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Report

Regional policies for green growth Nordic experiences

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ABSTRACT

Regional councils find many roads to green growth

The report discusses policies for green growth of a number of regional (or county) councils in Finland, Norway, and Sweden. These policies, which vary in scope, in ambition, and in degree of place-basedness, provide fertile meeting grounds for policy traditions for decarbonization of public services through public procurement and for innovation oriented growth initiatives. They mostly succeed maneuvering within constraints given by existing industrial structure and by inconsistencies in national and international policies, by leaning on second generation innovation system capabilities (correcting for market and systems failures) built over time. The more experimental initiatives involving a stronger directionality seem to benefit from place-based leadership in transforming both institutional settings and socio-cognitive orientations towards what it means to be green and to grow at the same time. Towards the end, we also discuss some challenges ahead, given that all regions are not equally well equipped for these transitions as the ones in our sample, and also given that the policy cases in our sample only to a smaller degree have addressed the heavier systemic restructurings required for successful transitions towards sustainability. Coordinated monitoring is recommended for systematic learning.

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PREFACE

This report is an output from the project "Where does the green economy grow? The geography of Nordic sustainability transitions (GONST)" and its work package on policy learning for green growth. The project is a collaborative effort between researchers from Lund University (LU) (coordinating partner), Aalborg University (AAU), University of Tampere (TAU), Technical University of Denmark (DTU), Nordic Institute for Studies in Innovation, Research and Education (NIFU), and SINTEF. Funding is provided by NordForsk (grant #83130) under The Nordic Green Growth Research and Innovation Programme – which is a joint undertaking with Nordic Energy Research and Nordic Innovation.

The report documents findings on the roles of regional authorities in promoting green growth regions in the Nordics studied in the project. Since most of the data was collected in 2018, concrete aspects of the cases described may have changed. This does not necessarily change the more general aspects of the processes that we have drawn from the case descriptions.

The report is written by Håkon Finne (senior research scientist at SINTEF Digital), Markus M Bugge (now associate professor at the University of Oslo, Centre for Technology, Innovation and Culture), Teis F Hansen (now professor at University of Copenhagen, Department of Food and Resource Economics and senior research scientist at SINTEF Digital), Suyash Jolly (now researcher II at Nordland Research Institute), Markus Steen (senior research scientist at SINTEF Digital), and Nina Suvinen (researcher at Tampere University, Urban and Regional Studies Group).

We thank the funding agency and all who have contributed to our improved understanding of the roles of regional policy and hope the present synthesis will be of use in further work.

Trondheim, 2021-06-21

Håkon Finne
Work package leader

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1 INTRODUCTION

1.1 Framing the issue: Regional policy for green growth

The Nordic Green Growth Research and Innovation Program has been set up to harness co-operation between researchers in the Nordic countries for the purpose of accelerating the transition towards a sustainable Nordic society¹. The GONST² research project contributes to this by focusing on how these transition patterns vary (or not) between subnational regions and how resources, economic, and political factors contribute to these differences. Such insights may be important in enhancing policies and actions to accelerate the transitions.

Decarbonization of industrial and other processes is a, if not the, paramount goal of these transitions. Even if this direction is given, however, the path is certainly not unproblematic. It may vary on several dimensions, and even within each dimension, some straightforward ideas meet with dilemma-like perspectives that permeate the accumulating, but far from complete, understanding of these matters. The GONST project and similar endeavours relate in some way to the following four:

- **Greener practices:** The transition towards a sustainable society depends to a great extent on changing unsustainable private and public sector practices in production and consumption (Stahel, 2019). However, many of these changes are not effortless and, in sum, certainly do not come for free (Barbier, 2011). Then, how will the costs and the benefits be distributed?
- **Greener structures:** The transition will even involve restructuring of large and complex socio-technical systems for providing sectorally differentiated social and economic functions (Kanger and Schot, 2019). However, the change processes will often amount to addressing wicked problems (Roberts, 2000) where there are no optimal solutions satisfying all actors. Then, how will smaller steps and grand plans interact in creating acceptable outcomes?
- **Regional differentiation:** The development paths of regional economies vary greatly and depend on natural endowment, institutionalized patterns of private and public governance, specialized knowledge creation and its application to the use of available resources, and social capital (Martin, 2011). However, the degree of dependence on, or lock-in to, these specific paths will most certainly influence the speed and direction of their transition (Martin, 2010) to paths that are more sustainable. Then, are there important interactions to consider between regional and national/international developments?
- **Regional policy:** Public regional authorities may be in a prime position to influence these regionally differentiated transition processes through their policies (Asheim *et al.*, 2006). However, their strategies in this field are as prone to experimental failure or success as at other levels of government (Cinar *et al.*, 2019). Subsequently, although successful regions could pave the way for other regions as well as entire nations, prime movers in policy innovation could even decelerate rather than accelerate the aforementioned transitions if their experiments fail. Then, are there policy spaces where regional authorities can expect to be more effective or efficient than others?

¹ <https://www.nordicinnovation.org/programs/nordic-green-growth-research-and-innovation-program>

² The full name of the project is Where does the green economy grow? The Geography Of Nordic Sustainability Transitions (GONST). It studies status and development in Denmark, Finland, Norway, and Sweden, primarily at the level of sub-national regions delimited by political-administrative boundaries.

The fourth of these perspectives is the main concern of the present report, but always with a view to the three others, which are pre-eminently visible in output from the other work packages³.

In the following subsections we consider what the concepts of green, growth, region, and (public) policy as sketched above might mean and how we apply them in the present report.

1.2 Visions and pathways: Green economy, green growth, and sustainability transitions

Green is the catchword characterization of economic and social practices and structures that benefit the natural environment, partly as a value in itself, and partly as a necessary condition for sustained human life and well-being. The question of sustainable green development has come to the political forefront internationally over the last few decades in response to sustained crises in climate, biological environment, and resource supply. Needless to say, the wide range of beliefs in both problems and solutions makes the change processes complex, and the global character of many of the problems stresses economic, social, and political systems alike, which in turn influences the actual solutions developed, adopted, and implemented (Capasso *et al.*, 2019).

It is not a given that continued economic growth, no matter how green, is the answer to the larger climate and environmental crises. Some see growth mechanisms in themselves as the main culprit and call for degrowth⁴. A green economy may be one which is heavily regulated and sanctioned in its practices and restricted in its growth. Others acknowledge limits to growth but opt for changes in growth patterns that result in globally more equitable conditions of life.

Obviously, organized production and consumption processes will also exist in a green economy, and even though they will have to differ in many ways from today's practices, it is difficult to imagine them without innovating firms and modern technologies in key roles. Private firms will also no doubt have to play important roles in transforming the socio-technical architecture of the systems that provide food, transport, materials, consumer goods, services, and investment goods. Even a net no-growth green economy would rely on growth in green sectors and practices to replace their non-green precursors.

Furthermore, influential researchers foresee that the participation of capital owners and other economic actors will be essential in designing and implementing the various transition processes and their outcomes⁵. This is not only because financial capital is controlled by powerful interests that need to be accommodated, but also because they command productive powers required for the transitions – powers that are well-organized and probably sufficiently flexible to be reconfigured for new practices. Successful innovators in this field will subsequently be followed by actors that do not want to be left behind. Hence it may make sense, even in a net no-growth scenario, to work with the Schumpeterian drive for profitable growth by the first successful innovator and eventually resulting in a creative destruction of old structures (Schumpeter, 1934) – provided, of course, that the innovations are green.

