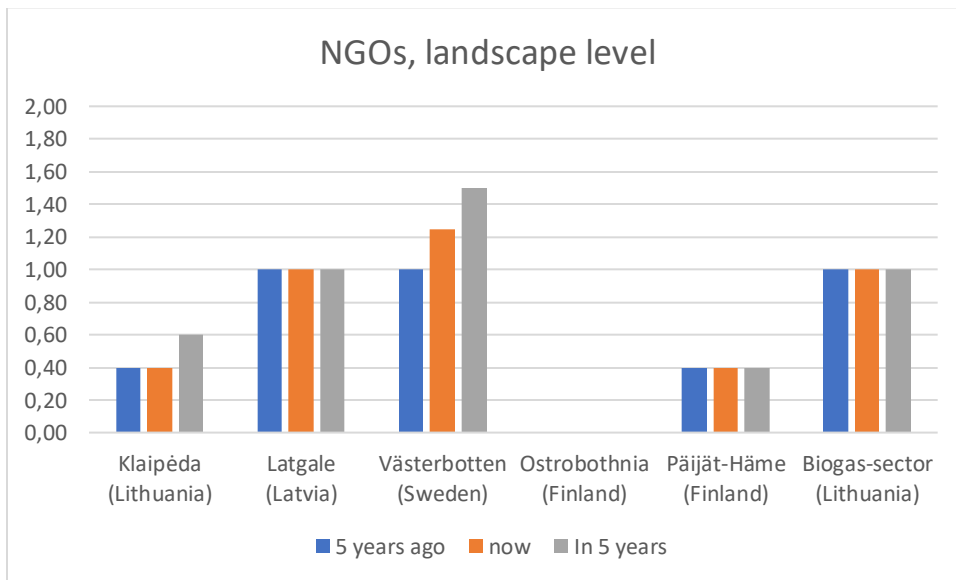


Figure 4.28. NGO interaction on landscape level

4.5 Stakeholder analysis - towards green transformation

As described in section 2, stakeholder analysis is based on the urgency, legitimacy, and power of each stakeholder. We have added these three figures together in order to form stakeholder analysis, which

shows the progress of individual stakeholders and can be combined to look at different helices and their progress towards GT.

Tables 4.3.-4.6 have gradually changing colours, where red indicates low value and green high value. The greener the colour, the better the situation. Yellow is used with numbers of 4 as this may indicate the presence of dangerous stakeholders, which have power and urgency of 2. Even though these sorts of actors were not identified in the stakeholder lists done by the regions, it was considered useful to look at this value separately as part of the analysis as well. Green on the other hand was used only on values of 5 or more as this means that there is some legitimacy, urgency and power on the stakeholders. Green figures basically mean that the helices are aware of the situation and are willing and capable to act in GT.

As can be seen on Table 4.3 companies are going to increase their power legitimacy and urgency and show activity towards GT. Biggest changes are happening in Latgale region in Latvia, as there the stakeholders have currently quite low urgency, legitimacy and power, but this is going to change in 5 years. Västerbotten has had similar development in the past, but is currently already on a green level. Biogas sector in Lithuania is also notable; companies have lower values now than they previously had, but there will be an increase. This was due to some actions taken, which did diminish the interest of companies to participate on biogas production. The situation is, however getting better with all regions regarding their companies. It was also mentioned by some interviews that markets are now expecting green solutions, so companies have had to react to this, alongside new legislation. It is notable that almost half of all stakeholders in companies were dominant and half dependant, which might indicate that dominant actors (and better economic resources) may help in transition towards sustainable solutions.

Table 4.3. Stakeholder analysis of companies towards green transformation

Companies	STK analysis per helix		
	5 years ago	now	In 5 years
Klaipėda (Lithuania)	4,7	4,9	5,0
Latgale (Latvia)	2,7	3,7	5,3
Västerbotten (Sweden)	3,0	5,1	5,7
Ostrobothnia (Finland)	4,0	4,8	5,0
Päijät-Häme (Finland)	3,8	4,8	5,5
Biogas-sector (Lithuania)	4,3	4,0	4,3
Total	3,8	4,6	5,1

When we look at universities (Table 4.4.), we can see a little different picture. First of all, Västerbotten from Sweden does not have very high figures regarding universities, nor much development. Their intervention area, focusing on hydrogen, is still at its infancy and there may be lack of experts regarding the field. It is also interesting to see two of the highest values in the table (all universities have urgency, legitimacy and power of 2) meaning that Latgale in Latvia and biogas-sector in Lithuania have universities which all will become definite stakeholders in the future. In other regions there will be development, but it will not be as fast it is with companies. One reason for this may be the fact that most of the universities

were considered to be dependable stakeholders, so they are looking for national and EU level before they start their actions are more reacting to GT than actively seeking for it.

Table 4.4. Stakeholder analysis of universities

Universities	STK analysis per helix		
	5 years ago	now	In 5 years
Klaipėda (Lithuania)	4,5	4,3	4,8
Latgale (Latvia)	4,0	5,0	6,0
Västerbotten (Sweden)	2,1	2,2	2,2
Ostrobothnia (Finland)	3,5	4,3	5,0
Päijät-Häme (Finland)	3,4	4,4	5,6
Biogas-sector (Lithuania)	4,5	5,3	6,0
Total	3,7	4,3	4,9

Public organisations on the other hand, seem to go green in a very fast pace. If one inspects table 4.5, it shows how regardless of the former development, 5 years ago, everyone is almost green already and reaching the highest values fast. It is also notable, that Latgale region in Latvia and Biogas-sector in Lithuania are once again reaching the highest score of 6 in just 5 years. Latgale's development is also impressive, if one looks at how low the value was 5 years ago. It is also interesting, that most of the definite stakeholders were mentioned to be at the public organisations, which indicates that the number of definite stakeholders would indeed correlate with higher scores in the analysis. Out of all helices, public organisations seem to be most eager to act towards GT. This is also understandable, as public organisations are the only ones, which have to implement European Green Deal and environmental issues are also a rising trend in politics.

Table 4.5. Stakeholder analysis of public organisations

Public organisations	STK analysis per helix		
	5 years ago	now	In 5 years
Klaipėda (Lithuania)	4,7	5,0	5,3
Latgale (Latvia)	2,2	4,8	5,7
Västerbotten (Sweden)	3,8	5,8	6,0
Ostrobothnia (Finland)	3,6	5,1	5,3
Päijät-Häme (Finland)	4,9	5,3	5,7
Biogas-sector (Lithuania)	5,0	5,8	6,0
Total	4,0	5,3	5,7

With NGOs, the situation is not as radical nor as fast as with public organisations (see table 4.6), which may be due to the fact that NGOs contained a lot of dependant and also some demanding stakeholders. Development within NGOs is not very fast, with the exception of Västerbotten in Sweden and with Biogas-

sector in Lithuania. In some regions, like in Ostrobothnia, NGOs are not very powerful and this may be one reason for this missing progress.

Table 4.6. Stakeholder analysis of NGOs

NGOs	STK analysis per helix		
	5 years ago	now	In 5 years
Klaipėda (Lithuania)	4,6	4,4	4,6
Latgale (Latvia)	2,6	4,0	4,4
Västerbotten (Sweden)	3,5	5,0	5,8
Ostrobothnia (Finland)	4,0	4,0	4,0
Päijät-Häme (Finland)	3,0	3,8	4,6
Biogas-sector (Lithuania)	4,0	4,0	5,7
Total	3,6	4,2	4,9

Stakeholder analysis seems to verify that the chosen stakeholder types and their typology by using urgency, legitimacy and power is shown in the tables as well. Public organisations (definite stakeholders) seem to react faster, companies second fast, universities then, and NGOs slowest. Dominant stakeholders seem to be able to follow GT faster than dependent stakeholders and demanding stakeholders have less options to do this. It is also interesting that Latgale region in Latvia is very rapidly changing in almost all helices. Lithuanian biogas-sector is also following similar process. In general, all regions are developing, and their helices are looking at GT as an opportunity because of this.

After inspecting the stakeholders, we can proceed to look more of the GT process. There we combine inspection of helices and regions and also look at the different levels, where they operate, in order to get a better understanding of what the situation regarding GT is.

4.6 Conclusions on stakeholders

Different types of stakeholders seem to work in a quite similar fashion, as public organisations were most often legitimate actors, among which there are many definite stakeholders. Companies are either

dominant or dependent stakeholders and act accordingly, in some regions more actively and in some more on their own. Universities are most often dependant and are following the lead from public organisations and companies. NGOs are the weakest actors and operate most often on a local level.

What can be drawn from this analysis is that public organisations are clearly in an active role if one hopes to enhance GT on a regime level, as they are most fluent operators on that level. They also have legitimacy, which is missing by many companies. This means that public organisations are most likely sought after by companies in the future. Analysis also shows positive development across cases. It could be stated that the analysis of stakeholders seems to work across several cases and intervention areas and offers interesting data to look at the region's situation towards GT. The presented analysis and methods could therefore be suggested for future users as well.

5 Comparison between green energy and circular economy fields

The focus on GRETA project is on two fields, green energy and circular economy. The case study regions have therefore identified their intervention areas based on these broader industries. Despite having a focus on one area, the partner reports (see section 2 regarding the template) of case study regions indicated actions regarding both fields in some cases and therefore we have used the cases to look at both green energy and circular economy, in order to see how they operate across the helices, levels of interaction and their focus on sustainability.

Please note that we have used anonymous evaluations of regional stakeholders, which means that we have used all the stakeholders in the analysis and were not able to evaluate whether individual stakeholders are more in the field of green energy or circular economy. Therefore table 5.1. is based on the partner reports and their interpretation, not on exact knowledge of all the stakeholders and their role in GT.

Table 5.1. Regions, intervention areas and use in industrial analysis

Region	Intervention area	Green energy	Circular economy
Klaipėda (Lithuania)	Food industry		x
Latgale (Latvia)	Metal manufacturing	x	x
Västerbotten (Sweden)	Hydrogen	x	x
Ostrobothnia (Finland)	Energy technology and circular economy	x	x
Päijät-Häme (Finland)	Grain cluster		x
Biogas-sector (Lithuania)	Biogas	x	x
Industrial analysis		4 cases	6 cases

5.1 Stakeholder comparison

When inspecting the number of stakeholders per helix, it seems that there are no major differences between the cases (see Figures 5.1 and 5.2.). Most of the stakeholders are dependent and most of the dependent stakeholders are universities. Companies are mostly dependent or dominant and definite stakeholders are public organisations for the most part.

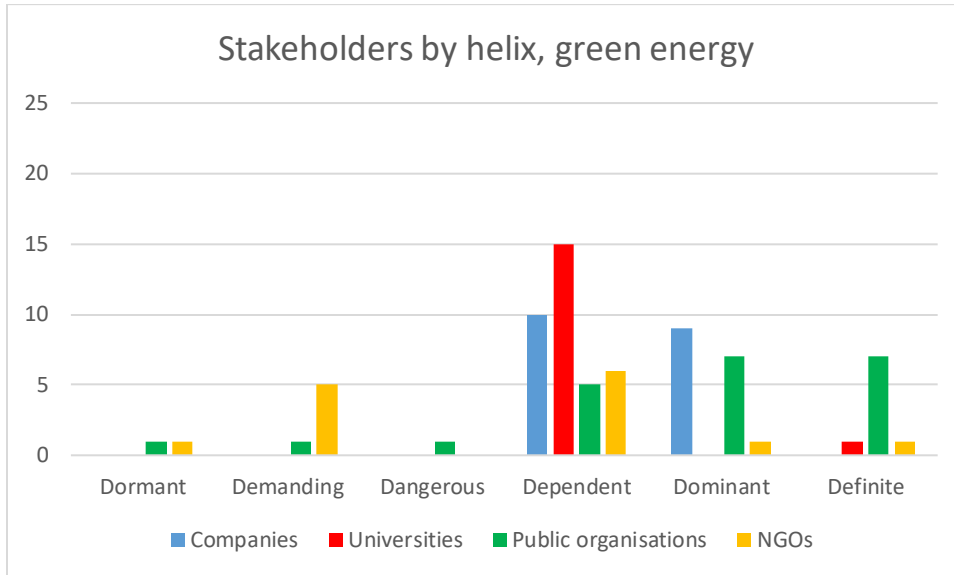


Figure 5.1. Number of stakeholders per helix on green energy field

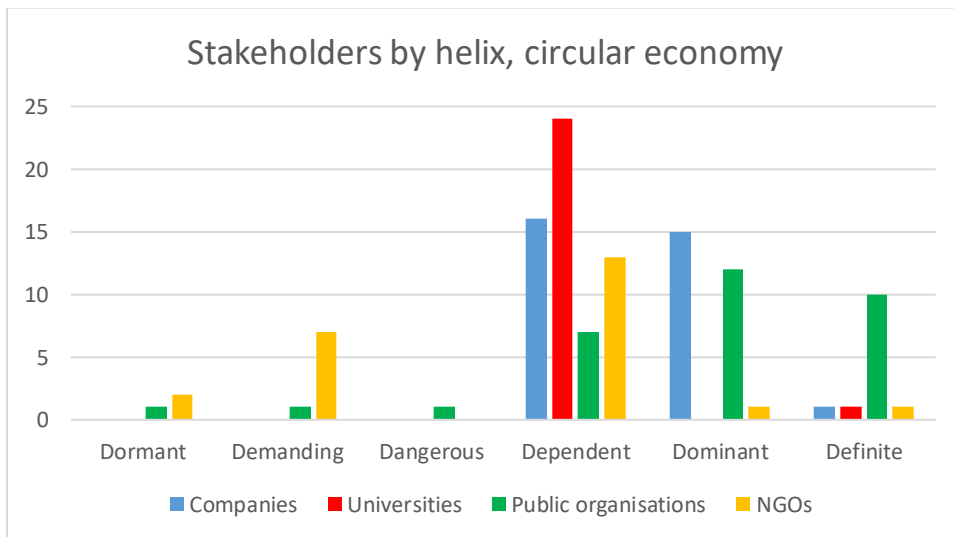


Figure 5.2. Number of stakeholders per helix on circular economy

When looking at the shares of stakeholders per helix (Figures 5.3 and 5.4), there is also very little differences, but it is interesting to notice that circular economy seems to have definite stakeholders on all helices. Public organisations of course are often definite stakeholders, but there seems to be a little more even spread of these actors on the field. There is also a slightly larger share of definite and dominant actors on the circular economy field, which indicates that it may be in a slightly better position for GT than green energy field.

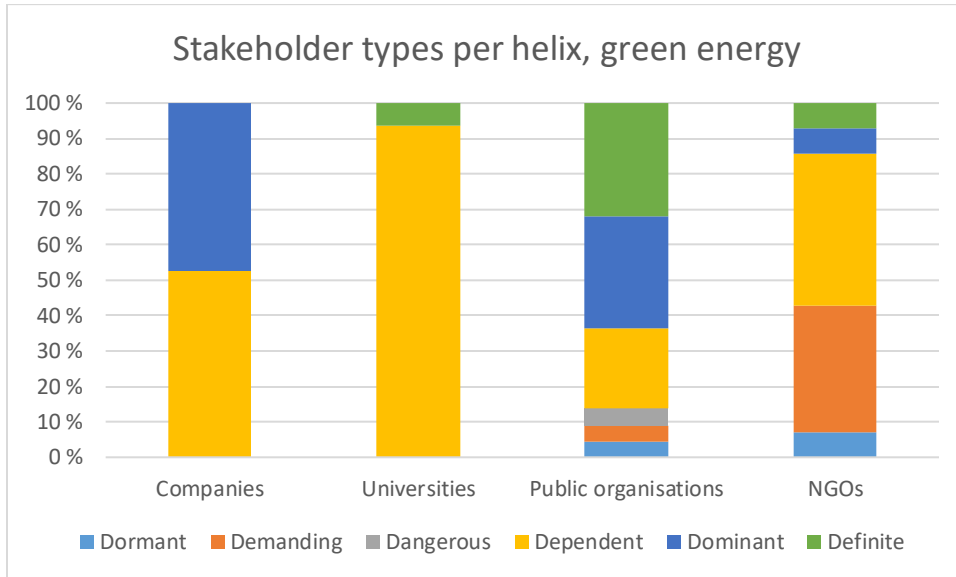


Figure 5.3. Share of stakeholder types per helix on green energy field

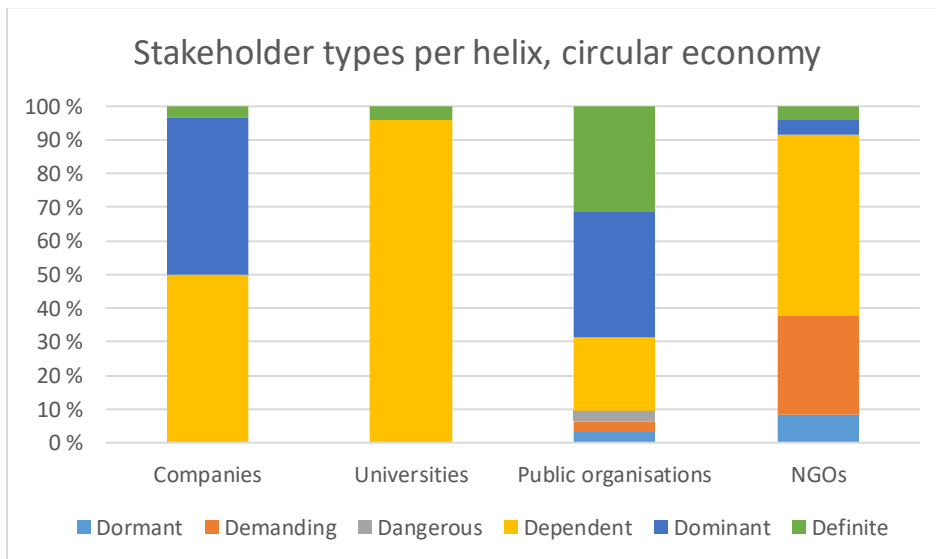


Figure 5.4. Share of stakeholder types per helix on circular economy

5.2 Urgency, legitimacy and power

5.2.1 Green energy

If one inspects the development of green energy regarding the urgency, legitimacy, and power, it seems that universities and public organisations are developing faster towards definite stakeholders and the companies seem to follow this pattern (See Figures 5.5-5.7). NGOs also show quite profound growth. Companies and universities seem to develop the most urgency.