³ The other work packages concern skills and technologies for green growth, institutional change, comprehensive sectoral case studies, and a literature review. See <https://www.gonst.lu.se/publications> for an overview of outputs from the project.

⁴ <https://www.degrowth.info/en/>

⁵ See, for example, Carlota Perez' ongoing work about a positive sum game at www.beyondthetechrevolution.com, with reference to how earlier technological revolutions have enabled new development patterns resolving systemic social deadlocks.

The OECD holds strong influence over its member states and also over important economic actors in the industrialized world. The OECD's conceptualization of green growth has gained prominence. They acknowledge that while economic growth in the past has delivered the material basis for social development, it has done so at the cost of a series of crises in resource depletion, air and water pollution, climate change, loss of biodiversity, and social inequity and destabilization. These are changes that in themselves threaten the well-being of future generations. Significantly, they also threaten the economic system itself as a contributor to future growth and prosperity without such negative externalities. Private and public actors need, according to the OECD, to make individual and collective changes within and between sectors in order to restructure economic and other activities in a green(er) direction. This may involve the regulation of certain activities but will at the same time open up new opportunities for growth by actors that are ready to divert from the wasteful trajectories in which many are partly or wholly locked in. The economic and political strategies required to make the economy sustainable is what they call green growth, formulated as "fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies" (OECD, 2011 p. 9).

A seemingly more neutral formulation of the definition is that of the United Nations, economic growth that is decoupled from (natural) resource use and environmental impacts (Fischer-Kowalski *et al.*, 2011). While this latter definition is less partisan because it does not directly entertain the notion of the primacy of the growing economy as the source of well-being, it may also be stricter because the OECD definition may, *i.a.*, make allowances for temporary exploitation of certain materials while waiting for alternative sources to become available. In this report, we use both these conceptualizations as guidelines for our work rather than as strict definitions.

We have also indicated that large socio-technical systems may have to change drastically for achieving green solutions in many sectors. For example, fossil free transport requires vehicles with another kind of engine, a distribution network for energy carriers that is different from the petrol trucks and petrol stations, fortifications and extensions of electrical distribution grids, increased production of electrical energy from renewable sources, new regulations for funding these extensions, and so on (Geels *et al.*, 2012). Such far-reaching change processes are part and parcel of the greater societal transitions towards structures that are ecologically, economically, and socially sustainable.

1.3 Regions and regions

We have already alluded to the multiple uses of the word region as pertaining to not only a territorially bounded area but also one that has a certain functional or structural homogeneity. In a **political-administrative** context, a region counts as such because it is under the jurisdictional governance of a public administrative body. This body is usually the executive arm of a council democratically elected, directly or indirectly, by the inhabitants of that area, but it can also be a regional branch of a state agency. These regions are typically larger than municipalities and smaller than nation states, and the territorial areas are mutually exclusive and usually cover the entire country. Their territorial boundaries are typically stable over decades, a fact that is important for the maintenance of statistical time series and other social constructs of what a region "really" is. However, definitions vary between countries, relevant public regional authorities may overlap territorially between them even within a country, and regional reforms sometimes restructure both the territorial boundaries of the regions and the mandates and responsibilities of the political-administrative units in question. In Europe, some regions are very large and practically assume the role of a state, recently also sometimes

with much higher ambitions of directed intervention in developmental affairs than what is generally the case of nation states (Gustavsen *et al.*, 1998). Other regions are essentially either large municipalities or a relatively weak collaboration structure in limited domains for smaller municipalities. In the Nordic countries, the span is much smaller, but there is still some variation between countries, and the structures are in flux; see the appendix (chapter 7).

In an **economic** context, which is the other main functionality considered here, a region may be vaguely defined in the terrain, but nevertheless have in its core a strong cultural identity, a production regime and institutions adapted to its natural endowment, a common labour market in one or more industries, active networks of economic and support actors, or other characteristic features that distinguish it from other regions, features that may be decisive in its economic performance and social development.⁶ Even though such regions may not coincide territorially with political-administrative regions, it is their functional homogeneity that is of interest, except for in one important matter: The various public regional authorities may have a significant influence on social and economic development within their assigned jurisdiction (Benz and Fürst, 2002). This also tends to draw empirical research on the regional aspects of economic development towards a preference for studying economic development within administratively defined territorial regions.

In the present report we take political-administrative regions as a point of departure also for the analysis of economic development because of the focus on public policy, but stretch the territorial scope wherever required for proper understanding. We also encounter regional reforms in several countries, reforms that may change both the territorial extension of such regions and the domains over which the various public authorities have their jurisdiction. Also note that we distinguish between regional authorities and the territories over which they have a mandate, whether they have different names (as in Norway: "fylkeskommune" and "fylke") or identical names (as in Sweden: "region" and "region"). We do this by reserving the word region for territorial entities and the terms regional council etc. for organizations.

1.4 Regional vs national vs local policy

Although this report is about policies for green growth, we treat the regional/national/local scale first at a generic level because policies for green and for growth come from different domains with each of their trajectories. We return to the merger of policies at the national and regional scales in section 1.6.

There are three main reasons for regional authorities or agencies to exist and to be responsible for public policies: the **practicalities** of territorial proximity, the (relative) **autonomy** to prioritize according to the regional population's own preferences, and the specific **knowledge** that stems from being embedded in social, economic, and political life in the region. There is often a practical need to be closer to the target audiences of policies, regardless of whether the policies are state-wide or region-specific in kind or in quantity. And inhabitants of a region may stress their right to choose their own directions through democratic processes. Even though a regionally differentiated understanding could be maintained by a central government, being more or less embedded in the struc-

⁶ There may, of course, be territories where the economy is not sufficiently homogenous to count as an economic region in this sense. Many of the studies that identify what makes some regions stand out economically are looking at the regional character of the economy rather than the economic character of a region (Benz *et al.*, 2000), either in terms of their endowments, their externalities, or their evolution dynamics (Martin, 2011).

tures that the policies are aimed at improving will often lead to a better understanding of the functioning or needs in the region in question, as a nuancing of generalized knowledge of the domain in question. These three main reasons are not mutually exclusive, which also means that they may result in converging or diverging policy outcomes within each region.

Policies that are region-specific in kind are, of course, strong candidates for regional formulation and execution. Place-based regional strategies clearly belong to these. While former research and innovation strategies at the regional level in the EU, for example, tended to follow a more or less uniform pattern determined by a linear science-technology-innovation model, the current understanding is that one size does not fit all (Tödtling and Tripl, 2005), with regional innovation system types as preconditions for suitable innovation policies (Isaksen and Tripl, 2016) or regional industry types for regional green growth policies (Grillitsch and Hansen, 2019), not to mention the emphasis on place-based strength development in smart specialization strategies (Balland *et al.*, 2019).

There are also some reasons for keeping public policies at a national level. In addition to downplaying the three main regional arguments, there are three main arguments for keeping the responsibility at the national level. One is about **effectiveness**: national policies will give the homogeneity of terms and the scale of efforts that may be required to achieve the targets of the policy. A second one is about implementation **efficiency**: Operating policy measures from one national source is usually more cost efficient and requires less human and financial resources than the delegation of the same or similar measures to a number of regional authorities. A third one is mainly **political** and questions the need for a political level of (semi-)autonomy between the national and local levels of democracy.

At the other end of the scale, cities have been suggested to be prime candidates for climate change governance. They are in general responsible for infrastructure and public services where most people live, and their direct interventions can be an effective way to reduce greenhouse gas emissions through these systems. Perhaps equally important is the advantage of mobilization and engagement at the local scale, at least when specific local combinations of needs, challenges, and opportunities can be addressed in experimentations that can not only solve these but also associate the solution with the city as a forerunner (here after Madsen and Hansen, 2019, which contains the original references). While the former (**authority**) advantage clearly extends to regional councils in charge of said infrastructures and services, the latter (**engagement and mobilization**) advantage may depend more on cultural identification and personal interaction more often found at the local level.

The outcomes of deliberations of these arguments result in differences in what responsibilities and options that lie with different regional authorities and agencies within different countries and different domains – and at different times. Institutional inertia may delay changes to accommodate new needs emanating from new situations or new preferences, and different change processes may be well or poorly synchronized. Regional reforms often do not go so far as the initial initiatives intended. In a changing world, whatever the current situation of regions, there will always be some question of match or mismatch between related policies in different domains and at different levels of governance, and these will typically vary also between countries, even in such a relatively homogeneous territory as the Nordic countries.

The higher the degree of autonomy of a political-administrative regional authority, the less its revenue typically depends on transfers from state government. The balance between regular funds transfer for mandatory services and administration delegated from the national state, ad hoc state funding of activities in the territory, and the authority's own revenue (from taxes or other sources, such as classical land rent) determines to some extent the authority's degrees of freedom in devising and implementing its policies. The fight for increasing ad hoc state funding (typically for projects) is imperative for all regional actors, meaning that they sometimes will (or will have to) balance the direction of their own preferred policies against available funding, when regional preferences are not prioritized at the state level. This may tend to hold back regions that are (potential) forerunners in a specific domain. A higher degree of regional autonomy may also result in resistance toward change, which is initiated centrally but less appreciated regionally. Good multi-scalar correspondence of policies and state and regional instruments that complement each other well, either by design or by proactive coordination at the regional level, may compensate for other inconsistencies in the system (Rogge and Reichardt, 2016).

The opportunity space for regional level policy agency (i.e., its relative de facto autonomy) is to a large extent contingent on multi-scalar governance contexts. For instance, in a review of energy-related priority settings in regional smart specialization (RIS3) agendas, Steen *et al.* (2019b) found that regional initiatives can easily be hindered by uncondusive policy frameworks at the national level. The need for policy alignment and consistency across multiple scales is increasingly recognized (see e.g., Matti *et al.*, 2017), making it imperative to consider how and to what extent green development aspirations in a region are contingent on policies and developments in other regions and at other scales (Capasso *et al.*, 2019).

In cases where a regional authority is an organization with a large footprint on both environmental and economic parameters, its strategies for its own activities may be as important for green growth as its influence on other actors in their region.

Many policy directives may come from above with a certain delegation of responsibilities for reaching national (and international) goals. The regional implementation may differ in terms of strategies chosen; such variation is sometimes an underused opportunity for learning about effectiveness and efficiency under different conditions.

1.5 Policy and strategy

Notice that we just discussed the relationships between state and regional policy without discussing the concept of policy. It was hardly necessary, as the term in everyday language is usually considered a generic concept for related principles, goals, strategies, instruments, and plans. Even policy science specialists say it is more difficult to agree on a definition of policy than on its many constituent elements (Weible, 2018).

Many definitions of policy rotate around principles or rules for action. This definition – or at least its linguistic practice – comes in two very different versions, however. One is the more general principles that underpin specific actions, decisions, or choices within the domain covered by those rules. Public policy thus construed may be institutionalized in several forms, ranging from specific laws and regulations via concrete and goal-oriented programs, strategies, and financial and other instruments to implicit decision criteria in the operation of either of these forms, maintained through an ethos or values. Even the absence of such forms may indicate a specific policy. In the other version,

a policy is construed as a set of formalized rules that constrain individual decisions in a passive way, as opposed to strategies that imply a proactive support and even generation of events that promote specific goals. In the need to maintain a transparent public sector administration, it is efficient (but not always effective) to base decisions on explicit operational rules rather than on strategic and tactical analyses not yet embraced by the agency issuing the rules.

In public policy, financial and other instruments and organizational tools at the disposal of strategic agents have a strong position. In the public sector, there is a great emphasis on documents that outline various aspects of public policy. During the GONST project, we collected close to 100 policy documents from national and regional authorities relevant to green growth.⁷ One in three of these were called strategies, one in four plans, one in four analyses, and the remaining documents had similar names. None were called policies. We believe this is indicative of the need that governments have to display action rather than "simply" intentions.

When we refer to public policies in this report, we mostly access them through the strategies, instruments, and actions of the relevant agencies, rather than the underlying formulations of intentions of principles or rules for creating green growth. Whenever we encounter rules or principles that play a role, these are frequently the result of other policies that regulate the powers of the public bodies whose green growth policies we are considering. Rules for public procurements are prime examples of such policies.

While much public administration since World War II has been built on assumptions of stable sectoral divisions with stable policies and little coordination needed between them (Rommetvedt, 2017), growing complexities in social, economic, and natural development over the more recent decades have been addressed in part by instituting policy mixes as a means of stimulation and regulation of processes toward desirable outcomes, so also in the case of sustainability transitions (Rogge and Reichardt, 2016). Many policies remain for a long time on governments' agenda and acquire institutional capacity around their implementation. This also indicates that agencies over time may become as dependent on their prior trajectories as industries on their technological development paths. Reorienting such agencies may become part and parcel of reorienting industrial development itself.

1.6 When green meets growth

Environmental values and economic values have over a long period of time been – if not always – in conflict, at least not necessarily well aligned. Environmental protection as a government concern in its current form did indeed grow out of the need to regulate industrial and other sources of pollution. In many countries, this has led to two different logics for devising and implementing green and growth policies. Although high level policies in both areas have emanated from the same parliaments, the two domains have been developed along two very different trajectories, both in terms of knowledge production, predominant values, and the institutionalization of policy development and implementation. At the regional level in Norway, for example, green legislation is mainly handled by the environmental protection unit of the regional state administration ("fylkesmannen", now "statsforvalteren"). Stimulation of regional economic and social development (to the extent that it differs from national development) has been the responsibility of the regionally elected county

⁷ Most of these are accounted for in the report on the eight regional cases of this project (Andersen *et al.*, 2019).

council ("fylkestinget") and its administration ("fylkeskommunen"). This is also extensively supported by the regional office of the state agency Innovation Norway, which supports budding entrepreneurs, established firms, and cluster initiatives in collaboration with, or under the direction of, the county council and its administration, within limits set at the national level.

The classical meeting ground for the two has been that of imposing green restrictions on economic, mostly industrial, enterprise. Although this has meant a certain development of a common ground, in terms of overlapping networks, knowledge base, careers, and interests, between regulators and industrialists, the two public policy areas have probably had a lesser degree of co-development, with their separation in silo-like organizations responding to signals from above rather than from the less frequent horizontal interactions. For one thing, the distinction between a regulation approach and a stimulation approach has led to rather different orientations of policy agents in the two domains, even when both have aimed at sustainable development (Kemp, 2000).