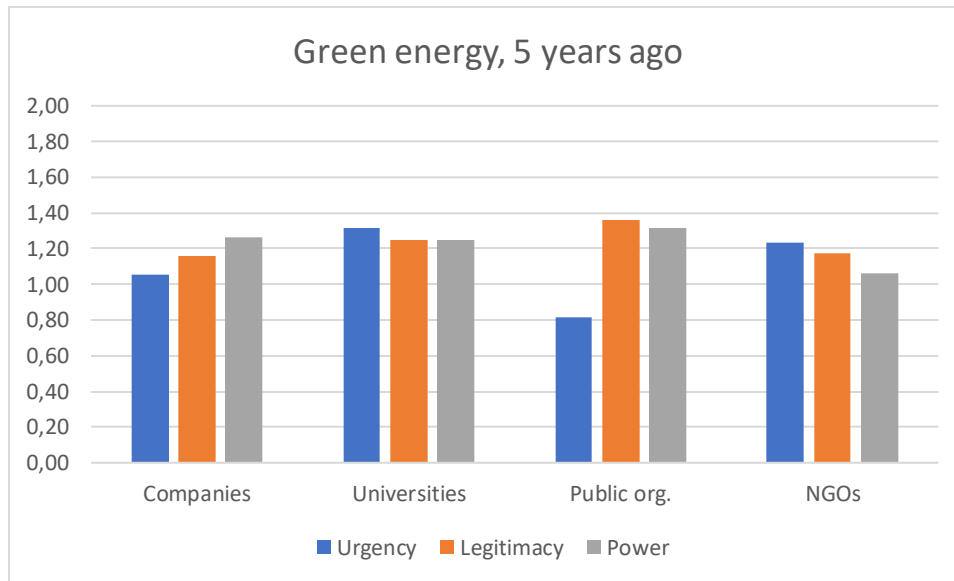


Figure 5.5. Urgency, legitimacy and power of helices in green energy, 5 years ago

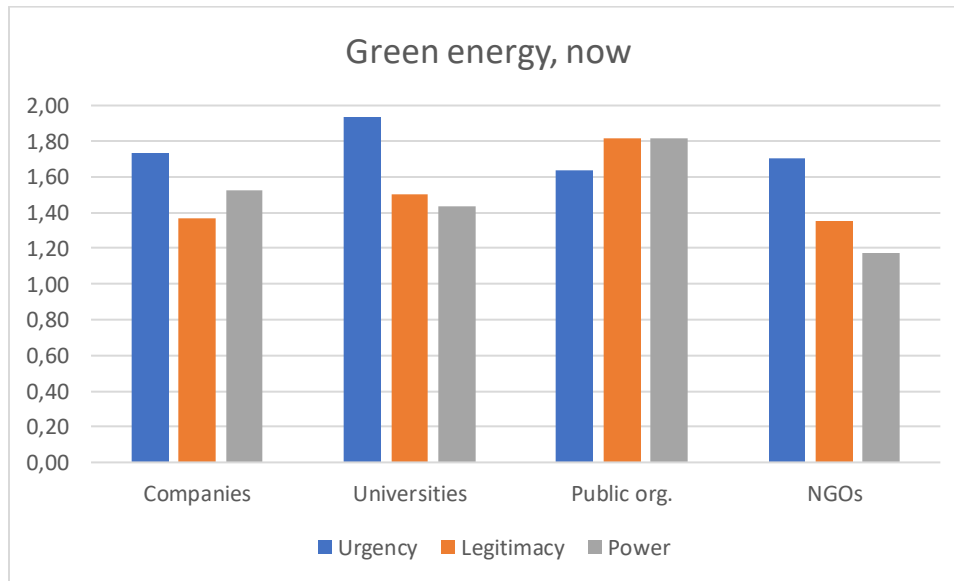


Figure 5.6. Urgency, legitimacy and power of helices in green energy, now

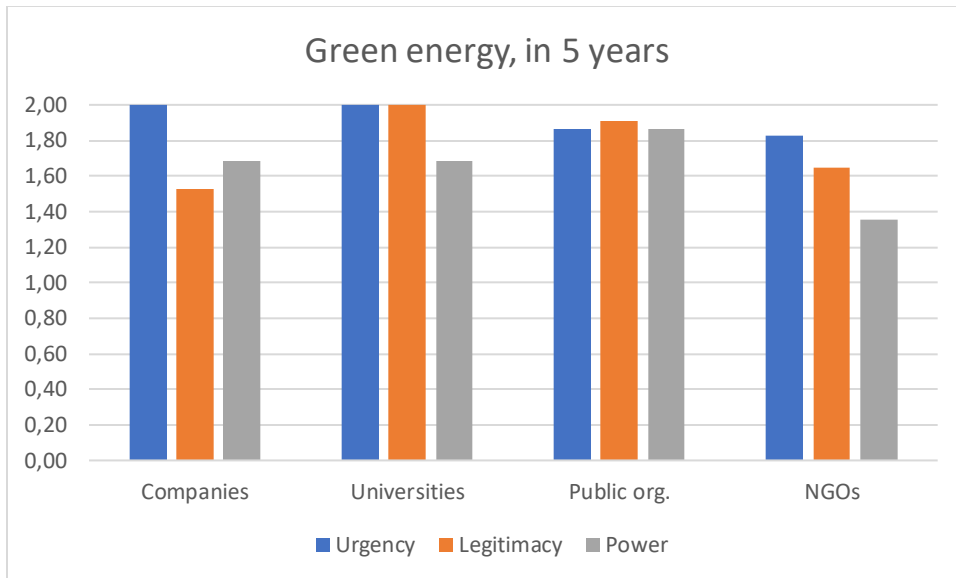


Figure 5.7. Urgency, legitimacy and power of helices in green energy, in 5 years

5.2.2 Circular economy

With circular economy the picture looks roughly similar (see Figures 5.8-5.10) but is more evenly spread across helices. Interestingly, companies also seem to reach high scores for urgency, even before other helices. Legitimacy is growing fastest on universities.

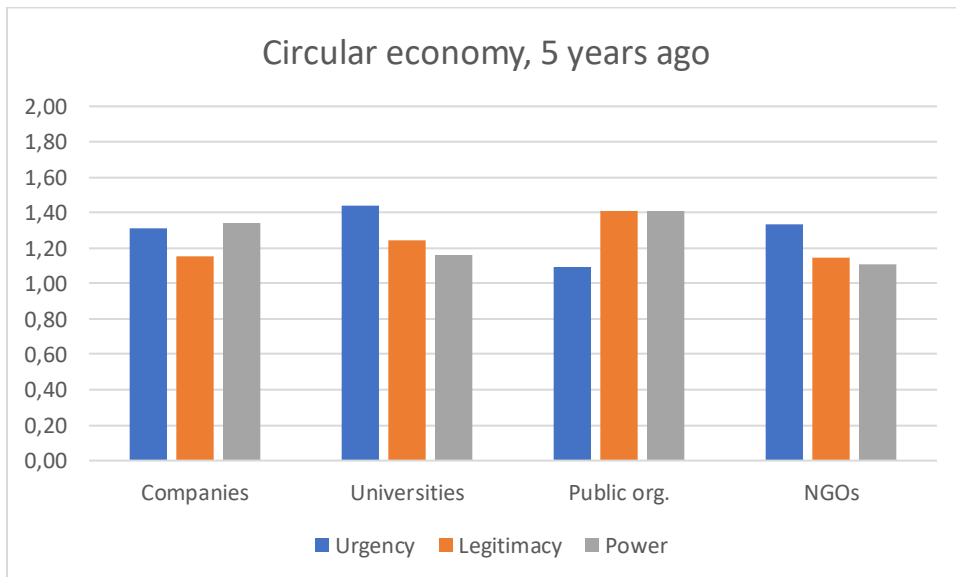


Figure 5.8. Urgency, legitimacy and power of helices in circular economy, 5 years ago

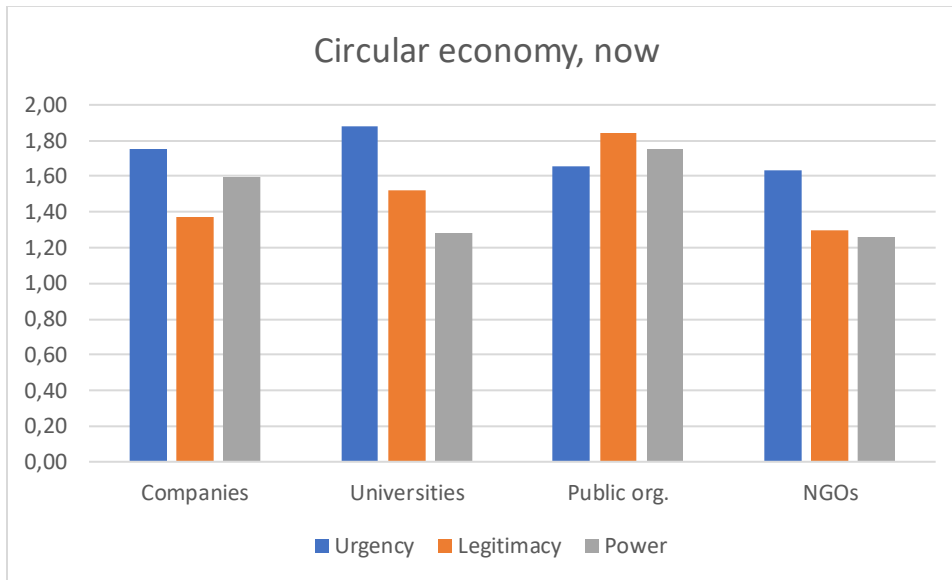


Figure 5.9. Urgency, legitimacy and power of helices in circular economy, now

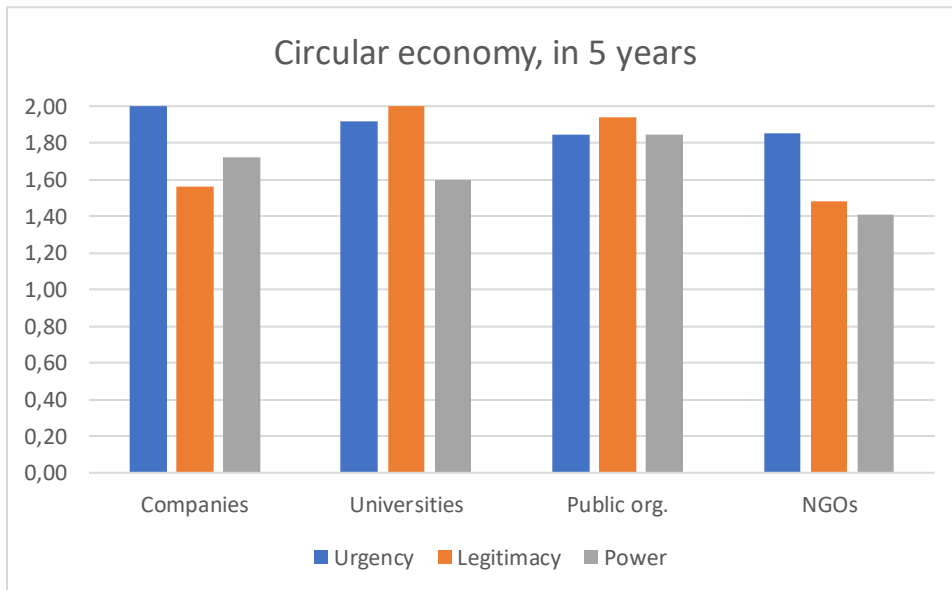


Figure 5.10. Urgency, legitimacy and power of helices in circular economy, in 5 years

5.3 Interaction with niche, regime and landscape level

5.3.1 Green energy

Similarly, to the level of interactions as was shown before, we can analyse how the combination of the 4 cases consisting of Latgale (Latvia), Västerbotten (Sweden), Ostrobothnia (Finland) and Biogas sector in Lithuania operate on the different levels. If looking at the Figures 5.11 -5.13 one can see that interaction on niche level is strong with companies and universities, especially, and strongest if looked across different levels. Companies are really active, since the estimates show almost full results for niche level interactions. It is interesting to see that universities are also able to increase their influence on a niche level, which may be due to the increased role of research in evaluating the environmental effects of innovations. Regime level is the field, where public organisations have most influence. This increase in their power may be due to the funds which are allocated through them or their role in sustainable development, which some companies are looking to use in order to attract the missing legitimacy for their actions.

Probably most interesting field is, however, landscape level and this is where companies, universities and public organisations are going to have more influence. This might indicate that the processes which are being developed in the regions will reach national or EU level and the regions thus become more relevant on a more global level. This also shows how green energy field is acting positively for GT, as they expect to become more relevant on landscape level in 5 years.

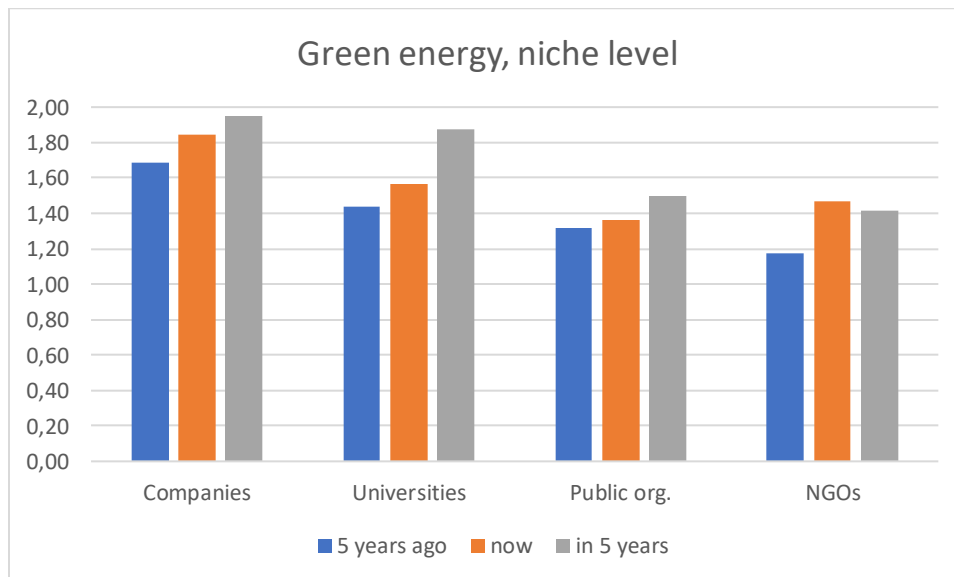


Figure 5.11. Green energy interaction on niche level

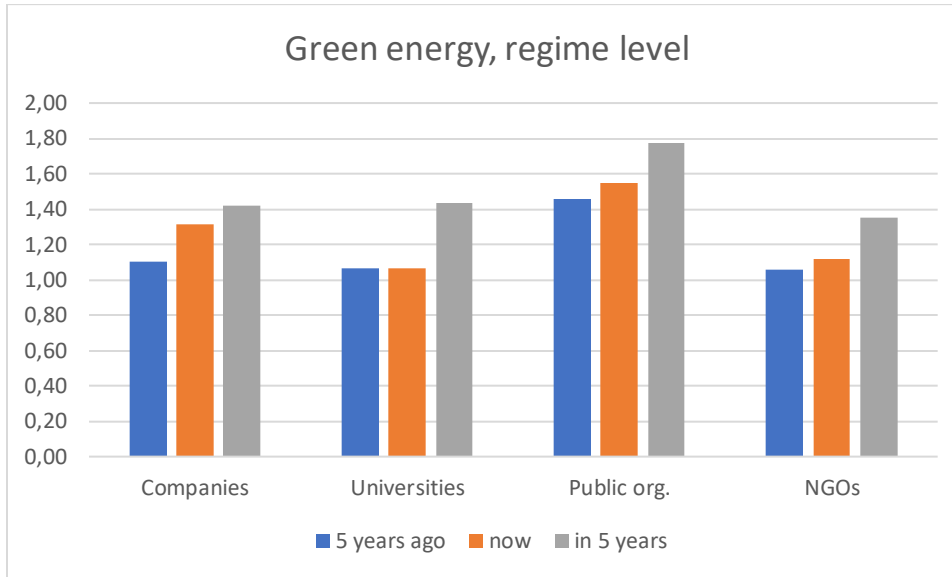


Figure 5.12. Green energy interaction on regime level

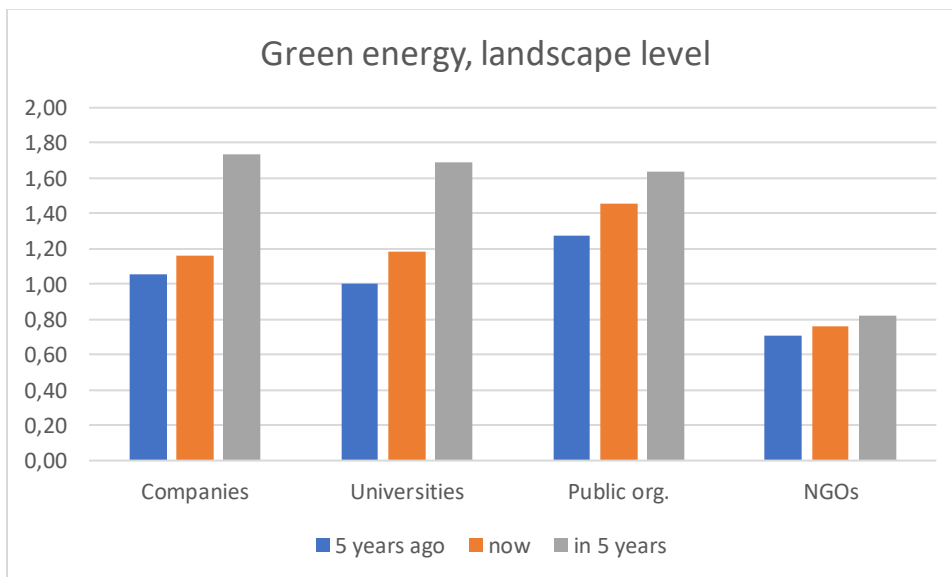


Figure 5.13. Green energy interaction on landscape level

5.3.2 Circular economy

When we look at the same figures (5.14-5.16) concerning circular economy, it does look different. As this list also contains all results, it can be used as an indicator for the whole cases as well as for circular economy. If one inspects these figures, there seems to be several differences between the industries, as rise in landscape level influence is missing. However, all helices will be active on niche level. Companies will also increase their influence on regime level.