On the other hand, many concrete environmental regulations could not have been implemented without technological and other innovations that we would today call cleantech – often provided by exactly the same industries that created the problems in the first place. By developing these solutions and selling them to firms required to curtail their emissions, new areas of economic growth have appeared, and their knowledge base has diffused to their customers. There exist, therefore, demonstrable cases of green growth, some helped by supporting growth rather than by enforcing restrictions. This should make it possible for even small public actors to contribute to green growth through their policies.

Facilitating and supporting growth that is genuinely green nonetheless remains a daunting challenge for policy makers. This is because "ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies" as emphasized by the OECD (2011) necessitates systemic change. In turn, this implies that innovation efforts increasingly need to be underpinned by a different rationale than 'simply' growth – which has been the principal *raison d'être* for public support of innovation. Essentially, this demands attention to not only market and system⁸ failures, but importantly also to transformational failures (Weber and Rohracher, 2012). These include **directionality** (ensuring innovation in a certain (*i.e.*, green) direction), **demand articulation** (barriers to market uptake of green technologies are often political, institutional), **policy coordination** (both horizontally and vertically), and **reflexivity** (monitoring complex processes towards particular goals) failures.

These new challenges for policy are reflected in novel innovation policy paradigms, most notably in the versions of **mission-oriented** (Mowery *et al.*, 2010; Mazzucato, 2018) and **transformative** (Schot and Steinmueller, 2018; Diercks *et al.*, 2019) innovation policy. While there are differences between these paradigms, for instance in that the former to greater extent emphasizes the role of science and innovation whereas the latter places more weight on behavioural change, they have important similarities. First, innovation policy needs to be attuned to grand societal challenges such as climate change and aging. Second, because societal challenges tend to be complex and unsolvable by technology alone, but also require institutional and behavioural change, both paradigms stress

⁸ System failures typically include (Weber and Rohracher, 2012): **infrastructural** failures (existing infrastructure not enabling for innovative activities), **institutional** failures (both formal and informal rules/regulations that hinder innovation), **interaction/network** failures (interaction dynamics are too weak or too strong), and **capabilities** failures (absence of necessary capabilities to adapt).

the importance of directionality setting and goal-orientation (*e.g.*, reducing greenhouse gas emissions) in innovation policy agendas. Furthermore, both emphasize the need to mobilize a variety of actors (beyond industry and R&D) to ensure broad legitimacy of problem framings, and to allow for a diversity of exploration in different solutions.

These changes in the very ways in which we think about innovation policy will obviously also influence how we think about the role of **regional innovation policy**. So far there is limited systematic research in this area. Tödting *et al.* (2021) discuss how a challenge-orientation necessitates a rethinking around regional innovation systems and how they should be supported. They point for instance to the need for more attention to **demand-side dynamics**, and the potential for supporting **diffusion and upscaling** of novel solutions within a region. From the GONST project, similar arguments are made by Bugge *et al.* (2021), who argue that given the right circumstances both in terms of societal challenge and potential solutions, existing regional innovation systems can be mobilized to contribute to transformative change.

2 RESEARCH QUESTIONS, DESIGN, METHOD, DATA

2.1 Research questions and research strategy

At the outset, the three research questions of work package 5 were formulated as follows:

- **Policy mix:** What characterizes suitable policy mixes for the nurturing of new low-carbon pathways in different regional contexts?
- **Policy practices:** What characterizes conducive policy practices and policy learning practices?
- **Legitimacy:** How can policy contribute to the mobilization of heterogeneous actor-networks and the creation of legitimacy for new low-carbon technologies?

As the project has progressed, it has become evident that these questions cannot be easily answered in their original form. This is mostly due to the great variety of policy approaches and complexities of contexts discovered. Certain conceptual issues have been addressed in separate contributions, *e.g.* on policy mixes (Steen *et al.*, 2020), on structural affinities between types of economic regions, innovation systems' institutional capabilities, and policies suitable for promoting green growth (Grillitsch and Hansen, 2019), and on institutional logics underpinning innovation policy in different types of regions (Cai *et al.*, 2018). This report, instead, sets out to explore the wide variety of regional policies for green growth. It is rather eclectic in its description of cases in chapter 3 and in the comparison of cases in chapter 4. We will, however, relate back to some of the concepts introduced in chapter 1, and in chapter 5, we will single out selected recurring patterns and also consider what seems to be missing.

2.2 Project design

The entire GONST project design has followed two main paths, with a broad literature review (Capasso *et al.*, 2019) underpinning both. One was a study of green skills and green technologies⁹ in different types of firms and regions across the four participating countries, using national register data (Tanner *et al.*, 2019; Østergaard *et al.*, 2019). This path is of lesser relevance for the present report.

The other design path in GONST was a multi-case exploratory and comparative study of developments of green growth in two regions in each of the four countries, following three lines of inquiry: the role of institutional change (work package 4), the role of policy (work package 5), and sectoral transitions as a whole (work package 6), where a sector was understood as industries (and related activities) that together provide a basis for fulfilling a relatively homogeneous set of functions in society. The major instrument of data collection was semi-structured interviews with relevant actors in public administration, private firms, intermediary organizations, and academic institutions (Andersen *et al.*, 2019). In addition, relevant policy documents at regional and state levels were sampled, collected, and studied, some strategically selected topical interviews not directly related to the sectoral cases were conducted, and a one-day policy workshop with invited experts from selected regions and the GONST research team discussed four cases of regional policy experience in-depth.

⁹ Technology, or, rather, technological development, is proxied by patent counts.

2.3 Sample selection and data

First, we selected case regions of particular interest (for criteria, see below). Then, from within these regions, we selected one set of case subsamples for each of the three lines of inquiry, each with their own unit of analysis: institutional change processes for work package 4, policies of regional councils for work package 5, and industrial sectors for work package 6. In other words, we do not cover all sectors, we do not cover all policies, and we do not cover all institutional changes in the regions from which we have drawn our data.

Not only that, but those policy units of analysis that we sampled might not be ones that are the most characteristic ones for neither public nor private actors in the sampled regions. Rather, the sampling logic is strategic, in order to identify cases and patterns of particular interest to explore promising processes of (promoting) green growth. There is also some overlap because of the nature of the processes studied. Together, we believe our explorations give a fair image of the variety of interesting green growth policy patterns in the four countries.

For the entire project, one region was preselected from each country and another one added after the project had started.

The criterion for selecting the first set of regions was a consensus among the researchers about a number of regions of a particular interest for study, either because they were judged to have succeeded in transitions toward green growth or because the political-administrative initiatives were particularly promising. The researchers knew a number of Nordic regions quite well from earlier or ongoing studies where regions had been selected along similar criteria. As a consequence, this also eased the identification of important actors, and it facilitated access to informants for interviews and to other data.

The criteria for the second set of regions were originally set to be green strengths in either skills or technologies, based on statistics to be compiled from register data once these had been acquired at the outset of the project. However, a preliminary overview did not result in any obvious candidate regions. Based on the need to have some variation of dominant policy within sectors and some variation between sectors, the four remaining regions were again selected on the basis of their perceived interest for understanding the geography of Nordic sustainability transitions. In practice, the final four turned out to be among the contenders for the first set of four leading regions. We explicitly avoided a baseline criterion; we did not select regions without demonstrable effort or results.

The choice to focus on leading or interesting regions makes sense in an exploratory design. It opens up for pairwise comparisons between and within countries, between and within a particular category (*e.g.*, a particular industry), and for comparisons along dimensions not determined at the outset but discovered in the data. The no-change (null hypothesis) data are contained in each case because of the dynamic character of the development processes. We did not aim for a complete set of comparisons, but rather for comparisons that might give some new and interesting insight, in addition to analyses of interesting single cases.

The design does not give a basis for statistical generalization to a larger population of regions. Such a generalizations also would not make much sense because of the exploratory character required to understand these transition processes.

The regions sampled are shown in Figure 1, and the combination of functions and policies in the regions under study for this report is shown in Table 1; see also section 7 for details.



Source: Andersen et al. (2019) p. 15.

Figure 1: Regions selected for GONST

Table 1: Elements of regional governance for green growth policies in Denmark, Finland, Norway, and Sweden

Regional elements	Denmark	Finland	Norway	Sweden													
Regional council Elected by Budget source and flexibility	Regionsråd Inhabitants From state (and municipalities); inflexible (earmarked)	Maakuntaliitto Municipal councils From municipalities; some flexibility	Fylkesting Inhabitants From state, partly flexible, some also have independent sources	Region Inhabitants From taxes													
Regional state	Administrations	Centres for Economic Development, Transport and the Environment; Regional State Administrative Agencies	County governors	County administrative boards													
Territorial correspondence between regional state and regional council	None since 2019	Some centres larger than regions, all agencies much larger	~ Identical	~ Identical													
Main responsibilities																	
Policy domains	Denmark				Finland				Norway				Sweden				
	CS	RS	RC	MC	CS	RS	RC	MC	CS	RS	RC	MC	CS	RS	RC	MC	
Green Growth ERDF			x		x	x	x	x		x	(x)				x		x
Public transport				x	x							x					x
Health (hospitals)									x								x
Second. education																	x
Waste				x				x									x
Regions sampled in GONST	Nordjylland (North Denmark or North Jutland) around Aalborg Syddanmark (Southern Denmark) around Odense and Esbjerg	Keski-Suomi/ Mellersta Finland (Central Finland) around Jyväskylä Pirkanmaa/ Birkaland (Tampere region) around Tampere city	Trøndelag around Trondheim, recently merged from two counties Hordaland around Bergen, which during the project merged with another county to Vestland	Skåne (Scania) around Malmö Värmland around Karlstad													
<p>Notes: Only main characteristics are included. Some intra-national variations exist in all four countries. Green basically means environmental protection. Growth at regional level is included in regional development. All councils obviously have responsibilities for greening their own activities. Responsibilities beyond green and growth are included in the table mostly because they represent important targets for green growth through public procurement or targets for decarbonization of own processes. ERDF means control over funds for regional development from the European Regional Development Fund, since 2014 connected to implementation of (mostly regional) strategies for smart specialization. These funds are major contributions beyond what the regional authorities themselves can muster.</p> <p>Responsibilities: CS: central state (or their non-regional administrations), RS: regional state, RC: regional council, MC: municipal council.</p>																	

From the regional case studies, thoroughly described in Andersen *et al.* (2019), we then singled out a number of regional council policies for green growth in their region. The sampling criterion was again to show a width of different approaches. Geographical or national distribution was a secondary concern. We selected no policy cases from North Denmark and Southern Denmark because the regional councils in Denmark had been stripped of their economic growth responsibilities. We selected two policy cases from Scania because they were very different. We also selected one policy case from each of the regions Tampere, Hordaland, Trøndelag, and Värmland. Finally, we selected no policy case from Central Finland because it was similar to Tampere in some respects and Värmland in others. The sample might have been different, but we do not think our main conclusions would change much.

3 SIX INTERESTING POLICY CASES FOR GREEN GROWTH

3.1 Public procurement for decarbonization of own consumption

The Scania regional council has since 2009 had a strong political commitment for the activities it governs or outsources to become fossil free, in line with a 2010 strategy document issued by the county administration board. Public transport is a major target; see the separate case description in chapter 3.6. The council administration's greenhouse gas emission analysis also showed that nearly half the CO₂ emissions from its activities (excluding public transport) stemmed from non-energy consumption, consisting of 8 per cent for patient meals and 40 per cent for work related consumables¹⁰. Almost all of this is consumed in the health care sector, in which the regional council has practically all of its own (i.e., not outsourced) activities¹¹. Changing the procurement criteria for these consumables received high priority.

For the purpose of our analysis, we have selected four consumables whose ease of decarbonization ranges from very hard to very easy. In falling order of difficulty, these are four disposables used in large quantities by medical personnel in patient interaction: gloves, aprons, and hard boxes and soft bags for collecting waste. In order to reduce potentially dangerous contamination, regulations and medical practice stipulate gloves and aprons to be used only once and then to be collected in suitable containers for incineration as dangerous waste. Incumbent products are made from plastic materials produced from fossil petroleum. Finding alternative non-fossil materials that are also suitable for gloves (for skin care, for pliability, and cost) is a well-known problem that is on the R&D agenda around the world along many similar substitution issues. For aprons the physical requirements are less demanding, and less again so for waste containers. There is also a long-standing debate about the relative merits of bio-based plastics, recyclable plastic, recycled plastic, and non-plastic materials, since many of these qualities are currently mutually exclusive, as concerns physical properties and life-cycle carbon footprint. This results in rather context-specific choices to be made, and even successful innovations may be short-lived.

The work was initiated by the regional council's strategic purchasing department. They found that the four consumables in question had different pathways towards becoming fossil free. For soft waste containers (garbage bags), non-fossil products turned out to be readily available at an acceptable price. Other waste containers were initially not prioritized. For gloves, a longer innovation effort would be required; this is still ongoing work (in many countries) that we do not address here. Bio-based plastic aprons were not in wholesale catalogues, but the production process was found to be relatively straight forward, only using a non-fossil material. Yet a regular tender process run by three different regional health service providers in Sweden had resulted in no offers, despite a view to large volumes (amounting to 100 million units per year for the Swedish health care sector in total) (Ochoa *et al.*, 2017). Scania's purchasing department then prepared to go through an innovation procurement procedure for the supply of one year's consumption of aprons.

For this purpose, the innovation agency VINNOVA commissioned an environmental management board, which is a part of the Swedish competition authority, to carry out the procurement in a four-phase process: preliminary market dialogue, qualification round to select potential suppliers, negoti-

¹⁰ This includes full life-cycle emissions for the consumables in question.