One reason for the missing influence on landscape level might be the fact that circular economy is more local in nature. Increases on regime and especially niche level seem therefore quite promising, as actors become more influential on local level. This may indicate a positive result for circular economy efforts in the case study regions. It is also notable, that public organisations have the highest score on landscape level in 5 years, and so public organisations therefore are most relevant for ensuring that there will be landscape level interaction.

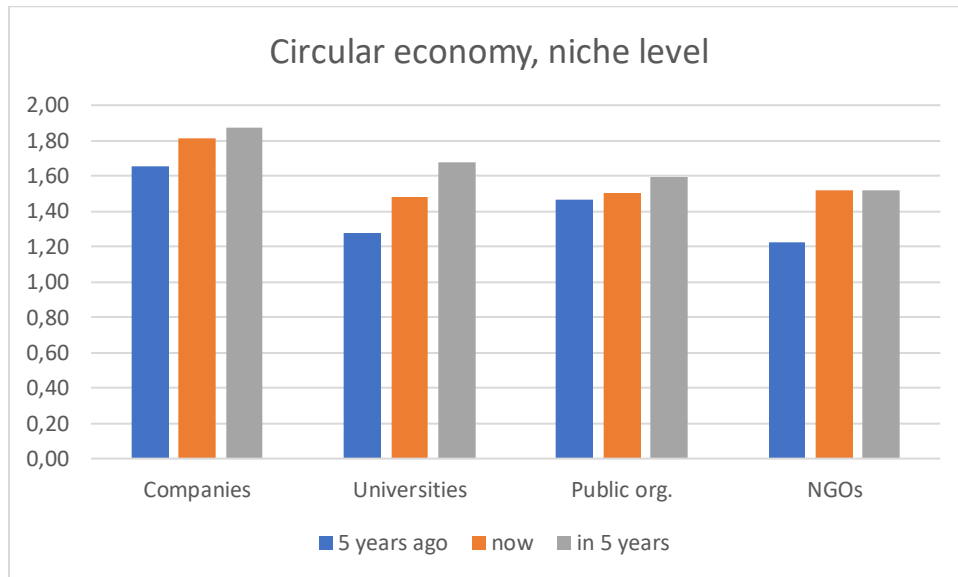


Figure 5.14. Circular economy interaction on niche level

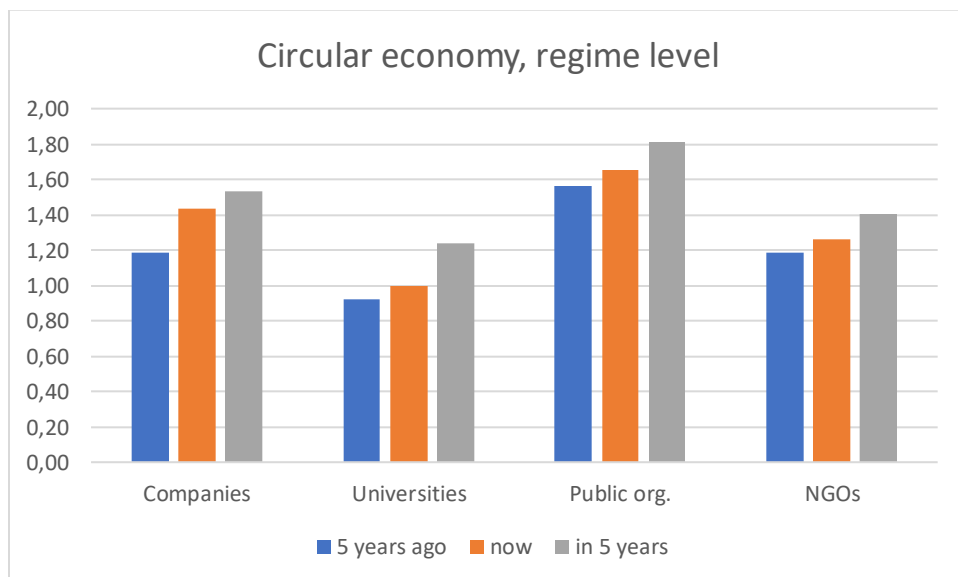


Figure 5.15. Circular economy interaction on regime level

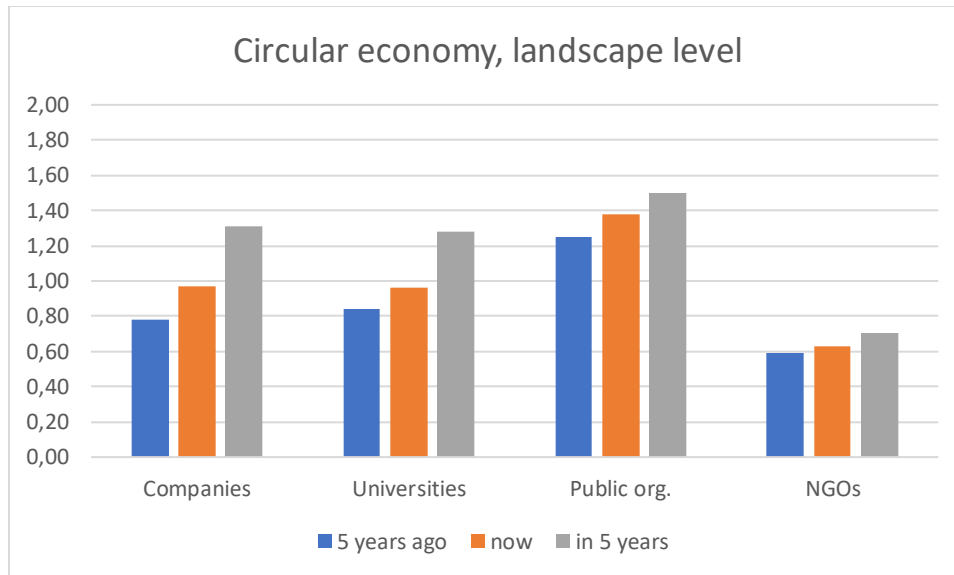


Figure 5.16. Circular economy interaction on landscape level

Based on the industrial analysis concerning the levels, it would seem that the differences between the industries are shown. Green energy is globally oriented, whereas circular economy is more of an internal process and therefore development trajectories seem relevant and promising for both cases. This analysis can also be taken further by looking at Penta Helix measurements and how different industries are positioned in their relation to GT.

5.4 Penta helix measurements

Penta helix measurements are based on stakeholder typology and how different types of stakeholders are positioned (see Table 5.2). In the analysis, the figures of urgency, legitimacy and power are combined as a single average, which is then compared to similar results for stage 0 stakeholders (non-stakeholder), stage 1 stakeholders (dormant, discretionary, demanding), stage 2 stakeholders (potentially dangerous, potentially dependent, potentially dominant), stage 3 stakeholders (dangerous, dependent, dominant), stage 4 stakeholders (transformative (funding), transformative (legislation), transformative (environmental will)) and stage 5 stakeholders (definite). This comparison of the case study averages to the typologies form a green transformation level for each helix. Please note that these include the same stakeholder types as presented by Mitchell et al (see chapter 2), but with additions to formed new stakeholder types in order to codify more options based on our analysis.

If the combined average for urgency, legitimacy and power is similar or higher than the GT level value, then this helix is positioned on that level. This arrangement allows for visual model, which shows how close the different helices are for reaching GT goals by becoming definite stakeholders on the field.

Table 5.2. Stakeholder types and their levels for making penta helix figures

Stakeholder basic types	Power	Legitimacy	Urgency	GT level values
Non-stk	0	0	0	0,00
Dormant	1	0	0	0,33
Discretionary	0	1	0	
Demanding	0	0	1	
potentially dangerous	1	0	1	0,67
Potentially dependent	0	1	1	
Potentially dominant	1	1	0	
Dangerous	2	0	2	1,33
Dependent	0	2	2	
Dominant	2	2	0	
Transformative (funding)	1	2	2	1,67
Transformative (legislation)	2	1	2	
Transformative (environmental will)	2	2	1	
Definite	2	2	2	2,00

As an example of the use of the table, we can use companies within green energy 5 years ago; average regarding their power, legitimacy and urgency is 1.16, which beats levels 0, 1 and 2 but is not enough to reach level 3. This means that GT level of companies is 2. However, we can also visualise how “close” different helices are of their goal, green transformation and sustainable goals. Figure 5.17 shows how helices have developed from 5 years ago and will develop in the next 5 years.

5.4.1 Green energy

As can be seen from Figure 5.17, all helices were roughly at the same situation 5 years ago. However, they have developed already, and public organisations seem to be acting ahead of other helices, reaching level 4 first. However, other helices have also increased in urgency, legitimacy and power so that that are able to reach level 3. Other helices meet up with public organisations in 5 years, with the exception of NGOs, which will remain at level 3. It should also be noted that none of the helices will reach the definite stakeholder level in 5 years.

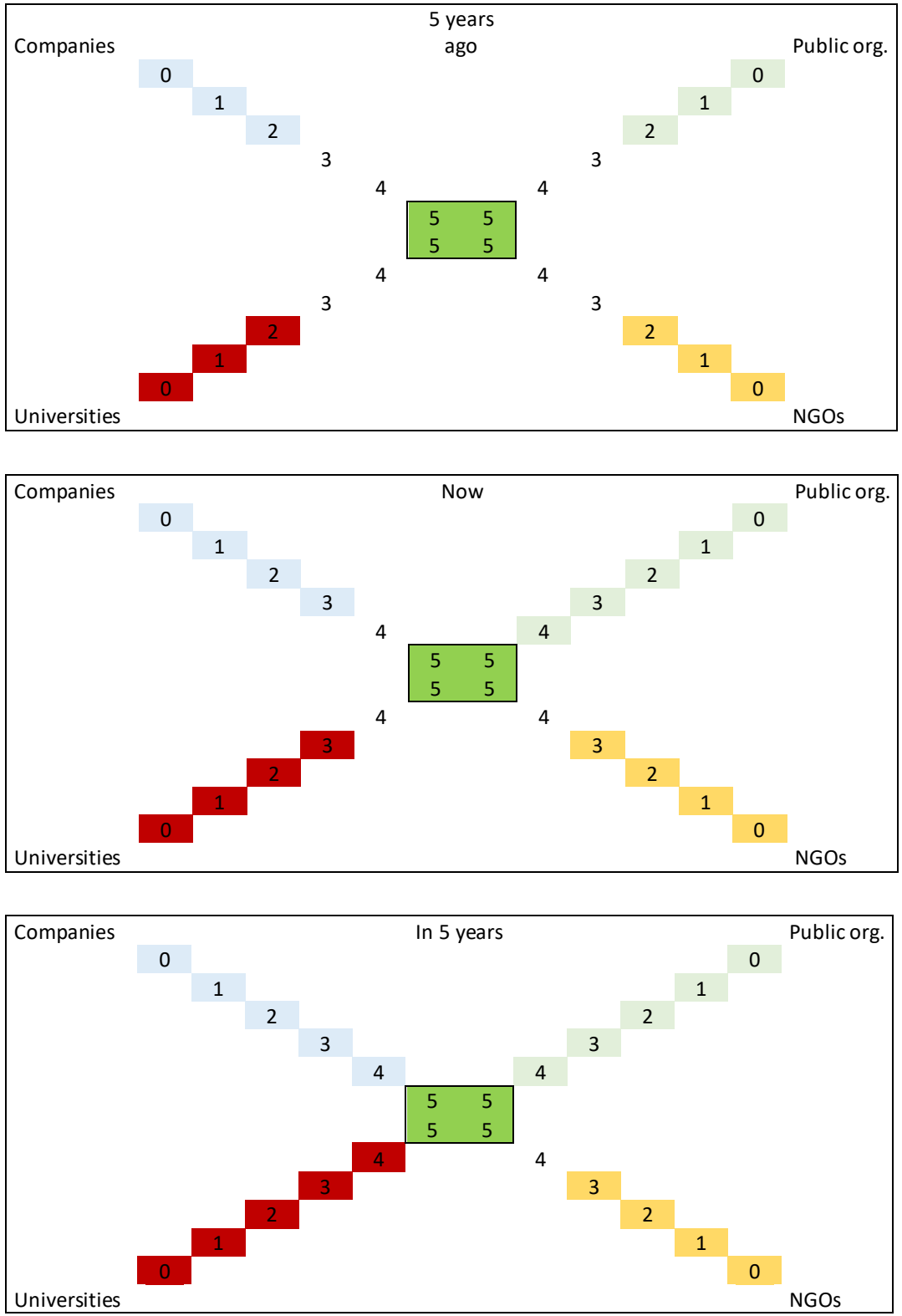


Figure 5.17. Penta helix figure regarding green energy

Now that we have the big picture visualised, we can look at the exact numbers. As can be seen from Table 5.3, Public organisations are ahead of other helices regarding their power legitimacy and urgency in all time scales. Universities and companies grow in a quite similar fashions, as their averages grow by 0.6 during the period. Universities just begin with a higher score and are therefore able to reach highest score before public organisations. In 5 years, Universities and public organisations are really close to reaching the definite stakeholder level.

Table 5.3. Urgency, legitimacy and power of green energy sector

	Average			
5 years ago	Urgency	Legitimacy	Power	Average
Companies	1,05	1,16	1,26	1,16
Universities	1,31	1,25	1,25	1,27
Public org.	0,82	1,36	1,32	1,17
NGOs	1,24	1,18	1,06	1,16
	Average			
Now	Urgency	Legitimacy	Power	Average
Companies	1,74	1,37	1,53	1,54
Universities	1,94	1,50	1,44	1,63
Public org.	1,64	1,82	1,82	1,76
NGOs	1,71	1,35	1,18	1,41
	Average			
In 5 years	Urgency	Legitimacy	Power	Average
Companies	2,00	1,53	1,68	1,74
Universities	2,00	2,00	1,69	1,90
Public org.	1,86	1,91	1,86	1,88
NGOs	1,82	1,65	1,35	1,61

One can also draw some notions concerning the pathways based on the analysis. When inspecting results from the “in 5 years” period, one can see that companies, universities and public organisations are the ones closing on the goal. Based on the averages it would seem that companies lack mostly legitimacy (legislation), universities only lack power (resources) and public organisations lack both urgency (environmental will) and power (resources) in order to reach the goal. These findings may help in explaining why different paths are chosen and what they mean in regional context.

5.4.2 Circular economy

When inspecting circular economy, the penta helix Figure remains similar (see Figure 5.18). All helices will begin on the 2 level and public organisations reach level 4 fast, while others follow. This similar

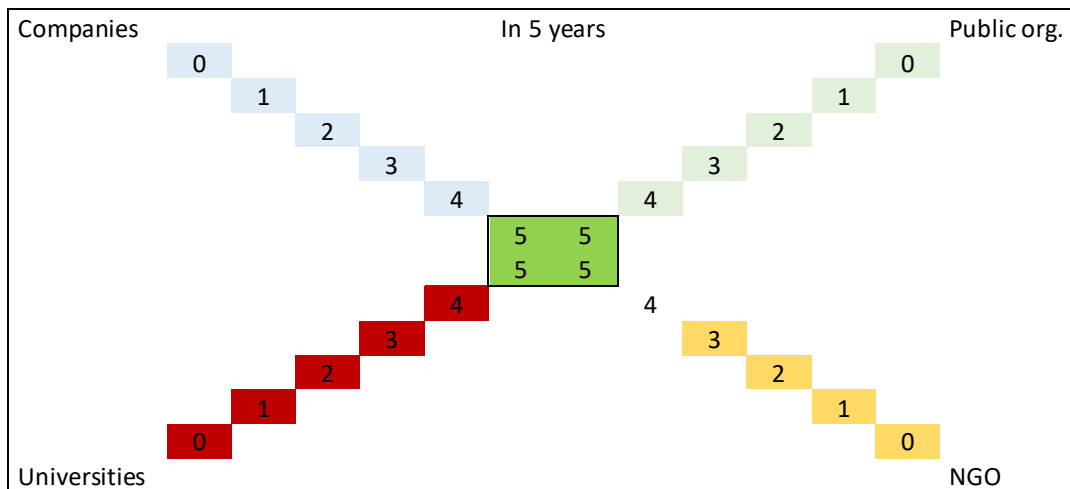
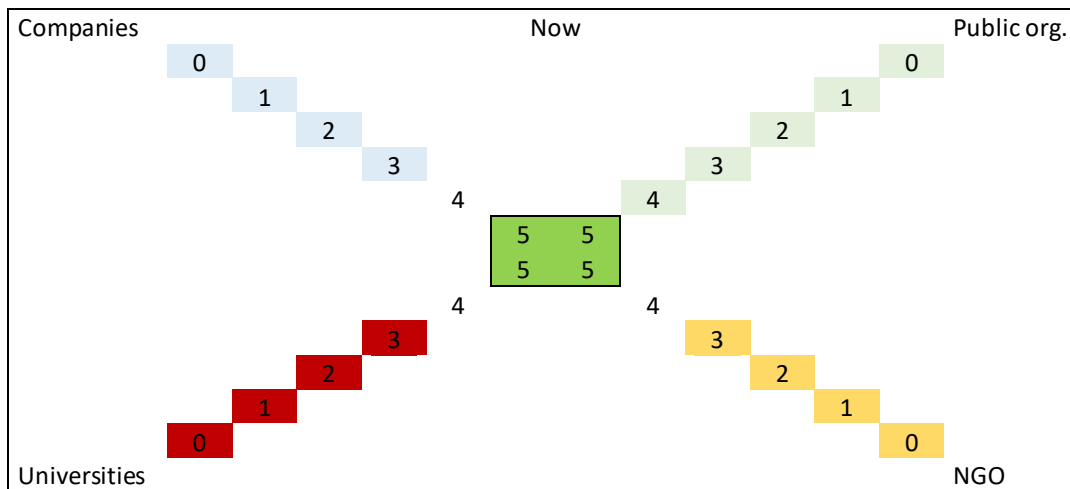
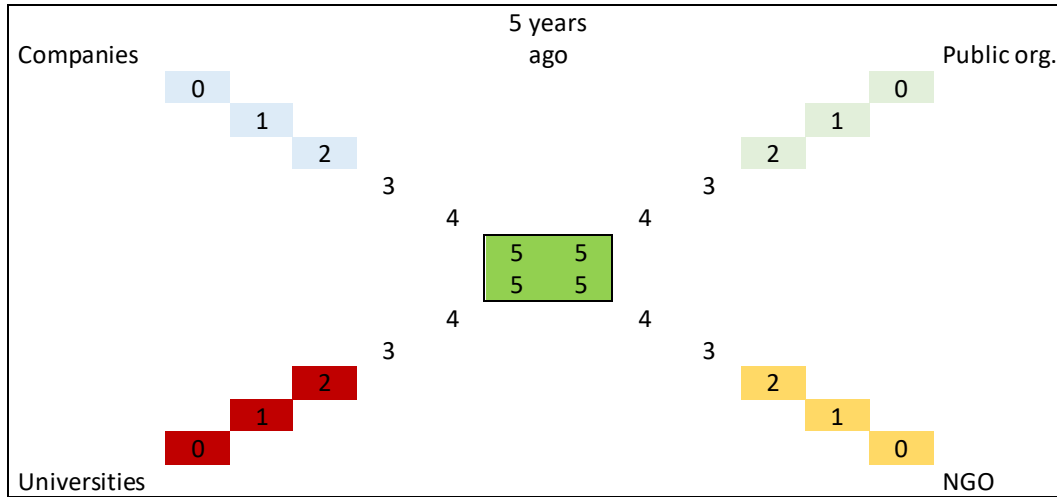


Figure 5.18. Penta helix figure regarding circular economy

pattern can be explained by the fact that the difference between cases is just two additional partners, so Pääjät-Häme and Klaipeda region from Lithuania has been added into the data for this analysis.

One can then look at the exact figures and look for differences between them (see Table 5.4). If one inspects urgency, legitimacy and power figures of all helices, it will seem that public organisations have the highest scores on all time schedules as well as biggest growth with over 0.50 average regarding their combined level of urgency, legitimacy and power. Universities and companies also follow similar pattern.

Table 5.4. Urgency, legitimacy and power of circular economy

	Average			
5 years ago	Urgency	Legitimacy	Power	Average
Companies	1,31	1,16	1,34	1,27
Universities	1,44	1,24	1,16	1,28
Public org.	1,09	1,41	1,41	1,30
NGOs	1,33	1,15	1,11	1,20
	Average			
Now	Urgency	Legitimacy	Power	Average
Companies	1,75	1,38	1,59	1,57
Universities	1,88	1,52	1,28	1,56
Public org.	1,66	1,84	1,75	1,75
NGOs	1,63	1,30	1,26	1,40
	Average			
In 5 years	Urgency	Legitimacy	Power	Average
Companies	2,00	1,56	1,72	1,76
Universities	1,92	2,00	1,60	1,84
Public org.	1,84	1,94	1,84	1,88
NGOs	1,85	1,48	1,41	1,58

Interestingly, companies already have full urgency in 5 years, but require more legitimacy in order to reach the final, definite partner level. Universities require resources but also some urgency to become definite stakeholders. Public organisations on the other hand have similar results as in previous figures; they require more urgency and power. NGOs are missing both legitimacy and power before they can become definite stakeholders. Based on the results, it seems that companies have urgency, universities and public organisations legitimacy and NGOs urgency in 5 years.

Based on this comparison between green energy and circular economy it seems that the general situation is quite similar. It is also clear that all helices lack either urgency, legitimacy or power and depending on the helix and region this can mean different things. However, companies seem to need legitimacy, public organisations little urgency and some power and universities both as well. NGOs have urgency but lack other stakeholder aspects.

5.5 Conclusions on comparison between green energy and circular economy

Both cases are somewhat different in nature and what is interesting these differences also seem to show in analysis. For example, green energy fields are more landscape-oriented because of its international nature, whereas circular economy is more evenly spread across all helices and influences are mostly on niche level, due to its local nature.

Helices seem to operate quite similarly on both cases, public organisations are seen as important regarding legitimacy, and companies and universities are following their guidelines. Interestingly, companies had biggest urgency on circular economy, which may indicate that there are many stakeholders, who see that as a potential business avenue, or who are already on the field.

Since development of both industries is positive, the only actions which could be suggested are to keep aware of potential challenges and to address them together. It is evident that all helices see the potential in GT regarding future so there should not be very many obstacles for increasing collaboration regarding green innovation actions.

Regarding European green deal it could be stated that the regions have done a big development jump in just 5 years, especially regarding the urgency to act for GT. If public organisations are actively engaging with companies and other actors and provide the missing legitimacy, as well as some urgency and power via supporting legislation and funds, there should be a positive process into GT. Some stakeholders will be more difficult to engage with, than others, but this wide view of common goals should make the effort a little easier. European green deal is therefore a welcomed addition to help in GT process.

6 Pathways and roadmaps towards GT

6.1 Paths to GT

6.1.1 Selected paths by respondents

In order to find out the process of GT in the regions, the partners asked the respondents which type of path to GT is the most likely for the respective region and intervention areas. The respondents were given following options, which they were asked to refer:

- Technological substitution: GT means that our existing industries will be closed down. The region will replace them with new ways of making a living through new economic activities/ new sectors and clusters
- Transformation of existing regime: We can manage GT through adjustments of our existing industries, skills, regulations and institutions.
- Regime reconfiguration: GT means that our existing industries, value chains and networks will be radically reorganized, and new actors will take core positions.
- De-alignment and re-alignment: GT mean that our existing value chains and networks will disappear. Economic activity will be based on surviving companies/ technologies, combined with new industries and organized in new value chains and networks. What is today small niches will become dominant actors.
- Institutional exhaustion: GT will be blocked due to deep conflicts. Existing actors and networks will react to macro level pressure through protests and slow downscaling.

Most of the 47 interviewees in all partner regions selected transformation of existing regime as a pathway for GT. It was understood as the change through adjustments of existing industries, skills, regulations, and institutions. We find three type answers:

- Regime transformation was chosen as the only path towards GT: in Klaipeda food industry
- Regime transformation was chosen as the main path towards GT, but some other paths were also mentioned by respondents in Latgale, Västerbotten and Lithuania bio
- Regime transformation was part of the main combination of development trajectories towards GT in Ostrobothnia and Päijät-Häme

Regime transformation was either major path to GT chosen by the respondents in every region or a combination of the chosen mixture of paths. (Table 6.1) None of the respondents chose *institutional exhaustion*, stating that GT will be blocked due to deep conflicts, industries will react to macro level pressure through protests and slow downscaling.

Regime transformation was mentioned as most common in Klaipeda, Latgale, LithuaniaBIO, and Västerbotten. The respondents assessed mostly how suitable the pathways are for the existing state of the GT. Respondents of Klaipeda food industry did not mention other options, but of LithuaniaBIO, Latgale and Västerbotten, also different other paths were mentioned. However, in addition in Latgale, LithuaniaBIO and Västerbotten, respondents supported many pathways or combination of pathways. For instance, in Latgale, some experts noted suggested a path *with elements of regime reconfiguration, de-alignment*

and re-alignment. According to one expert in Latgale, there can be some elements from many path options in the development.

In *Klaipeda* food industry, companies will be able to retrain and replace existing facilities by naturally moving towards GT. Abrupt industry-reshaping change were not expected, instead, the *transformation is anticipated*, and it will be gradual. The incumbent companies have a solid position in the markets, and it would be extremely difficult for a new food company/invention/start-up to initiate larger scale reforms. However, technologically advanced niche start-ups might supplement the industry. The incumbent companies are strong, so the niche companies can influence GT only in longer term.

The respondents on Klaipeda food industry assured that gradual transformation would not harm smaller companies as well. Even though they lack of both human and financial resources to implement innovations, they will eventually adapt either to market regulations, production requirements from clients or general industry trends. The presence of these companies is also supported by customers' preference for local production and short value chains, which gives them especially advantageous place in Lithuanian markets and fosters cooperation with local farmers. Automation processes and digitization strategies in companies might contribute to GT as well, since these processes help to improve material monitoring and efficiency. One of the experts stated that in food and beverages industry material tracking is very advanced – you can precisely identify sources and the amounts of every food material that goes into the final product, which creates an advantage for circular economy applications in business.

In *Latgale* region, the respondents pointed a need to be careful not to damage economic development and welfare. The goal is to use advantages, technologies, and infrastructure for company modernization and for transformation to new production processes, not to close companies. Replacing one company with another will not have any positive effect for the development. If industry is producing products, which are needed for society, then they can adapt. If industry is producing products where demand is decreasing, company need to reorganize. The production processes of Latgale metal and mechanical engineering are already now at the EU level. One respondent in Latgale pointed that the industries will adapt and adjust to GT. Some small companies might disappear, merge, or transform due to GT. If a new company is established, it already from beginning use the latest technologies. Even if regime transformation is preferred one, also reconfiguration processes are going on in Latgale: large companies disappear, leave behind infrastructure, work force and resources and there come in other companies just following global tendencies. In addition, some elements of dealignment and realignment was recognized, when investors come in, develop some niches, which have not been in Latgale region before. They create new networks and new niches, for example, electrical appliance manufacturing, IT sector, high technology companies.

One expert explained that usually the highest resistance comes at company level from lead technologist and lead energetic. They tend to continue their usual pathway and they do not need any changes. Some representatives of companies and municipalities favour GT in their communication, but when it comes to doing, something works against these changes. According to one expert, GT in Latgale region is difficult, and too big push for changes might even cause resistance among companies. However, if there is enough effective technologies and transfer, and good examples, GT could work for Latgale region. Experts pointed out that in Latgale region for successful GT a *leader or leading institution is needed, which owns a trust.*

The most relevant path in *Västerbotten* is the transformation of existing regimes that every expert described as the best pathway for the region: existing networks, value chains and companies will overcome difficulties in adjustments, adapt to new regulations, and discover green growth opportunities. Some experts also highlighted the option de-alignment and re-alignment, possible due to the development of hydrogen and battery industries, which is changing the industrial ecosystem towards GT. *Västerbotten* 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 the existing strengths and some of existing companies. In the de-alignment and re-alignment process, existing value chains and networks will disappear. Economic activity will be based on surviving companies/ technologies, combined with new industries and organized in new value chains.

In *Ostrobothnia* and *Päijät-Häme* the combination of the paths were most common. In *Ostrobothnia*, many respondents mentioned that *both technological substitution and transformation of regime* are already in effect. However, many saw that existing companies are so vital for GT that they will not probably perish but are the companies which future will be built upon. One respondent also highlighted the fact that if promising niche products do appear, the big companies will buy them to add to their existing knowledge base. Therefore, the local companies were seen as steady regarding future. Regime transformation was highlighted especially regarding circular economy (CE), as it will not function without proper ecosystem between regional actors. CE simply functions better when it has some wider customer base, as this allows new niche companies to look at specific recycling activities. Finnish market is limited, and it was suggested that cooperation with Sweden might prove to be useful regarding this. Respondents also highlighted the role of citizens and the distribution of knowledge as citizens are the ones who can affect landscape level (political decision makers) and they can also act as new niche level actors if they do establish new CE based SMEs. Universities were seen as important in this role where they distribute useful knowledge and attract young people to the region, who may then establish new niche activities.

In *Ostrobothnia*, regime may however also *reconfigure*, and at least new battery manufacturers are now entering the region. The respondents did not address this, since news about it came after conducting the interviews. Fragmentation was however mentioned to be a possible threat as well as possibility. New activities and businesses develop, when new companies put focus on specific parts of existing businesses; its processes, markets, products, or business model and develop new businesses based on this observation and improvement.

In *Päijät-Häme* the respondents saw *transformation of existing regime and regime reconfiguration* as the most likely way for GT. Actors can adapt when they have enough time and money. The driver of GT is niche action, and it means changes both for corporations and better use of ecosystem services. Business ecosystems based on GT make the change easier for companies. Transformation of existing regime will help to support those sectors, that suffer the most or have to abandon the sector altogether. Existing companies adapt and overcome their difficulties and quickly start producing a new product. Production and industry can be adapted and changed; more energy-efficient solutions can be made. Niche in action has more room for change made by an individual. It is a good model alongside technological change.

Respondents in *LithuaniaBio* pointed, that regime transformation was selected, since there is no possibility to substitute present employees and specialists in a timely manner. The respondents in *LithuaniaBio*

pointed, that rapid change (regime reconfiguration) is difficult to implement because of the need for specialists and the need for knowledge. Pathway for GT must be prepared with supporting strategic documents. In LithuaniaBio, some respondents noted that for *regime reconfiguration and for dealignment and realignment*, technologists and specialists should be prepared, and it takes time of at least 4–5 years. The state must contribute to the transformation of the regime - through taxes, audits, labelling, etc.

Table 6.1. Paths to green transformation across regions by respondents

Regions	Technological substitution	Regime transformation	Regime reconfiguration	Dealignment and realignment	Instit exhaust
Klaipėda (Lith) food and beverage		Main path			
Latgale (Latvia) metal and mechanical engineering		Main path	Mentioned	Mentioned	
Västerbotten (Swe)		Main path		Mentioned	
Ostrobothnia (Fin), energy technology, circular economy	Belong to main combination already in effect	Belong to main combination already in effect	Mentioned	Mentioned	
Päijät-Häme (Fin) grain cluster		Belong to main combination	Belong to main combination		
Biogas-sector (Lithuania)		Main path	Mentioned, important in 2030s	Mentioned, important in longer term (2050)	

6.1.2 The role of technologies and technological substitution in GT

Even if the respondents did not choose - except the case of Ostrobothnia - technological substitution as the main pathway to GT on their intervention areas, the role of technologies was seen generally very important in the GT.

In *Klaipėda*, the main driver of GT is R&D solutions - the supply of more efficient, cheaper products or technologies. Representatives of companies emphasized that constant investments into new products and technologies are necessary to maintain competitiveness in global market. Nevertheless, very few companies have started active investment into new circular economy methods, because those technologies are too expensive, or companies are not aware about them. The range of structural changes are essential to intensify knowledge transfer to manufacturing industry. The region Klaipėda lacks a one-stop shop for all companies that are looking for advanced digital or circular solutions. NGOs (development agencies) and Klaipėda University may become a regional innovation front line for businesses towards

their journey to circular economy and innovation and thus closer integration to international value chains. They can connect business needs and may suggest ready-made solutions or help to connect with relevant market players locally or internationally. They are already well linked to some industry sectors that are looking for new digital solutions; they understand these sectors' priorities and demands. However, business community would like to see Klaipeda University or other Lithuanian university taking on *the* role of circular economy knowledge and excellence promoters by engaging with relevant business community and focusing on their issues resolution; providing market insights; developing R&D projects on circular economy topic. In order to upgrade the traditional economy into the circular economy, a Lithuanian circular economy innovation ecosystem should be build based on substantial technology and R&D capabilities. Fostering GT of the Lithuanian food and beverage is seen as result of upgrading the Lithuanian economy itself through strengthening its innovation capacities and infrastructure, in particular digitalisation and automation technologies, circular economy capabilities.

In *Latgale*, mechanical engineering and metal industry technologies and technology substitution play a general role. However, in *Latgale* new technologies must come together with informed decisions, knowledge of role of innovations, GT and *leadership which can communicate changes from national level to niche* (company level). Therefore, technologies together with appropriate competencies/communication are playing the most important role in green transformation.

In *Västerbotten*, respondents argued, that new technologies will help the GT and will not expected to close down any industry. The need is to be able to find financial solutions and business solutions so that the companies are willing to invest in the technologies that will help the GT.

In *Ostrobothnia*, technological substitution is going forward all along and it will do the regime reconfiguration by that way. Cheaper technologies will substitute old ones. Technological substitutions are seen as important pathway but did not come up as the most important in most of the expert interviews. It was also mentioned that we already have the technologies for carbon free climate; one only has to apply them. New hydrogen based technologies were still seen as important in the future.

In *Päijät-Häme*, the change in the current system can be adapted, changed, more energy-efficient solutions can be made. Niche technologies has significant role in that. Existing production sectors are adapting and starting to improve practices and introduce new technologies. This is unlikely to take big steps.