¹¹ 35,000 jobs.

ation, and award, for the supply of 5.2 million bio based disposable aprons. The regional administration was assisted by their wholly owned innovation management company (Innovation Skåne), which specializes in innovation management and support in the health sector in the region. Potential suppliers were invited to different seminars to take part in a dialogue and nurses from the region's hospitals also participated in the discussions to gain a better understanding of carrying out the public procurement measure. A test panel was set up which was responsible for testing products based on the functional requirements and provided new inputs for developing the aprons. An industrial designer helped the suppliers develop their solutions and a consultancy firm helped to make sure that the documentation and requirements were meeting the targets throughout the product lifecycle. Several meetings were held between different suppliers around issues such as a realistic share of renewable material in the aprons, price, and delivery time. The final tender document was prepared with specific criteria (at least 70 % renewable material) and then finally the tender was awarded to a company in May 2016 for producing disposable aprons consisting of 91 % renewable material. A 25 % reduced price was also achieved, and better quality and design than the aprons previously purchased. The pilot project for procurement therefore also helped the region to develop its knowledge base regarding public procurement for sustainable innovations in the future which are not in a commercial stage and also help companies increase their competitiveness for climate friendly products (Ochoa *et al.*, 2017).

The most important obstacles turned out to be to identify companies with the relevant production competence, preferably in the region, to convince them to consider a market regulated by public procurement rules, and to stimulate them to taking the risk of this particular product innovation for which the public sector would be practically the only market segment, albeit a fairly large one.

During the search process, the regional team also came across new offers for hard waste boxes made from Brazilian bio-based plastic (animal based) and also from other materials (forest based). These offers from companies to develop and sell new products came from indirect interaction through the business community, most likely through word of mouth. One company in question then also wanted to use the opportunity of sales to the region's hospitals as a basis for producing their own bio-based polyethene (based on fat from local herds) to replace Brazilian import.

To summarize, this policy approach of public procurement with preparative search or innovation steps may be useful for regional decarbonization. It is neutral as to whether it provides growth or not within the region. However, the participation of an intermediary like the innovation support company that took part in this case, may help identify actors in the region that are willing to take on the required innovation process and the risk involved in moving into a new market segment. Such an experimental approach has also proved useful in engaging end-users in the process of matching new products to end-user requirements and practices. The intermediary may thus both directly and through networks provide competences normally missing from a strategic purchasing department, which is usually better trained for setting up procurement processes and contracts within legal requirements, thinking in terms of risk distribution and cost reduction, but otherwise relying on other input for the actual content specification.

Later, the regional council's administration has engaged the cluster organizations in the region directly as intermediaries to generate better involvement from more companies in the region. The goal is still to provide solutions to the decarbonization of consumption by the services of the regional

council. However, the strategy outlined above gave glimpses of both the potentials and barriers toward using public decarbonizing procurement to enhance economic development in the region. The new strategy is then also aimed at using these decarbonization efforts to stimulate local industry to provide new and competitive solutions, which they can then also provide to other customers, i.e. both national and international health care markets. In this way, the regional council would not only continue to decarbonize their own consumption, but also create opportunities for green growth in the region.

The first step in this new strategy is to semi-annually gather all the CEOs of the cluster organizations in the region along with the CEO of Innovation Skåne, the regional administration's purchasing director and their regional development expertise. At the time, there were ten cluster initiatives in a wide variety of industries supported by Scania regional council: Sustainable Business Hub, Media Evolution, Mobile Heights, Packbridge, Skåne Food Innovation Network, Resilient Regions Association, IUC Syd, Medicon Valley Alliance, Swedish Maritime Technology Forum, and a tourism cluster. The different cluster initiatives are important for driving innovation and sustainability in the region and to attract new investment for the region by branding itself as an attractive location. The cluster CEOs between them know their 1,500 member firms and their capabilities very well, they are also versed in how to stimulate firms to break new ground either in products or in markets that require new capabilities (such as public entities or foreign countries), and they can more easily than many others facilitate new direct relations within and between sectors. All actors involved understand that these steps may only be the first ones in lengthy processes of creating green growth in the region.

3.2 Public procurement for enabling industry to decarbonize regional public transport

The Hordaland county council in 2007 pledged a political obligation to take its share of decarbonizing public sector activities. Its administration has prepared climate budgets since 2016 and the analyses had shown that 99 per cent of the direct CO₂ emissions under the council's control came from public transport with ferries, boats, and buses, with ferries on top (43 per cent), just ahead of buses (37 per cent).¹² The renewal time for long term contracts for ferry operation was rapidly approaching, and a failure to start their decarbonization at this opportunity would postpone the process for many years, not least because many of the ferries were approaching their economic life time and a retrofit for battery operation would in most cases not be feasible. Such a move would also be required on the basis of a 2015 parliamentary decision about decarbonizing public transport ferries, although the decision was rather vague inasmuch as it gave a direction and no timeline, and state funding was not a topic at the time.

Non-fossil-driven ferries were not readily available when the procurement preparations began in 2015, but a state agency had recently successfully procured the world's first battery-electric land-to-land ferry service for a high-volume state highway fjord crossing in the neighbouring county.¹³ A shipyard in the greater region, with regional suppliers, had successfully built, equipped, and delivered this ferry in 2014. This project demonstrated the technical feasibility of designing, producing, and operating an all-electric ferry and its requisite surrounding infrastructure (notably charging facilities and electrical grid fortification), mainly relying on capabilities readily available in the greater region, which is characterized by successfully specializing in all things maritime. However,

¹² Ferries are designed to carry cars and trucks (and passengers). Boats may be rapid passenger vessels or slower and usually small(er) multi-purpose vessels.

¹³ This county (Sogn og Fjordane) later merged with Hordaland (to Vestland).

this would not guarantee capacity for, and industry interest in, producing, owning, and operating a veritable fleet of 20 suitable ferries required for serving the 17 connections, infrastructure for land-to-land, land-to-island, and island-to-island operation, and – significantly – at an acceptable cost. Even if shipyard capacity – the crucial section of this value chain – appeared to become available because of a continued downturn in the maritime industry's petroleum extraction customer segment since the latter's peak in 2004, commercial risks would have to be identified and apportioned.

The council's administration – with its small environmental staff in a lead position – prepared three alternative scenarios with differing degrees of decarbonization, cost, and risk. The council opted for the most ambitious alternative in terms of reduction of greenhouse gas emissions, despite significantly higher cost estimates and risks. Even when it was later confirmed that substantial state funding could not be expected and the cost for the council would rise significantly, the council maintained its choice, much to the surprise of many observers. It is thought that this was possible because of a shared interest between environmentalists and industrialists experiencing a drop in maritime sales for petroleum activities and eyeing a technological leadership entry in a new market for non-fossil maritime vessels.

After some time and with increasing domain-specific technical detail required, more of the preparation of the tender documents was transferred to the administration's public transport department¹⁴. They undertook fairly general technical feasibility discussions with representatives of relevant industrial actors in the region, in part facilitated by cluster organizations, and lengthy concrete discussions about state funding with relevant centralized state agencies. The latter were reorganized during the pre-procurement period, and this certainly did not help in putting the innovative regional efforts for non-fossil ferry acquisitions on the agenda for targeted state support.

The project encountered at least two important lock-in barriers that increased cost or endangered feasibility. One was the institutionalized timetables, around which many inhabitants and firms in the periphery had adapted or even built their own operation. Adapting these timetables to a charging schedule that reduced the number of charging stations in the periphery could reduce the investment cost by a significant amount¹⁵, but politically this was hardly an option. Another lock-in was in the electric grid companies, whose funding mechanisms are strictly regulated because of their position as holders of a natural monopoly. These rules allowed for new charging facilities to be connected to the grid, but at a fixed (average) cost. They had no incentives or even possibilities for taking the extra cost of building capacity and infrastructure for battery charging facilities in remote (as opposed to central) locations. The regulations were written at a time when there was little need to consider the possibility of a systems transition from fuel to electricity supply in remote areas. As a first mover among county councils, the council and its administration had to be prepared to pick up the extra cost of circumventing these two barriers, unless they could change the underlying causes.