Respondents of *LithuaniBIO* pointed, that EU support could act as a good catalyst for innovation. The company may not be ready for new investments at some point, but the support can encourage faster implementation of GT.

6.1.3 Do GT need new activities and actors?

The respondents generally assessed that there are enough actors, but in some cases, there might be more space for new actors and activities. Even if there might be enough regional and national actors involved in GT in *Latgale*, no one is set as main responsible and coordinating institution for the process. Therefore, activities are not coordinated and there is not enough information to make definite conclusions. In addition, more information is needed from niche level.

Respondents in *Päijät-Häme* also emphasized a need of expertise in transition orchestration in the region. In *Päijät-Häme*, an impartial and open expert organisation would be necessary. Regional Council could be that kind of organization, but the resources at the moment, and also the competence of people, are not sufficient. In addition, clear national guidance is needed.

Respondents in *Västerbotten* pointed a holistic approach towards GT, and transformation of society as a whole, where different actors from different helices should work together to have the best effect. In systemic view, actors, regions, and national level work together.

New activities and actors are needed in *Ostrobothnia* to build a working circular economy ecosystem. In energy technology, new actors are not necessary, but there is a need to stay on top of related development and therefore new activities are constantly sought after. There is a trend towards wider servitization and mutual development with regional actors to offer a specific solution instead of some general products. Regional focus also forces companies to remain quite open on their innovation processes and this enables possibilities for new entrepreneurs.

Respondents of *LithuaniaBIO* outlined, that currently there are enough actors as professionals with higher education, who are familiar with all necessary activities to be taken to make the actual GT to happen. The biggest universities are active with sustainability programs, and similar activities are needed by other actors to fill the knowledge gap. However, new activities, such as employing networking and more horizontal cooperation between different levels and different stakeholders would give more understanding of GT concerning different stakeholders' positions. Networking activities also could increase trust, would show the benefits of communication, and would lead to more ambitious goals towards GT.

6.1.4 Risks and uncertainties

Many respondents had concern on the timeline for GT. In some regions, like *LithuaniaBIO*, the risk was that companies do not have enough time to adapt to the requirements of GT, and to implement green technologies. In some other regions such as *Päijät-Häme* and *Ostrobothnia*, the concern was that the change towards GT is too slow and timescale unclear.

The respondents in *LithuaniaBIO* had concerns on allocation of the state and EU funds, since they are not transparent enough. In local level, the risk is a huge gap of knowledge and education regarding the overall conception of GT, CE and bioeconomy, and need to change everyday life. The unclear basic notions of GT were misunderstood partly because of limited knowledge and lack of information in a national language.

Also in *Latgale*, the respondents saw that there is not enough information on what companies in *Latgale* do plan to do with GT. However, at least some companies are looking positively at GT, and look at it as an opportunity, a new way for development and a new advantage. However, there is a risk that not enough many large companies are looking GT as opportunity.

Respondents in *Ostrobothnia* pointed irrational political decision-making not based on facts. Risk was also seen that the citizens are not ready to change their lifestyle. To implement GT more information, ambitious goals and regulations as well as willingness to change one's way of thinking is needed. Everything should be recycled which needs a great deal of reorganizations and re-thinking on how one uses resources and how one can recycle effectively. Some respondents saw a risk, that some countries might benefit from

using fossil fuels longer than others use, so nations, which are not taking the major steps towards GT, may reap the rewards.

For Västerbotten, the skills is a bottleneck both to adapt to the digital transformation, but also to better match the companies need for workforce and by developing the skills of workers (lifelong learning).

6.2 Opportunities and threats

Majority of respondents see GT as an opportunity and not as a threat to different stakeholders. The most common expressed opinion regarding GT was an expression of 'new normal' and 'new reality'. Many see the opportunities for business like new businesses, saving costs in energy and material resources, etc. Some large companies are forerunners, but for many companies especially SMEs GT is seen as a threat, since green technology is expensive, and regulations too complicated. It is also threat for some sectors such as turf producers in Finland, or food and beverages companies in Klaipeda, which export outside the EU. For public organisations, universities and NGO, GT seems to be more opportunity than threat. Tight timetable was regarded both as threat and as opportunity, when it is forcing companies to transform. Threat is that open opportunities are not used or will be used too late. The national and regional goals might not be reached. Some regions such as Päijät-Häme already have long experience in GT with environmental innovations and clean tech, but the political decision-making and the defensive lobbying by some interest organizations might be threats also there. Respondents pointed systemic change, and the challenges to the entire society, not only businesses. Education of young people is an important issue.

In *Klaipeda*, GT can open several opportunities for the companies that are oriented towards developed markets in which sustainability is a preferred product feature, but not to the companies exporting to non-EU markets. Green technologies mean often higher production costs and higher prices for the final products, which cannot compete in markets outside the EU, as the consumers in these markets have a lower preference for sustainable products. The threat of lost competitiveness in non-EU markets was stressed especially by public organisations. The promotion of local and sustainable food chains provides growth opportunities for Klaipeda businesses.

In *Latgale*, the opinions of the respondents were varying depending on their helices and work experiences. Companies can reduce their operative costs through more effective heating systems, or reduction of water consumption. Companies are motivated to save resources, make production cost effective, create value added. Second, GT opens doors for new niche products, new markets, new technologies and increase of competitiveness. Universities can offer new technologies, methods, and approaches. Municipalities see GT as an opportunity to implement EU activities and receive financing.

There is a threat for Latvia that goals will not be reached, sectoral industries do not involve and therefore there is a risk not to reach planned results. For companies' reduction of resources could cause serious consequences. They could lose what they own now. GT is too timid about new technologies, and society is not well informed. Some stakeholders might have opportunities, but will not use them, maybe because of lack of comprehensive information. After new regulations due to GT, some companies might be too late to make changes in production. It is important to make changes at niche level in a timely manner. Some may lose markets, production process may become more expensive, and clients may be loosen,

because markets already are changing. The competitiveness may decrease; some processes will become more expensive to fulfil environmental requirements. GT can cause dissatisfaction risks, if there is no readiness for adaptation.

In *Päijät-Häme*, different opinions occurred depending on whether GT was considered in terms of business, individual or overall. The respondents saw many opportunities and threats (table 6.2). The current support tools were not seen as sufficient. Systemic change should be emphasized, not only business aspects. It would be important to reach a public agreement on what GT is. The objectives of GT programme are picked up by different organisations for their own purposes. Overall management or facilitation in this transition is challenging and therefore, according to many interviewees, there is a need for public, impartial guidance.

In *Ostrobothnia*, GT was seen as an opportunity: sustainable living and growing economy are opportunities for global success for companies and for the whole region. Political decisions and misallocation of financial support by the public organizations are threats, as well as legislation, which does not give enough flexibility. Views on pathways varied, but in general, the region is following the direction towards GT. The whole region may transform into GT driver, as large energy technology companies are working on networks trying to benefit from the global trend towards greener future. The networks spread the knowledge of regional and local solutions, which then turn into business opportunities. Knowledge exchange was considered crucial, and the role of universities in enabling collaboration with companies and the city of Vaasa was highlighted. Since GT is all about changing the entire society, it requires new ways of thinking and wide collaboration. There are no simple solutions, but definitely a need for regional ones. Circular economy needs more networks and drivers for building a strong ecosystem. Energy technology already is a driver, but now the challenge is to engage citizens and SMEs in order to ensure that they are also on board.

Respondents in *Västerbotten* emphasized how to get the natural resources in a sustainable way, for example in the forest industry/bioeconomy, which has a potential to reduce our dependence on fossil fuels, but the sector also has other values such as biodiversity. The large investments planned in northern Sweden (for example Hybrit, Northvolt) were mentioned as opportunities for investors to focus on niches that have potential to reduce CO₂ emissions. Many opportunities relate for hydrogen as energy carrier that enables to reduce or eliminate the fossil carbon dioxide emissions. Hydrogen connects the electricity system and other energy sectors and simplifies the integration of renewable energy into the system. There are large investments in developing hydrogen in northern Sweden (Green Steel, Green Fuels, Hybrit, Center for Hydrogen Energy Systems Sweden etc.). Hydrogen can be used as a fossil-free fuel in heavy transports such as busses, trucks and ships. In addition, hydrogen can be used in refineries to produce biofuels with low carbon dioxide emissions or replace fossil-based raw materials. The large investments in northern Sweden provide opportunities for investors to focus on niches that have potential to reduce CO₂ emissions. However, there is a challenge in decision-making: should new industry and distribution stations for hydrogen be supported, or should more renewable electricity production be built? In addition, the fierce competition is a challenge, as well as scaling up the single projects.

In *LithuaniaBio*, some stakeholders see GT as threat, because of regulations are too complicated, technologies are expensive and have to be covered by private funds, and the adaptation time is too short.

However, for universities and public organisations, GT is seen as an opportunity. NGOs are seen as favouring most from GT. Potential threat is the sceptics' especially in primary production. There is not a single right path of going from a threat to an opportunity, and different sectors and stakeholders should have been given an opportunity to choose the most suitable path for them. There should be enough flexibility given to all sectors and activities to choose their best way towards GT. The selection of the path to a particular stakeholder might be guided by arranged supportive principles, tools, measures, but not the enormous restrictions and fines; the transition period is necessary.

How to change the threats to opportunity?

According to the view of *Latgale* experts, large companies, which have long-term development strategy will adapt to the new rules and situation. They will see economic advantages from different GT projects, and they can show an example for small and medium size companies. For some companies, GT will cause problems, and some will leave Latvia. In future climate changes, even the ineffective companies will be as a trigger to think more about transformation.

In *Ostrobothnia*, many respondents saw that local companies are so strong that smaller companies most likely will not substitute them. One respondent explained that the bigger companies simply buy the niche level actors if they come up with some interesting solutions. This can be a threat, if new and sustainable technologies are removed from the market. There are also some differences between energy technology and CE, as energy technology network is already strong, but CE was seen more as a new thing, which needs an ecosystem to allow niche level activities to spur new business opportunities. In energy technology, more collaboration is needed in order to gain knowledge about regional factors, as these help companies develop new business models and servitisation which is coming more crucial when selling energy solutions. Experimental culture was highly hoped for the region. It was also seen as important to attract new actors to keep the region strong in the future. Regional actors should cooperate more in order to form new networks, which could then strengthen the development in progress. Many experts highlighted the role of knowledge in changing people's habits. However, knowledge should be in a form, which is easily understandable, perhaps similar as in CE roadmap, with focus on concrete actions. People are proud that Ostrobothnia can play a significant role in helping the world to become greener in its energy consumption. Years of work done in the region is now meeting with a rapidly growing market and this creates positive "buzz" for the whole region.

In *LithuaniaBIO*, the main tool to change GT from a threat to an opportunity is education. There is a huge need to educate younger and older generations. GT has to become 'new normal' not only to those who are directly related to GT, but to the whole society. According to the experts, systemic strategic goals should be set for different sectors. A unique approach was proposed by one expert: the transformation of the existing regime is the path we are currently. Regime reconfiguration should happen in Lithuania until the 2030s, in case the existing strategies and programmes are taken into account. In addition, by 2050s de-alignment and re-alignment should be reached in Lithuania, when the investors enable growth from below of niche companies, re-shape the region and create new networks and value chains, partly based on the existing strengths and some of the existing companies. One other expert pointed that transformation of existing regime and regime reconfiguration can be and had been interchanging interpreted,

taking separate parts from them and composing a new derivative. Existing networks, value chains and companies overcome difficulties in adaptation to new regulations, and discover green growth opportunities, and at the same time, some of the existing companies start to loose, and small, green companies start growing slowly and taking part in newly modified existing networks.

Table 6.2. Opportunities and Threats

Region	Opportunities	Threats	From threat to opportunity
Klaipeda	Customers' preferences support small SMEs, and local production and short value chains fosters cooperation with local farmers Niche start-ups supplement the industry	Loss of competitiveness in non-EU markets Green and digital agendas in Lithuania are still not seen as complementary	New transformative policy Multi-sector approach National strategy
Latgale	The use of advantages, technologies, infrastructure for company modernization and for transformation to new production process Reduction of production costs, saving resources New niche products, new markets, new technologies, which increase competitiveness	Too timid about new technologies Stakeholders don't use the opportunities they have, some companies are too late Some processes might come too expensive The more you push to GT, the more there is resistance Lack of leadership	Leader or leading institution for coordination of GT More information and education
Västerbotten	Investments in hydrogen production and distribution Hydrogen as fuel in busses, trucks and ships Biofuels Niches to reduce CO2 emissions	Scaling up single projects of hydrogen fails Fierce competition Difficult choices for distribution of energy Need for skilled workers	Holistic change Educating skilled workers (lifelong learning)
Ostrobothnia	GT is global success for companies in energy technology Networking led by the large companies can turn to the business opportunities Good co-operation between stakeholders	Political decisions Misallocation of financial support (national level) Legislation and regulation are not flexible enough Bigger companies buy the niche companies	Establishment of a new ecosystem for CE More efforts to change peoples' habits
Päijät-Häme	New technologies, ecosystems, value chains, and supply chains offer business opportunities Sustainable CE products and services Good consumer attitudes Financial benefits, financial support and tax breaks for change The possibility is to improve competitiveness, exports, attractiveness and quality	The change is made only when it is necessary Actors do not know how to utilise available funding The change is too slow, and the market disappears Difficult to launch profitable new operations and ecosystems No re-users for recycling plastic in Finland.	A coordinating institution Clearer definition of GT and common agreement on it Systemic change is for the whole society Joint event for GT

	<p>New kind of cooperation between companies and public authorities</p> <p>Regulation can curb consumption and use of natural resources</p> <p>Improving energy efficiency</p> <p>A need for new solutions</p> <p>Food innovations, vertical farming opportunities</p> <p>new plant species that do not need space</p>	<p>Things can become politicized</p> <p>Theory and practice do not meet: you get what you calculate</p> <p>The old structures and harmful technologies will not be eliminated</p> <p>National targets are too ambitious, and will not be reached</p>	
Lithuania BIO	<p>Opportunity for universities and NGOs,</p> <p>New normal, no alternative</p>	<p>Too complicated regulations, too expensive technologies, too short time</p> <p>Sceptics towards GT (primary production)</p>	<p>Education, information</p> <p>Systemic strategic goals</p>

Green washing

According to respondents in Latgale, green washing is used by some NGOs, but also by ministries. Latgale region has no instruments to reduce their own expenses and include GT into actual budgets, and therefore the topic of GT is green washing for them.

Green washing can be seen in the use of terms “sustainable”, “environmentally friendly”, “organic”, “recyclable”, “natural”, since there is an open discussion about the definition of these notions, and there is no common regulation or requirement when a company can use those terms. To some extent, the green washing could be tackled with eco-labels and certification. They are a way to promote sustainable companies and their production, but not a way to prevent the ones pretending to be environmentally friendly. As the expert from the public sector in *Klaipeda* stressed, the overall level of knowledge and awareness about truly sustainable practices should be increased to reduce green washing. This concerns not only consumers but also investors, suppliers, retailers, and other value chain participants, as in longer value chains it becomes more difficult to track the environmental footprint of a product. (*Klaipeda*). In other regions, the experts pointed, that green washing should be prevented with education, open communication, and discussion. There should be clear criteria what is green and what is not, as well as life cycle evaluation of products. (*Latgale*), and it should be openly highlighted how the carbon footprint has been calculated (*Päijät-Häme*). In *Ostrobothnia*, some respondents saw fabrication and green washing in green electricity certificates, but other respondents saw verification of production as a sign of trust.

6.3 Mobilisation of stakeholders and suggested policy tools

The main stakeholders of GT are either public governments at different levels or large companies. However, the respondents pointed, that all stakeholders are important, but they have different roles in GT. Public actors should motivate hesitating stakeholders for instance paying attention to the benefits of GT. They should encourage dominant stakeholders with power and legitimacy and increase their

urgency towards GT. There should be also more research such as quantitative studies about companies in relation of GT.

The engine of GT for the private sector is the market. Especially the value chain context is big trigger for GT since the products for exports and in value chain must fill sustainability standards required by market. It is often requirement also for the suppliers. Regulations and public support, especially EU support can encourage faster implementation of GT activities. Many tools, such as building test systems and test beds for innovative could be used, as well as building a green innovation system and environment for experiments. Many respondents emphasized the role of adequate information and communication on GT, as well as information and benchmarking of good examples towards GT, especially for companies. The information should be targeted according to the type of companies, and it should be close of everyday life. Communication on GT should belong to the tasks of regional governments and other public organisations, but in some cases, also NGOs and universities are important communicators.

Cooperation among stakeholders should be encouraged, and networking is needed for regional capacity building. Stakeholders should also network in their own fields but also in building common regional strategies. Cooperation is encouraged among regional stakeholders. Some respondents emphasised discussions in cluster cooperation (PH) and private-public partnerships towards GT (Ostro), other emphasised cooperation between regional and national stakeholders. There should be more discussion on equal distribution of the benefits of GT, and GT could be guiding principle for regional development programs. In could be seen as an attractor. Regional strategy that focus on the GT should be supported also by national actors.

The analysis of *Klaipeda* food and beverage industry proved that stakeholders have different perspective on GT and therefore before deploying regional strategies it is important to find a common understanding between all those actors:

Demanding stakeholders are looking for new circular economy solutions and green technologies that could link both economic and environmental solutions together. The main source of these solutions are innovations and R&D activities. Most of them are regional SMEs that are aware of environmental challenges but could not find technologies that is both environmentally friendly and economically feasible. Once they realize the potential of the technology that solves their problem, they are willing to adopt these solutions and contribute to the environmental goals. However, regional SMEs are not well informed about R&D activities and innovations in the national universities, therefore the transition stagnates.

Dependent stakeholders do not have a power to make decisions regarding GT, therefore they depend upon advocacy from more powerful stakeholders. The experts mentioned that this role in Lithuania is taken by environmental NGOs, which pay the biggest attention to environmental goals, but usually don't take into consideration the higher costs of new technological solutions. Therefore, they need to form alliances with the creators of new innovative solutions that could advocate for GT. In addition, some small regional companies see GT as a threat because of high costs of new technologies, however these companies lack power therefore they are dependent on the position of associations that represent them.

Dominant stakeholders do not have an urgency to adopt CE solutions very quickly and usually play passive role in adoption of new transformative solutions. However, when the urgency arises, they easily start the

adoption and promotion activities of new transformative technologies, measures and regulations. Regional public authorities of Klaipeda region should pay attention to the benefits of GT, but do not force it to be implemented too quickly, because there could be negative side-effects, such as loss of competitive advantage, unemployment, bankruptcies etc. In addition, associations, confederations in the manufacturing industry are an example of dominant stakeholders who can either allow or block green transformation depending on their attitude towards an innovation – whether they perceive it as a benefit or a threat to their members.

Discretionary stakeholders possess only legitimacy, but do not have power nor urgency, therefore their role for the success of innovation is often ignored. Experts mentioned that consumers are very important discretionary stakeholders. Gaining acceptance from discretionary stakeholders is an effective way to deal with resistance that innovations often face from incumbents. Support from discretionary stakeholders also attracts powerful stakeholders to adopt innovations.

Definitive stakeholders have all three attributes: urgency, power, legitimacy, and are high-priority stakeholders. Therefore, all other stakeholders are putting their efforts to get these definitive stakeholders interested in GT. On the regional level Lithuania does not have this kind of actors, on a national level the ministries could be considered as definitive stakeholders, however it was mentioned that the ministries don't have an urgency to start GT.

In *Latgale region*, private sector had no urgency 5 years ago, but situation now has changed and most probably will change after 5 years, because of national level planned activities in terms of JTF support activities. GT is in interests of companies, because clients are asking about sustainability principles, how do the companies produce, recycle, save resources and reuse them. It is not only marketing, but also change of production itself. For large companies, energy efficiency results are much more visible than for SMEs. Companies are looking forward someone who will help with relevant information both about planned policies in future regarding energy, green innovations and tax policies, and about available support measures to promote changes. Until now, companies have relied on themselves and other channels of information mainly from cooperation partners. Latgale planning region is trying to communicate with companies, but not all have been reached, and therefore new approaches must be used to communicate with everyone.

Universities can provide scientific and create new solutions to the industry. NGOs and public sector can inform private sector about national and regional level goals and activities, mobilize stakeholders, and create positive environment for changes. If there is not enough information – clear and motivating examples, comparison about gains and losses of GT, it will be difficult to persuade target groups.

Latgale respondents pointed changes in regulation as mobilization tool for companies to transform. 1) Fiscal instruments such as tax policy regarding business support or business restriction. For example, by introducing new tax for natural resource use could prevent its use for purposes when it creates emissions. 2) Availability of support measures, grants, and credits. 3) Information for society, change of habits and patterns. There is a term “do not do significant harm”, meaning that project implementers need to consider activity effect on climate. Important is explanatory work, need to educate society about different climate and environmental questions how we can reduce energy consumption. Information must be credible and adequate – it means that need to spread useful targeted information for specific groups.

Communication needs to be divided by categories – for small and medium size companies, for large companies, examples of best practice need to be different for each group. We also lack full comprehension what are green technologies. Need to involve private sector, inform, and educate it. This could be the task for professionals and sectoral associations. In addition, useful could be promotion examples of best practices. The risk in GT is that operators such as companies, research institutes, organisations and the public sector will choose from the objectives of the transition those who contribute to the operator's own purposes.

Some experts emphasized that consciousness come from early age – from school. It is important to work with the youth and introduce them activities on GT and climate neutrality.

In *Västerbotten*, Sweden, climate adaptation is regulated in various laws and regulations for the public sector. NGOs are promoters in the system and create possible activities for GT. Public sector acts as intermediaries, and promote development of GT, for instance with founding. Companies create new products important for GT, involved in international networks, in research and pilot projects on GT. Universities drive research and development within GT, and educate skilled workers.

Suggestions for better mobilization of stakeholders in the paths towards GT: 1) Building up test system for companies to start testing new products and methods; 2) System thinking from policy to financing; 3) Knowledge and information: Through information and knowledge-raising initiatives, by forming networks and by supporting projects and investments. 4) Building networks for enhancing capacity for transformation. Actors in the same sector apply for funding so that not all actors court individually. 5) Regional strategy that focus on the GT: a common approach for the GT that have a top-down and bottom-up approach. A clear "green" RIS with a focus on conversion and fossil-free energy production resp. fossil-free transport system

In *Päijät-Häme*, different types of organisations are involved, but they should have clear roles, and the operations transparent. Public actors have some power and legitimacy through funding regulation, and they can lead GT. The leading role requires more cooperation and clear communication. The central city of the region, Lahti, has a strong desire and history to act as a forerunner of promoting green values. City of Lahti has also power and urgency to act as an example to other cities and municipalities. Public procurement and their environmental criteria will play an important role in GT. The city's criteria support carbon-neutral and climate-friendly procurement quite well. Lahti Green Capital is one of the successes stories and it is important to use this status in the future to increase awareness of the Päijät-Häme Green Region. Challenge is that local politicians do not talk much in general and publicly about GT. Regional organisations, such as regional councils, play an important role in lobbying. Expectations for public sector and policy institutions are high in guiding, supporting and regulating GT. Politicians and decision-makers in municipalities and cities should commit to GT. For example, a certain percentage of the city's procurement decisions meet the criteria for circular economy. The objectives of the transition should also be reflected in the Regional Programme, which also provides guidelines for the activities of municipalities. GT must be the guiding factor in decision-making.

Universities and educational institutions are particularly interested in promoting change, they have urgency, but not all interviewees experienced them as strong players. In particular, science universities are guided by research interests. And even if research are related to e.g. circular economy, the journey from

research to concrete GT is long. To support niche innovations, the start-up hub activities of universities should be more effective. There was criticism that universities are not successful in commercialising innovation at an adequate level. The region requires more expertise and international network cooperation. Strengthening interdisciplinary cooperation between companies and universities is seen also one way of promoting niche innovation.

Some lead companies are forerunners in commercializing innovations that utilize biological side streams. Green innovations from individual lead companies inspire smaller companies to develop innovation. Smaller SME's need more support, know-how, network cooperation, and funding. Companies are waiting for public guidance and support for GT. The old companies should do things in a new way, and there should be more niche companies that produce radical innovations. Lead companies, clusters and ecosystems take development forward. Big pilot projects are good way to test new technologies and cooperation.

NGO's, in particular entrepreneurs' interest groups and their influence on GT, especially for small businesses, are seen as important and they have some power and legitimacy. Now, for example, the Chamber of Commerce, Entrepreneurs association and Farmers and Forests Owners Union MTK are perhaps more defensive about the stability of companies' operating conditions, rather than encouraging or supporting GT. Their power is strong, especially for small businesses. NGO's should be supportive of the change, but they seem still to defensive old structures. If the renewal required for GT takes place too slowly, the competitive advantage will be lost. According to Farmers and Forests Owners Union MTK, agriculture and forestry are dictated by the EU and are dependent on support EU policy.

Civil society and its role will be bigger when looking GT in practice. In particular, in bioeconomy, in CE, and in the food and beverage industry, the role of consumers is important. Consumers are increasingly able to influence what kind of products are sold in shops.

Climate partnership between SME's and cities/municipalities helps to adapt to new rules and to find new business opportunities. GT must be discussed and facilitated in the cluster cooperation combining quadruple helix actors. There was expectations of brightening the common outlook in GT. Regional actors should establish relations with a wide range of levels and decision-makers. There is expectations about the orchestration of the change, and about an impartial transition leader.

In *Ostrobothnia*, a regionally based global company Wärtsilä is building new R&D facilities in the region. The company is leading GT activities in the region, but pressure for this change has come through EU, Finnish and regional goals for GT. Years of niche-level work has finally meet with pressure from landscape level and this has created a positive "buzz" for the regime change. Companies see more opportunities in looking for societal solutions instead of plain products. Regionally adapted solutions seem to be a necessity for GT in energy technology field and this means that all aspects from society need to be addressed in order to gain the knowledge, which helps to sell new solutions. The cooperation between public and private actors has increased due to GT and new business model to align sustainable solutions have emerged in a short period. The role of this cooperative cluster is significant in developing new energy technology solutions, which will help in making energy production carbon free on a global level. The cooperation can now be turned into new type of business knowledge, which will help companies to sell

global solutions instead of simple products. Companies see public organisations as business partners instead of bureaucrats or legislators.

SMEs may struggle to grasp what GT does mean for them. In addition, some respondents mentioned that large energy technology companies may focus on certain aspects in GT, such as fuel solutions, but in general sustainable thinking is not necessarily required from sub-contractors. It would be useful to help SMEs to recognize the effects of GT, so that they could start more sustainable ways for production. NGOs are in a supporting role, but some of them have taken a more active role in enabling SMEs knowledge concerning GT, through development projects and actions like the CE roadmap.

The respondents acknowledged universities' role and discussions lifted the need for knowledge exchange among the regional actors, where universities can have a role. However, in the GT their role was not seen as important as that of public organizations and companies. They are not participating in all projects in the region, which may be because companies own R&D personnel are more engaged with them. The Smart partner campus is an attempt of the company to have its own campus, which raises the question why the campus in the city was not a viable option.

EU has been a driving force for CE, but the pressure has been milder, and this has not gained focus on carbon neutrality. However, it has started stirring the regime with CE experts as drivers. GT in the field of CE seems to come from top-down, from landscape to niche level. Niche level has also been working on it for years, but more of a recycling point of view and not necessarily from CE point of view. Furthermore, CE requires a solid system (regime change) before new companies can be established, as Finnish market is quite small. Regional development organisation Vasek has prepared the CE roadmap, and is a driver towards GT.

Regional Council has an important supporting role, as it will distribute the GD funds in the region. These funds could be distributed to support more experimental culture in the region and CE-based solutions will require more help from public funds than energy technology does. The support for GT comes through national operational programme, and the region has gained little funding from national level and this of course diminishes possibilities for projects to test things out. Companies are able to take some risks but public organisations do not have this ability and development funds would therefore be crucial. Many respondents expressed a hope that GD funds should this time go to GT actions and not on general regional development. New, experimental business culture was highly hoped.

The role of cities seems to be rising, as they are important focal points for climate battle and seem to embrace more active role in the region. The cities have traditionally been active in recycling issues and could therefore act as a useful platform for engaging with citizens, who have an important role influencing how the market works in the future.

Turf manufacturers need help in their search towards new solutions. Some respondents pondered on the possibility to use still turf as fertilizer as well as the use of turf fields to raise some moss or other equivalent new products.

For construction company's new business models and regime transformation was hoped for, since the way of destroying existing buildings before building new ones is not very sustainable. This culture is strong, and it is difficult to change it. New companies would be needed for the market but it is difficult for them

to break through. Perhaps more awareness of these activities and more pressure through legislation and citizens could help in making them change. It was also addressed that biodiversity is left out from many GD and GT activities, even though changes in ecological ecosystem are permanent in nature.

In *LithuaniaBIO*, ministries set rules and requirements for all national and regional stakeholders. This relationship is vertical, even though there is discussions and consultations between different policies (and ministries) and stakeholders. Ministries have initiated discussions on EGD, recovery, and resilience building plan internally and with social partners, and organized meetings for reflection of various EU documents on GT. However, this revealed that there is no common vision on the implementation of EGD.

Companies have a key role in GT, and they are involved in GT because of market demands it. The products of companies must meet the sustainability standards required by customers. Multinational corporations contribute to increased costs by agreeing on higher output prices. An evolutionary path has been taken to the implementation of environmental issues in engineering industry. In the agricultural sector, there are no significant potential breakthroughs, unless foreign investors inspire them. Agriculture companies have not yet understood that the role of GT will increase significantly in the near future, and export products have to meet green criteria. Companies will have to adapt new regulations and market demand on GT.

Institutions of higher education and universities need to prepare more technologists and specialists who can develop innovative technologies. Education is important aiming to create common understanding. Universities and NGOs can attract public attention towards GT. GT is possible in future with the help of young people, who are more open to changes. Targeted support for GT is also a tool to strengthen a GT. More information and awareness raising tools need to be used for involvement of the older generations.

A useful tool to mobilize different stakeholders to make them move toward GT is to (1) encourage cooperation, (2) participate in various platforms and networks. The stakeholders should be more encouraged in such networks. (3) mobilization through economic benefits.

Table 6.3 presents some policy tools across the paths to GT. The policy tools are at the regional, national or EU-Level. They can be hard tools related to regulation or softer tools like mobilisation stakeholders, communication, and benchmarking.

6.4 Role of regions and different stakeholders in GT today and in future

In the Nordic cases, Ostrobothnia, Päijät-Häme and Västerbotten, the regions seem to be drivers of GT, whereas in the cases of Baltic countries, the drivers are mostly public organization at the national level, and the regions are more interested. However, the large companies in Klaipeda, Latgale and Lithuanian biogas are also drivers of economic development and of GT.

Most of the experts of *Klaipeda* food and beverage agreed that European green deal is a new guiding principal for the future development linking environmental and economic goals. Therefore, Klaipeda region needs a new type of transformative policy to achieve sustainability objectives. The region needs to have a vision of a process of transition, which brings together a range of different sectors of the economy and the environment, thus it needs to build a multi-sectoral approach where they should focus not only

on an investment, but also on legislation and even consumer behaviour. The right mechanisms and actors to govern this transition should be put in place on a fair and sustainable way. This could be achieved at the national level, because the most dominant stakeholders regarding GT are working on that level. The government should think how to use the innovation funding to find solutions, to address the most prominent challenges created by the green deal, work with private, societal, and public actors, and only after that use funds to deploy those new solutions. National government should build capabilities to use the fund for GT and engage all the needed actors on this process. According to the interviewed, Lithuania is lacking a clear strategy and vision on GT both national and regional level.

The regional level should also be taken into consideration as an important actor, because the regions need to find solutions that engage people. Regional government should involve all stakeholders that have right expertise, knowledge and capabilities to deliver strategies, but also ensure that the strategy will be delivered in a fair way: companies impacted by GT should be involved in the regional dialogue.

The main role of the regional government should be to involve all regional stakeholders and have a dialogue to find consensus on how investment funds should be spent that the benefits of GT would be distributed equally. There should be a clear strategy and understanding how the supply of green technologies and innovation could be stimulated among regional SMEs. The primal goals of the region should be an increased number of companies adopting new technologies and product innovations because this would allow regional SMEs to connect into global value chains and create a higher value for global consumers. In addition, due to having a better knowledge of the characteristics of the local labour market, regional government should focus on providing trainings and requalification courses tailored to local companies' needs. Finally, local consumers were identified as an important actors that could facilitate transition, therefore certain actions could be directed to promote the demand for green products and services.

The *Latgale* planning region is like intermediary institution between national level institutions and municipalities and companies in Latvia. It has a role of communicating and informing the municipalities and companies to projects on GT. Latgale is one of the five new planning regions in Latvia, and the regionalization process is going on. The environmental experts pointed the need of leader or leading institution coordinating the GT process and encouraging regional actors to implement GT.

According to the interviewed experts, Latvia's regions are quite similar; therefore it is not so easy to say something specific and different about one region. In June 2021, administrative territorial reform came into force, according to which planning regions are intermediary institutions between national level institutions and municipalities and companies. It has role to communicate and inform municipalities and companies to develop regional level projects or motivate and educate companies for implementing green innovations. Planning regions are willing to have more functions and greater role, but they have still limited capacity and financial resources. If any new support measure with appropriate financing is coming into agenda, it is welcomed and accepted.

Latgale planning region can be seen as interested stakeholder towards GT. GT and green innovations is a new concept also to Latgale planning region and municipalities, and their experience in innovation promotion is still limited. The region can implement projects and receive financing, but it has limited power, legitimacy and urgency. Planning regions have business support centres with the roles of communication, information to companies, and municipality specialists deciding on available support. The region can

provide information, and motivate actors. Latgale planning region is able to support niches and economic actors, but its resources and capacity is limited, it has time and resources for limited communication, and limited projects. GT is not set in regulation as a function of planning region; all activities arise from EU support measures and national level activities.

Each sectoral ministry, planning region and municipality are involved in GT process, but it is up to them to decide the practical steps. Sometimes responsible institutions just do minimum work without looking at actual results. There has not been enough examples of good practices, or information to encourage companies to take steps towards green technologies and GT. Experts expect Latgale region to have more important role in GT. Everyone wishes to have leader and coordinating institution which help all involved parties to communicate, disseminate relevant information, share experience, and push GT forward. Since climate neutrality is a priority both at EU and national level, and JTF activities are focused also on Latgale planning region, the role of Latgale planning region role in promoting GT will increase during planning period for 2021-2027. Therefore, the path we are following towards GT will put the regional institutions and actors in a core role in promoting regime change in the future. This will strengthen the regional level.

Västerbotten is a driver, the regional government (Region Västerbotten) has the responsibility to steer and coordinate ongoing and future projects, and GT is a very high priority. As GT must be a systemic approach and the value chains don't stop at the regional level, it is important to continue to build networks and cooperation. The respondents pointed the role of regional strategies and funding in creating opportunities for GT, and encouraging cooperation of regional actors

Municipalities and regions are making strong efforts for Sweden's climate change, not least in district heating, public transport, waste management, education, and advice. Based on a situation with strained resources, it becomes necessary to prioritize to 1. Increasing the cost-efficiency of the climate policy framework, 2. Accelerating technological development that have the potential to contribute to major emissions reductions and reduce the cost of achieving the government's climate objectives. Specific policy instruments also aim to increase efficiency by addressing other market failures. 3. Tailoring policy to increase effectiveness and efficiency, since the possibilities for change differ among different types of companies depending on size, and capital vs. labour intensity.