Other risk factors came from the lack of prior domain experience and – as described above – from the lack of state support for these activities.

¹⁴ This department is separately branded and consequently may appear to be a company owned by the county council. It relies on private tenders for the actual operation of the transport. In some other counties, the councils have selected to organize this as a wholly owned limited company.

¹⁵ Estimated at around 100 MNOK or 10 M€

In the eventual tender document, the administration had gathered the 17 connections in five independent packages, with different implementation timelines, and they had made it technology neutral as per council policy. The document then stipulated 55 per cent reduction in CO₂ emissions and 25 per cent reduction in energy consumption¹⁶ as a qualification criterion and further reduction on both parameters as award criteria. Following discussions with the industry, the administration had set this formulation to avoid a simple biofuel for fossil fuel substitution. The bidders were required to acquire and own the vessels and to construct the charging infrastructure and then sell it to the county council at cost. The purpose of the latter requirement was to let the bidders match the infrastructure to their own propulsion technology choices. The winning bids were all hybrid battery electric but prepared for all-electric operation under normal circumstances. All bids were for all five packages, which were eventually awarded to four bidders.

The county's procurement of 20 ferries led to a mature supply capacity and the shipyards in question in the region have up to 2018 delivered 70 or 80 battery-electric ferries in total. Two new factories in the battery value chain have also been established in the region. They have also delivered batteries to shipyards abroad. Other counties with extensive ferry operations have followed suit – although they have also learnt that there is insufficient state funding, and they have not all been willing to prioritize this area as much as Hordaland county did.

3.3 Circular business models for existing industries

Trøndelag county council has a long history of using their regional development funding to support the regional economy by stimulating collaboration between firms and researchers.¹⁷ The rationale is to channel more benefits to industry in the region from the nationally leading technological R&D capabilities in its largest city, Trondheim, also known as the technology capital of Norway. For several decades, politicians and researchers have considered the university/ institute/ industry R&D activities to be one of the top major assets of the region in an economic sense.¹⁸ Traditionally, this preoccupation with research-enabled industrial development has also included some political prioritizations, partly as a response to perceived industry needs and opportunities (*e.g.*, firms in the geographical periphery with no or low R&D propensity), partly to promote technologically based value creation with a societal benefit (*e.g.*, clean technology), and partly to stimulate industrial connections expected to bring about learning (in technology, business, and organization) between some of the region's leading sectors (blue aquaculture and green¹⁹ agriculture). The county administration also has a long history of strategic and tactical coordination of project funding with the regional branches of national innovation and R&D agencies, and with the universities (and research institutes) in the region.

In 2018, in preparation for the merged council's new regional development strategy, the council's administration started promoting circular economy as a way of combining the council's growth support efforts with its increasing emphasis on sustainable development. The proponents of this policy move used the long-sought green-blue sector connection as a starting point that found an opportunity space in the overlapping interests of both the prior county councils and administrations. Other

¹⁶ These are reductions compared to previous operation statistics.

¹⁷ The county consisted of two counties up to 2019. However, their development plans have been developed and implemented jointly since at least 2005.

¹⁸ This was boosted by the 2006 OECD report on the regional economic contribution of HEIs (Sotarauta *et al.*, 2006).

¹⁹ These sector shorthands are pre-sustainability era colour codes.

sector-specific support packages – including separate packages for blue and green sectors – also included sustainability criteria for project selection, but the administration argued that circular economy was such a new concept that it would require an extra focus and effort, and also bring out untapped growth potential in building value chains between them. In 2020, the council accepted the administration's proposal to allocate 7.5 MNOK annually (15 per cent of its funds for regional development support), and the administration later has acquired the right to transfer funds from the other packages to circular economy as needed.

The administration had strengthened its staff with relevant academic qualifications for the task. The staff developed several initiatives, some approaching it from an environmental perspective (*e.g.*, collection and processing of maritime plastic waste), some from an industrial growth perspective (*e.g.*, industrial symbiosis). The administration singled out an industrial site where several firms were located back-to-back with little exchange of energy or goods between them. They sponsored a student study of the potential of an industrial symbiosis between many of the firms. The students showed that practically all the streams of some potential value pointed out of the site and compared it with the Danish circular economy success in Kalundborg, where most of the streams pointed to their nearest neighbours. Many of these exchanges might not be profitable when considered in isolation and by individual firms, but they gave a much better prospect of total growth – and green at that – when viewed in combination.

The administration then decided to use its external innovation support system to drive this process locally. This consists mainly of a number of territorially distributed consulting companies that in part are financed through their operation of different support schemes for business development on behalf of the county council, SIVA, and others.²⁰ The underlying logic, of course, is always to improve the innovation capabilities of the firms, and this requires a local guidance capacity embedded in the local business matrix rather than reliance of a national market of consultants. Hence some of the local consultants were trained in circular economy matters and were charged with implementing this initiative.

The council's administration found that local mobilization would only have its intended effect of initiating actual industrial projects if significant local opinion-formers actively promoted the concept. In this case, the crucial person was one of the main investors behind several successful local industrial establishments. This investor (and other opinion-formers close to industry) were in the network of the council and its administration, but not so close as some of the local consultants now in charge of mobilizing for industrial symbiosis. This first-hand closeness probably contributed strongly to the first projects and to the establishment of a multi-industry cluster organization supporting its member firms in all things circular.

Another important lesson was the need to translate the concepts of circular economy per se to an industrial practice. This is not only a question of translating an academic vocabulary to a practical one, but also about reorienting institutionalized linear business models to circular ones that involve a wider set of premises. It also involved scrapping some of the new ideas and adapting others to current practice. Hence the implementation by the local consultants did not only involve an application of the theory of the circular economy, but rather a translation between an academic practice and

²⁰ SIVA is the national agency for promoting industrial development in the periphery. Many of these consultancies started as operators of industrial parks and business gardens on behalf of SIVA, a job they still maintain. They are now typically co-owned by local municipalities and local private businesses, and SIVA.

an industrial practice, in which some of the message was lost. The intermediary function of the local consultants worked both ways. For example, industrialists entrusted the consultants to obtain clarification with the county administration of availability of public support for specific projects, precisely because the consultants were able to translate the communication both ways to avoid misunderstandings.

One of the barriers to creating growth based on circular economy principles was soon discovered: that the public support available for reducing innovation risk was set up to support high-potential, high-risk projects for single recipients. There is also a lot of support mechanisms for bringing firms together and for collaborative pre-market R&D projects, but not so much for actual investments where two or more firms share the risk, and the growth potential may lie in the real options (for others) rather than in the actual project (for the initiating firm). Or in other words, the support schemes implicitly assume the logic of linear rather than circular business models.

3.4 Reorienting a cluster from classical to bioeconomic uses of forest resources

Värmland regional council²¹ and Värmland County Administrative Board have for at least 15 years allocated personnel and funding to stimulate the development of new growth sectors in the region, in particular with increased use of collaboration with the local university.