Large green investment in Västerbotten is an opportunity effecting other sectors such as housing, infrastructure, skills, and health sector. The experts stated, that Västerbotten should be a front-runner in the GT, and stakeholders at all levels should join to increase the benefits of GT.

The experts saw the regional level as a leader, and Region Västerbotten should have the overall responsibility for managing and coordinating ongoing and upcoming projects. It should also initiate networks. To support the knowledge process as well as create platforms for different actors to cooperate is an important task for the regions. Regional level has better knowledge on opportunities (niches) and bottlenecks for the change. Regions should speak with one voice, point out the vision and create strong ecosystems / value chains that contribute to sustainable development. The region also has an important role vis-à-vis the EU and national level to be a dialogue partner so that the new policy is in the best possible way. The regions can be even better contribute to GT will not happened only by one actor, and we see a shift going from the growth-oriented development to a more sustainable development throughout the system. The regions can trough or financing help the niches, but the niches are affected largely by policies and

financial frameworks as they are often not robust enough and diversification can take place unless the larger (dominant) companies / public sector are interested in testing the new technology. This can create so-called "values of death" when niches cannot finance the next step.

Sustainable should be better analysed and integrated into regional development work. There is a strong belief that region (government) can be a forerunner in GT. There are conflicts related effectively use our natural resources in the adaptation work of GT while there are other interests to take into account such as biodiversity, Sami industries, etc. EU and national level has high ambition to develop the bioenergy, such as biofuels, sustainable housing, clothes etc. There is not enough forest resources for everything, choices should be made, and other sustainable materials searched. Västerbotten has a major challenge in finding the right supply of skills due to the large investments. Here, the regional government can support development and be a link to both national and EU level. Some of the crucial sectors such as electricity capacity to the industry is decided at the national level and are a condition for the GT such as different permits. This can be a bottleneck for development if we can't find a more efficient way to fasten some processes. GT is also pushing the system to make regulations that fits actors and not slow down the development with bureaucratic rules.

Päijät-Häme is a driver of GT based on the long-term environmental work of the region. The clear strength of the region is that green innovations, such as cleantech, energy reduction, environmental technology, water purification, have been influencing the background for the past 15-20 years, which provides a good basis for GT. The experts in *Päijät-Häme* emphasizes the importance of regions in knowledge-based cooperation, and the role of regional business developers to involve SMEs in GT.

The change will strengthen cooperation and interdisciplinary cooperation between forerunner organisations in particular. It is hoped that the concept of regenerative farming will bring new niche solutions, especially in the development of plant-based foods. If cooperation is strengthened, the region's role in GT may also be strengthened in the future. A fair transition is important, since jobs and businesses will be lost in some sectors.

The region *Ostrobothnia* is a driver in GT especially due to its energy technology cluster, seen from national and EU perspective. There are over 140 companies working on energy technology field and most of them will get new orders because of GT. The cluster companies have built alliances with public organizations. New type of business knowledge is created at regional level, which can help to find global solutions. The tight climate objectives and plans of the national actors and the regional capital Vaasa city is a pressure for the regional actors. This means the regime level is going stronger and the actors cooperate closer together to test different solutions, and offer then the solutions to landscape level (export). Region is a testbed for new green innovations. This cooperation has already proven to be effective, as *Aurora Bothnia-ferry* and *Smart Partner campus* have proven. The region has also benefitted from strict environmental goals, as this has created pressure to create solutions, which can make societies carbon free already in 2030 and not 2050. Ambitious goals have turned into ambitious goals on global markets, which is very fitting description of the effects of GT on the region.

CE has different pattern, more top down and landscape pressure. It is not driver, but interested and a keen follower of other regions and solutions. Many steps have been taken, but CE still requires more combined efforts to develop a working ecosystem. Mostly work has been on public hands and has slowly

started to circulate among companies. More actions towards GT are needed and the regional actors will need to learn more concerning its practical application, especially relating to SMEs. The CE requires a solid regime to work on and it is hard to start developing from niche level, as the regional energy technology companies have originally done.

The city of Vaasa has taken first steps as a business developer itself. These processes will change the regional level into something new in future. Collaboration between the city of Vaasa and Wärtsilä may turn into new businesses and jobs in the future, but it may also be that the company is looking for R&D practices on its own and does not engage the local universities. However, this may also act as a huge opportunity for the region as students across the world want to become experts in energy cluster. The development happening in the region is an attempt from Wärtsilä aims to gain credibility as future energy solution provider and lift its profile from a possibly viewed sunset industry (as it used to sell diesel engines) into a thriving sustainable manufacturer, i.e. a true driver of GT. Cooperation between actors will increase, and in the future, the fragmentation offered by the new battery manufacturer may create new opportunities for collaboration and new businesses as well. This collaboration is based on existing networks and people.

According to the experts of *LithuaniaBIO*, Lithuania is interested in the process towards GT. Government should be the initiator of GT. It should educate society, prepare sufficient information, and collaborate with other actors. There is still no systematic approach to the green course in society, and no common green innovation or environmental strategy for all economic sectors with involvement of all Ministries. It is important to involve all responsible ministries in this strategy. In order to strengthen the transformation, it is necessary to educate and inform the society.

The role of the state and regions in GT is important in the design of strategy and an action plan (e.g. Roadmap). The action plan should be accompanied by information, publicity, education, and awareness raising about GT. Role of the region is to support investments when the potential for green investment increases. It is expected that the path towards GT will put the regional institutions and actors in a core role in promoting regime change in the future, which will strengthen the regional level. There will be changes through adjustments of existing industries, skills, regulations, and institutions. Pathway for GT must be prepared with supporting strategic documents. The state must contribute to the transformation of the regime - through allocations, taxes, audits, labelling, etc. The EU regulations leave less room for debate on whether or not to accept the green course. The EU support plays an important role, as it can act as a good catalyst encouraging faster implementation of GT activities.

A good example of networking and horizontal cooperation is the 'Roadmap for Lithuania's industrial transition to a Circular Economy'. This Roadmap is innovative and attracts all kinds of stakeholders who are relevant in the field of circular economy. The main strength in creating the Roadmap for CE is cooperation, co-working, co-creation and horizontal networking on creation of the Roadmap, where all stakeholders are heard and can influence the process. Roadmap might be a huge step in enabling a CE in Lithuania.

6.5 Dynamics in multi-level systems of governance and the challenges on paths towards GT

According to the respondents the pathway towards GT is based on both top down and bottom up. Regulations guide development towards GT, and top down guidance is necessary, since GT is a systemic change in all levels. Legislation, policy and finances come from the top-down and make a framework (incentive) to companies and their long-term investments. Technological and niche based change is more bottom-up, but needs a broad perspective and guidance. New niches are often developed in the supply chain, when important actors find new solutions, but this needs support from a more local/regional actor. Innovations in companies emerge by pressure, which is coming up from the landscape-level and from the consumers. Many reports pointed a need of more and better information from the national level authorities.

The participation in the global value chains in *Klaipeda* industry has an impact on intensity of GT, in particular through knowledge and technology exchange with the firms operating in the global economy or by acquiring requirements provided by partners. Vice versa, improvements in the technology also have an impact on the place of the national economy and its firms in the global economy and specific value chains. Experts have amplified the significance of global value chains as ways to get access to technology and markets. However, Lithuanian food and beverage manufacturing industry is integrated in diverse kind of value chains, and knowledge exchange doesn't happen in every case when a firm from one country interacts with a firm from another country, for example foreign partners from CIS region usually don't require advanced sustainable solutions or certificates. It is important to take into account the needs and opportunities of companies in the context of global competition when making national decisions on green transformation. Experts demanded smarter tools that could enable government to make client-centric decisions based on their positions on a value chain and capabilities to restructure manufacturing operations.

Integration into the global economy can act as important catalysts for change, but equally, alone are not the driver of technology upgrading. Much of upgrading of national firms in the value chains happens because upgrading the economy itself and the firms that constitute it, rather than through the value chains themselves. Here the big role has public organizations that make decisions regarding environmental requirements. Government should not try to move to GT faster than other players in the market, otherwise companies may lose a competitive advantage. The consequences of GT should be assessed, as these solutions are costly in any case. A plan should be drawn up to encourage different actors - suppliers, producers - to contribute to the transformation. In addition, regional agencies such as Enterprise Lithuania or DIHs should provide internationalisation support to reduce the risk of entering new niches and markets. The experts mentioned clarity on target market segments and knowledge on relevant business issues, market potential; go-to-market strategy: client acquisition strategy, product portfolio, value proposition.

The experts on Klaipeda also assumed that technology transfer and GT happen through capital import – foreign direct investment (FDI), networks and subcontracting. FDI is a potential source of more intensive GT. In order to integrate Lithuanian industry into sustainable international value chains, the complexity of measures are required: support in finding export partners; consulting regarding relevant quality or other industry standards and requirements (here agencies such as Enterprise Lithuania may aim to take the

leadership); Regional agencies should make a strategic approach how to attract FDI that would foster green transformation

Latgale respondents had generally different views on GT, but they agreed that at national level GT is implemented through regulation. However, at niche level companies must understand national level policies to adapt new policies. Proactive information to niche level is so important to accept changes and to help plan the future. Despite this lack of information from governmental institutions, companies have their own channels of information which come from international consumers. Consumers are asking about sustainability, about company attitude and production process. Companies can plan their future by answering demands from consumers.

In *Latgale*, a lack of coordinating institution and of leadership for GT is creating challenges for all stakeholders. MoEPRD is most visible institution for GT, but it is not the only one responsible for implementation of sectoral actions. There are Ministry of Economics, Ministry of Transport, Ministry of Agriculture, which also are responsible for certain tasks. Involved are also planning regions, municipalities, private sector, and universities. There should be coordination between actions and support measures. Motivation and encouragement process is partial and is up to each involved party and their interest in this process. Everyone wants to be informed and involved and there are potential for *Latgale* planning region as a leader, there is potential also for NGOs and sectoral associations, which can use their channels and access to companies.

MoEPRD is developing JTF activities focusing on two planning regions – *Vidzeme* planning region and *Latgale* planning region. The regions should elaborate action plan, which corresponds to the activity. It is an opportunity to show themselves as important stakeholders, which manage and coordinate JTF implementation. Support measures will be aimed towards local municipalities and regions for capacity strengthening to support GT, and towards companies for infrastructure development which is needed to reach climate neutrality, support for product development and greening measures, also development of skills, retraining activities for transition to climate neutrality. Someone should provide appropriate information for companies, educate, explain, provide also examples of good practices, and motivate for GT. A comprehensive quantitative survey of largest companies in *Latgale* region is needed. This is also main target group for JTF activities and is expected that the biggest effect we will see if GT will be focused firstly on such large companies.

The experts in *Västerbotten* agreed that sustainable development is a prerequisite for positive economic development and that “business as usual” entails greater risk and higher costs than taking measures now. They pointed, that the success of cooperation of and at different levels is significant for change. The strategies need to supplement each other both at Regional-National and at EU level. A better leadership is needed at all levels. The big actors already priorities this, but the whole values chain with suppliers, research and innovation actors as well as new skills should be supported towards GT. *Västerbotten* has a strong sustainable ambition and a chance to get resources to make a sustainable energy transition. Many actors have already started their path towards GT and are positive to the changes, and financial approach needs to adapt so that it is easy for stakeholders to get support to GT development.

GT is not a new or strange topic for the actors in *Päijät-Häme*. Much has been done about the environment for several decades. The environmental experts selected for the interview dealt with the transition

from very different perspectives, not just from their own point of view. The challenge is that if the communication, orchestrating and support for change at different levels of actors is not successful, the region will be overshadowed by the regions that have succeeded in this. Political disagreement on climate change and emissions targets, are already dividing decision-makers. Conflicts between different value worlds are quite likely to intensify. This can be seen at all levels at EU, national and regional level. The recovery and other funds should genuinely target at measures that will preserve biodiversity. GT might be driven more by the pursuit of growth and support for unsustainable businesses.

Among the interviewees in Päijät-Häme, the city of Lahti and the development company Ladec were interested in making a joint event with the Regional Council regarding the importance of GT in the region. The event should highlight in particular, what GT means in concrete terms in Päijät-Häme, and for different stakeholders, and for individuals. In addition, tools will be put together to promote and communicate GT in the region as clearly as possible.

Also in *Ostrobothnia*, many risks and uncertainties are related to political processes. For example, climate goals are sometimes a political compromise and not based on facts directly. Tight timetable is one such example; although the companies can potentially benefit from it, the development of such technologies will cost more money. One respondent described this: “Everything can be achieved already with slight tweaking of current technologies; it’s simply a matter of values. However, faster solutions will cost more money.”

Landscape level is crucial, as national funds may help in developing a more experimental culture and this may turn out to be hindrance if national level does not recognize the GT potential in the region.

LithuaniaBio report pointed, that since Lithuania is still a moderate innovator, top-down acceleration might be significant to move fast particular on urgent solutions, which would knock out the fields of activity. The bottom-up process will happen, in case the favourable environment will be created for the GT-focused solutions. First of all the crucial role in this combination is played by knowledge and education regarding the issue. Secondly, financial support is necessary to make the pathway acting. No transformation is possibly only on a voluntary basis or spatial initiatives. Thus, the funds should be allocated prudently and systemically, to reach the actual desired green transformation. Therefore, trust, responsibility and transparency in these processes are the crucial factors for a fruitful turn forward

There are several challenges on the path towards GT. Stakeholders should work together to promote and implement GT and not to focus only on internal communication or daily matters. In many cases, companies collaborate with other companies. There is a need for a greater transparency of public support through agencies. The public sector must create transparent, open and equal conditions for all. The aim is to avoid (1) interest groups that are aiming to represent only their own interest and (2) interest groups that would like to get exceptional rules for their participation in the market to get funding.

Table 6.3 Some policy tools towards GT mentioned by the respondents

Tools	Contents	Outcome
-------	----------	---------

Regulation	Changes in regulation motivate companies to transform and make green innovation Tax policy regarding business support or business restriction	More actors participating in GT More green innovations Green growth
Incentives , Drivers	Economic incentives R&D	More actors direction GT More green innovations
Mobilisation, Cooperation	Encouragement of cooperation, participation in various platforms and networks Encouragement of urgency of dominant stakeholders <i>Building networks to upgrade capacity for transformation</i> Climate partnership between SMEs and cities	Cooperation helps to adapt to new rules and to find new business opportunities. .
Benchmarking	Promotion of good practices, which are clear and motivating examples	Learning from others, reflecting and developing own innovation system
Experimentation	More experimental culture Pilot projects as a testbed of new technologies, products, methods, and cooperation	Companies see opportunities in societal solutions Regionally adapted solutions for GT can gain knowledge on new solutions
Education Civil society	Education in schools	New generation open to GT
Research System thinking	Quantitative survey of companies Clearer definition of GT Research on potential of GT	Building innovation ecosystem for green activities and CE All aspects of society and region is transformed
Information, communication	Everyday life examples for stakeholders Concrete achievements towards GT more visible. Targeted and credible information for specific groups Joint event on GT in the region	Better communication and enhanced capabilities of stakeholders towards GT. Change in mind set of stakeholders
Strategic tools	CE should be seen as a process Systemic strategic goals for sectors	GT should be the guiding factor in decision-making.
Tools towards public government	City's procurement decisions meet the criteria for circular economy. Soft instruments to encourage faster transition to more resource efficient technologies or products	Green transformation of public organisations and innovation policies
Tools towards companies	Public support on the "green" impact of technological solutions: tools for measuring and developing a company's CE	Companies able to transform and are involved in GT

	performance; services and audits to support in identifying processes or technologies that could be upgraded	
--	---	--

6.6 Summary

Even if GT has a clear objective, such as zero emission and climate change as well as saving resources of our planet, the foundations of the notion should be better defined and communicated in research and in the EU and national documents. The notion of GT is similar with notions such as sustainable transition, energy transition, deep transition etc., but it emphasises more green growth. There was evidence of some misunderstanding of the notion of GT. Generally, more information and communication on GT is needed.

Renewable energy and circular economy are key fields of our cases. However, the contexts of the cases vary, but in all cases, we can find interaction between landscape and actor-based microeconomic development (niches). Most of the respondents selected regime transformation as the main path towards GT. However, the experts also saw possibilities for new actors and activities, and the importance of technological substitution, especially in longer term. Many respondents saw also dealignment and realignment as well as regime reconfigurations as possible paths towards GT in longer term. Landscapes evolve constantly and change fast due to regulation and legislation. They refer to national and EU governments and value chain configurations. Respondents emphasised both top-down and bottom up (niche) development.

Regions are important in the multi-level- governance towards GT. They are more drivers of GT in the Nordic cases, in Baltic countries regional actors seem to be more interested, even if some large companies and public organisations also are drivers. The coordination is vertical compared to the Nordic cases. In future, the role of regional level will be stronger in the path towards GT.

Regions or regional actors can be ‘agents of change’, depending on their motivations, political powers, and capabilities. Regional actors can influence the way GT is affecting their economies and societies, and at the same time, they are able to shape GT in their regional strategies. Some stakeholders might see GT as opportunity, but respondents pointed out that threats can - at least some degree - be turned to opportunities with more information and communication, as well better coordination and right targeted support.

There is also some evidence that incumbent economic actors are re-thinking and reconfiguring their original business models due to GT, which influences the smaller companies for GT.

The actors and activities outside the regional sphere influence the GT. There were both economic influence in terms of value chain perspective to the production, and multi-level governance to the development activities. Value chain activities are diffused across different organisations. Global value chains can be as levers of green technology and give incentive to transformation. They are also a way to get access to technology and markets. Multi-level governance is complicated setting, in which EU- and national institutions are important building the landscape level.

Place-based resources might enable and contribute to the processes of GT. However, they depend of the development history of the regions, such as institutions, quadruple helix arrangement, and markets.

Respondents pointed different perspectives on GT, and the fact that there will be both winners and loser in transformation. There is need for common understanding, as well as transparent and just strategies. The strategies should be designed and implemented in partnerships, such as public-private partnerships or climate partnerships, which means generally co-operation of quadruple helix actors towards GT. In addition to the coalitions, visions appealing all actors and inhabitants, and articulation of common interests are important. Some regions/respondents emphasised the need of leading institutions or coordinator in GT. The role of a leading institution is to inform and engage different stakeholders, identify different interests and capabilities of stakeholders, mobilise stakeholders, and coordinate efforts towards GT, and possibly lobbying for regional interest at the national and EU-level.

7 Green Transition in BSR

7.1 Landscapes are changing fast

Today, landscapes around BSR are changing fast. Mother Earth is pushing for urgency across the globe. The space for dormant, indifferent or ignorant stakeholders (position 1, 2 and 3 in the stakeholder analysis referred to above) is rapidly shrinking. But in terms of policies, powerful stakeholders are still not aligned in a definite position supporting a clear GT strategy. Instead, the contrary positions of dangerous stakeholders are filling up. There is a pressure for change, but the direction of change is still unclear, and there is a lot of resistance against the on-going efforts of landscape level co-creation.

The EU Commission has taken several bold initiatives recently, building the definitive core of the strategy, with suggestions of new short-term objectives (2030), with carbon tax and other crucial regulatory instruments which is aiming at kick-starting the road towards ZNE 2050 across several sectors, agriculture, forestry, energy, metal, housing and others. However, there is an on-going struggle inside EU, with countries and sectors also on the dangerous side, defending positions which will be lost if the strategy is implemented. There are positive but also mixed signals coming from other dominant stakeholder, such as USA, China, India and others. However, most major discretionary stakeholders have internal problems, with strong internal dangerous stakeholders, as well as formations of dominant stakeholders, powerful actors who are in the game, but not yet converging into a definite position.

Thanks to the initiatives inside the energy industry itself, such as the IEA strategy referred to in the introduction, the basic building blocks of green growth are slowly moving in place. Inspired by promises and expectations of future regulations, several major actors inside the technology sector are moving from a position of dangerous stakeholders into a definitive position. They continue to produce oil and gas, but they stop investing in exploration of new fields. Instead, they invest in green energy production. This means that the energy sector itself is not moving from a “sleeping giant” into a “dangerous stakeholder” position where they defend their interest against emerging clusters. That move might have stabilized the hegemony of oil, gas and coal and blocked the way for green energy. The world could have moved into a brutal technological shift. Instead, we see a process of de-alignment and re-alignment, where green niches become powerful and hegemonic through utilisation of and integration into oil industry money, institutions, companies, technology, infrastructure and skills.

This has led to a powerful alliance of financial capital, economy and technology inside the definite stakeholder position 7. It has opened a path to green growth. As illustrated below, from a slow start, green energy is following an S-curve of diffusion, with rapid growth which slows when it becomes mainstream, as illustrated below. We are now in the beginning of this growth phase of the S curve, which will flatten out 10 years from now.

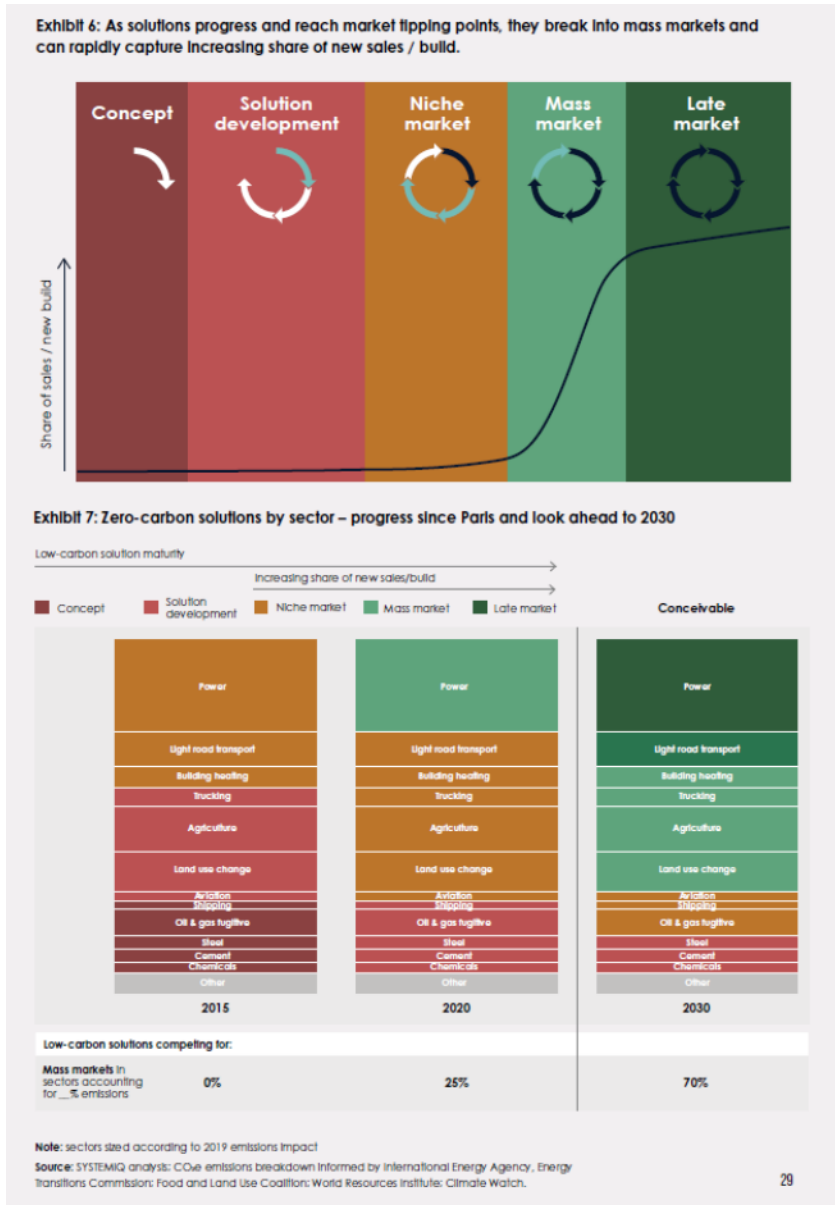


Figure 7.1 Diffusion of green technology 2015-2030. Source: Systemiq 2020: 29.

7.2 How does the roadmap look like?

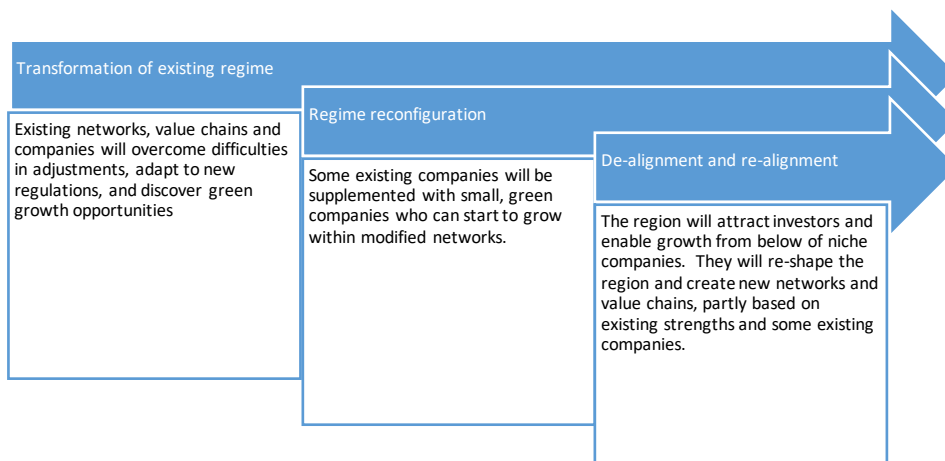
Technological transformation means that one regime or technological paradigm replace another through a process of creative destruction. This was the classic case of the industrial revolution in England in the early 19th Century, when factory production, driven by coal and steel, replaced and marginalized craft-based production of textiles, other sources of energy and other materials. It was repeated in different parts of the world, in many sectors. Characteristic features are that the powerful stakeholders of the old regime are destroyed. They are unable to take the leap to the new technology, because it is too long. They resists the new, emerging regime. They may succeed in stopping it in some regions and sectors for a while.

The process is characterized by polarization between dominant stakeholders supporting the new regime and dangerous, marginalized stakeholders defending the old. The result is polarization in winners and losers.

As demonstrated above, our informants anticipate a slower transformation based on inclusion of existing stakeholders. If so, we are facing another possibility, an extended process of transformation, which goes through three phases. It starts with incremental transformation of the existing regimes and moves from there into a broader process of reconfiguration, a state where the old regime can still be recognized, with substantial changes, and then into a radical transformation, referred to as de-alignment and re-alignment, where a new regime is formed, based on related components of the old regime. A characteristic feature of this extended process is that stakeholders are transforming themselves, and adapting to change in a way which opens up to new roles, including conversion of their old skills and technologies into the new regime.

This process of transformation is taking place through core stakeholders who are able to bridge the gap, by taking the role of dominant stakeholders, connecting to macro level changes and “take green growth home” to the region.

.... in all cases we can find place based, regional interaction between landscape and actor-based microeconomic development (niches). Most of the respondents selected regime transformation as the main path towards GT. However, the experts also saw possibilities for new actors and activities, and the importance of technological substitution, especially in longer term. Many respondents saw also dealignment and realignment as well as regime reconfigurations as possible paths towards GT in longer term. Landscapes evolve constantly, and change fast due to regulation and legislation. They refer to national and EU governments and value chain configurations. Respondents emphasised both top-down (landscape) and bottom up (niche) development.



7.3 The role of the regions

A successful transformation is going to create winners and losers. Accordingly, it creates a lot of resistance from powerful stakeholders. Mother Nature herself is playing an important role, as she reminds us of the looming dangers created by climate change. This is the domain of policymaking where deals have to be made between competing stakeholders, some winning from green growth, and some losing. Somehow, regulations promoting transformation will be implemented, and losses have to be overcome. This transformation is place based; it is going on in regions.

Regional actors need to actively manage the transition towards a more sustainable social, technical, economic and environmental system and adapt to the external changes in the landscape. There are many differences between regions: the types and severity of environmental impact, resources available to regional actors to deliver the transition, groups of actors, networks and institutions, which can be involved in the transition process to drive or support the process, and stakeholders who may oppose the process. Capacity for technological innovation, the political strength of fossil fuel incumbents, potential for nature-based solutions will also differ, as will visions and priorities.

Based on the importance of public organisations as main drivers of GT it could be stated that public smart specialisation activities have been and will be important avenues to continue discussion on regional level. As many European funding instruments are already regional and connected to smart specialisation, they offer a way for aiding regional green transformation and help in understanding the challenges and opportunities within regions. Regional entrepreneurial discovery processes become more and more important avenues for understanding green transformation.

In addition, different transition processes will take place at different geographic scales and will require policy responses at the relevant level. Carbon tax and carbon tariffs are two examples of national policies with clear implications for global trade and competition. Support schemes for renewable energy or changes in national educational curricula to reflect future challenges are national and EU policies, other events and related policy challenges are regional or local in nature, such as the structural impacts and job losses related to phasing out coal power plants.

The concept of multilevel governance is therefore highly relevant to transitions. The scale at which processes need to be governed depends both on the distribution of competencies and resources as well as on the geographic scale of drivers and impacts. Ideally, these two, the processes that need to be governed and the responsibilities, are aligned. Multi-level governance of sustainability transitions is therefore required.

A regional and local approach to transitions also allows for policy innovation and experimentation. Regions and cities are important for implementing innovative governance approaches and serving as sites of experimentation. While governance systems are already largely set out by EU and national legislation and policy, there is significant scope for creative approaches. The regional and local level is also important for innovation, especially in the creation of protected niches necessary for transformational innovation. The regional level allows for experimentation through the creation of experimental conditions at a small-scale local market, such as local support schemes, networking of local actors, building on local innovation potential, local niche consumer segments, etc.

Seen from the point of departure of EU cohesion policy regions are suited to deliver sustainability transitions for a number of reasons:

- Cohesion policy implements investments, which are relevant at multiple scales. It is place-based, therefore it is suited for delivering sustainability transitions which focus on co-creation within a local context. It also implements investments, which are relevant on a national scale, which is required for large scale roll-out of new technologies and solutions.
- Transitions require a multi-sectoral integrated approach, in particular a link between innovation and diffusion, but also between other socio-economic system elements such as infrastructure, labour markets, skills, and education. Cohesion policy has a strong focus on integrated approaches to development and therefore it is suited to delivering sustainability transitions. It also has a strong focus on innovation.
- Sustainability transitions are expected to have significant investment needs as well as capacity building needs. Both investment and capacity building can be delivered by cohesion policy.
- The partnership approach of cohesion policy can be aligned with the co-creation approach of sustainability transitions.
- There is a demand for strong and pro-active public sector taking the lead in the regional and national strategy of transformation. We are talking about a multisectoral approach growing a different innovation ecosystem.
- Smart specialization has offered a forum for public-private discussion and could be used more actively for looking at green transformation challenges and opportunities. Related funding instruments are also useful in encouraging pilots and experimentation.
- There is also a need for information and education on the background of the transition, as well as education of workers and specialists implementing the change in practice. More efforts to change peoples' habits are needed, as well as clearer definition of GT and common agreement on it. Systemic change is for the whole society.

References

- Economist 27.10.2021 on Yoichi Kayas formula. <https://www.economist.com/special-report/2021/10/27/the-economics-of-the-climate>
- European Commission (2021). Delivering the European Green Deal. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en#working-with-nature-to-protect-our-planet-and-health
- Geels, F. (2006). Co-evolutionary and multi-level dynamics in transitions: the transformation of aviation systems and the shift from propeller to turbojet (1930–1970). *Technovation* 26(9), pp. 999-1016.
- Geels, F. (2019). Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective. *Current Opinion in Environmental Sustainability* 39, 187-201.
- Geels, F. and Schot, J. (2010). The Dynamics of Transitions: A Socio-Technical Perspective. In John Grin, Jan Rotmans and Johan Schot: *Transitions to Sustainable Development. New Directions in the Study of Long Term Transformative Change*. Abingdon: Routledge, pp. 11-101
- Geels, F., Turnheim, B., Asquith, M. Kern, F. and Kivimaa, P. (2019). Sustainability transitions: policy and practice. EEA Report 9/2019. *European Environment Agency*. Luxembourg: Publications Office of the European Union.
- Giulio Boccaletti says more. an interview Nov 2, 2021. Project Syndicate. [An Interview with Giulio Boccaletti Nov. 2, 2021 by Giulio Boccaletti - Project Syndicate \(project-syndicate.org\)](https://www.project-syndicate.org/interview-with-giulio-boccaletti-nov-2-2021)
- Greta (2021). GRETA. Available at: <https://www.lars-project.eu/home/>
- IEA (2020). Net Zero by 2050: A roadmap for the global energy sector. Available at: <https://www.iea.org/reports/net-zero-by-2050> (accessed 10 September 2021)
- Johnson (2021). The Green Recovery is up to the Regions. LARS Newsletter 6, 3-4. Available at: <https://www.lars-project.eu/results/meetings-and-events/lars-newsletter-6>
- Mariussen, Å., Mäenpää, A., and Virkkala, S. (2019). Revealing of the Innovation Potential in Baltic Sea Region – A Comparative Analysis, LARS WP3 report. <https://www.lars-project.eu/>
- Mariussen, Å, Virkkala, S., Finne, H. and Åsen, T. M. (eds) (2019). *Entrepreneurial discovery processes and regional development: new knowledge emergence, conversion and exploitation*, Routledge
- Mitchell, R.K., Agle, B.R. & Wood, D.J. (1997). Toward a theory of stakeholder identification and salience: defining the principle of who and what really counts. *The Academy of Management Review* 22:4, 853–886.
- Ritchie, H. and M. Roser: Emissions by sector [Emissions by sector - Our World in Data](https://www.worldometers.info/emissions/). (accessed oct 18, 2021)
- Smart Specialisation Platform (2021). European Commission. <https://s3platform.jrc.ec.europa.eu/>
- Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review* 20:3, 571–610.
- Systemiq (2020). The Paris effect. How the climate agreement is reshaping the global economy. https://www.systemiq.earth/wp-content/uploads/2020/12/The-Paris-Effect_SYSTEMIQ_Full-Report_December-2020.pdf

Attachment 1. Questionnaire

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 downscaling

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? Add your own picture here

Do you agree with this transformation of different actors? Example table

Stakeholder	STK type in GT		
	STK level*		
	5 years ago	now	in 5 years
Company 1	4	5	5
Company 2	4	4	5
Company 3	5	3	5
University 1	4	5	6
University 2	4	5	6
University 3	4	6	6
Public organisation	5	6	6
Public organisaiton	6	6	6
Public organisaiton	1	1	4
NGO	3	3	5
NGO	5	5	6
NGO	4	5	6

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

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?

Stakeholder in the interventon area X	How do stakeholders view GT?		
	Yes or no		
	Opportunity	Threat	Green washing
Company 1			
University 1			

Public organisation 1			
NGO 1			

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?