The main problem to be solved has been the regional impact of the global structural crisis beginning in the 1990s in the pulp and paper industry, which traditionally has been a cornerstone of the region's economy. Increasing global competition, production overcapacity, environmental pressures on the industry, along with falling demand for paper from primary pulp (because of recycling technology) followed by reduced demand for print paper due to the growth of digital information carriers, all contributed to the prolonged crisis.

The regional support has followed two major policy directions: a cluster initiative and a university engagement. These have merged over time towards a bioeconomic policy development path.

A regional effort and support from cluster researchers has since 1999 secured long term national funding of a cluster initiative named Paper Province, an organization originally comprising seven member firms from the pulp and paper industry. Their sector – which significantly includes a sizeable sub-sector of developing and providing machinery for the processing industry world-wide – has long since gone through the restructuring. The regional specialization in drink cartons and similar applications (and related machinery) has come strengthened out of these restructurings and incumbent firms are able to harvest profits from their operations, evidenced also by recent large foreign direct investments in the region. Paper Province originally proved instrumental in addressing shared concerns about availability of skilled labour. This helped give the public agents behind the collaboration initiative greater legitimacy among industrial actors, over time replacing the local rivalry over access to raw materials by a collaborative mindset addressing future visions and collective action. The organization gradually gained a steadily broadening membership not only of local businesses, but also of national and international firms with production facilities in the region. A significant change occurred when the organization in 2012 was opened to firms that relied on the resources of

²¹ Technically, Region Värmland, and not to be confused with the Regional council of Värmland, which is the name of a collaboration forum between Region Värmland and its constituent municipalities.

the forest for other purposes than pulp and paper production, firms that might compete with the incumbents over raw materials supply, hence stressing the profitability in the packaging firms. Given current developments, Forest Province might become a more suitable name for the cluster than Paper Province. Visionary actors in support positions in the region have used their influence through the organization to create a growing understanding of the possibilities of creating new and profitable industry based on a variety of biomaterials from the forest, notably through a series of lignin demonstration projects.

The first identifiable boost in the direction of regional authorities to stimulate using R&D in the solution, applying a triple helix approach, was an OECD report that recommended to strengthen this university – industry relation (van Vught *et al.*, 2006).²² The connection of Karlstad University to the forest based industries was significantly strengthened through regional co-funding (2010-2014) of ten professorships for this purpose. When the smart specialization strategy movement penetrated regional authorities throughout Europe from 2014, the renewal of the forest-based industries became the prime (but not the only) target for the strategy developed by the regional administration and sanctioned by the regional council.²³ The smart specialization initiative has benefitted from the presence of place-based leadership and mobilization of regional actors and the high level of trust and social capital developed over time in the region (Jolly *et al.*, 2020). This gave access to ERDF funds on premises well aligned with the prior strategies of enhancing the R&D component of innovation for growth and modernization in the region. In 2016, a new initiative named Academy of Smart Specialization was formed to serve as a meeting arena for regional authorities, Karlstad University, companies in the region, and representatives from civil society to develop new knowledge for a transition towards a modern bioeconomy in the region. The Academy has also been evaluated by OECD and found to be a successful initiative in promoting new skills and specialization in forest based bioeconomy (Trapasso *et al.*, 2020).

How are these growth policies related to greening? Climate and resource issues were not at all strong drivers until very recently. Simply by relating to forests as a key asset in carbon containment and as a renewable biological resource, these growth initiatives have acquired a green spot on the spectrum along with many other bio-economic initiatives. The two green movements from paper to electronic media and from incinerating to recycling used paper initially created a decline in the forest-based industries in Scandinavia. New growth will depend on bio-technological progress in replacing wood for petroleum in new products (*e.g.*, plastics and fuel) and wood for products relying heavily on petroleum or on scarce resources further upstream in their value chain (*e.g.*, wood for concrete in construction or for fish food in aquaculture), and on the condition of sustainable forest management. Somewhat ironically, a traditionally green industry may be both an asset and a liability in the transition towards an even greener one. In this case, the challenge of the regional authority lies rather in aligning national policies, university priorities, and incumbent firm strategies with its intentions for growth based on alternative high-value uses of forest resources.

²² The report came in a series of OECD initiatives that also resulted in the aforementioned report for Trøndelag (Sotarauta *et al.*, 2006), and the two regional administrations have had many fruitful exchanges over the years over this and related issues.

²³ Other priorities of the strategy include advanced manufacturing and complex systems, nature, culture, and digitalization of welfare services.

3.5 Platforms and ecosystems for cleantech growth

The regional council of Tampere (Pirkanmaan liitto) is a coordination organ for its constituent municipal councils. It has since the late 1990s worked extensively to create green growth in the region by reorienting several firms and initiatives towards a cleantech self-understanding. This would entail that they in part or whole – regardless of whether they belong to machinery and automation industries, ICT services, health technology, media, knowledge-intensive business services or other sectors – provide solutions for firms, public authorities, and consumers that enable their transition towards a sustainable future. The main strategy in this policy effort is to develop platforms on which all sorts of actors can find each other in developing new solutions, rather than to promote specific industries or markets or to solve specific challenges.

The mandate of the regional council's administration is limited. In many respects, the policies of Tampere city also become the policy of the regional council. However, when the Council of Tampere Region started in its current form in 1994, the regional councils got to manage the new state governmental 'Centre of Expertise programme' (CoE, 1994–2013) (Työ- ja elinkeinoministeriö, 2013), in order to cope with the severe economic depression. The programme and its execution were based on regional strengths, innovation, and cluster thinking, and especially on the collaboration of research-industry-government (triple helix) parties. Much of the policy and related support capabilities for growth at the regional level has grown out of their success in instilling this body of thought in universities and large firms, some of which were then set to join the premier league of national clusters (the SHOK programme, 2006-2017) co-ordinated by jointly owned companies rather than by regional council administrations.

The body of thought underpinning the CoE made the transition to the place-based strategies of smart specialization relatively smooth. The new theory is that it is the capabilities in the region that underpin the successful sectors, rather than the incumbent large firms of those sectors, that create the most likely sources for a new and diversification-oriented growth. However, the focus of CoE and SHOK on the larger companies (Lähteenmäki-Smith *et al.*, 2013) had resulted in an unease about the possible undervaluation of small or independent initiatives that could create new development paths. This might be a critical resource, particularly when it comes to systemic changes required for sustainability.

After the cluster era, the Finnish innovation policy seeks inspiration from such concepts as an innovation platform and innovation ecosystem (for the differences between cluster and platform policies, see Sotarauta and Suvinen (2019)). The prototypes of platform-based innovation ecosystems are those where a huge firm (such as Apple) creates a globally available digital platform on which anyone can deliver their services, sometimes even in competition with the platform owner (such as Amazon's marketplace). This in itself constitutes a major restructuring of the sector. The platform owner harvests from the winner-takes-all logic of a value network (Stabell and Fjeldstad, 1998), but the point here is that the self-organization and global access for anyone to provide new services or solutions over the platform mobilizes the creativity of the crowd (McAfee and Brynjolfsson, 2017; Halme and Niinikoski, 2019) and will support an innovation eco-system around it with new types of actors and collaborations that in turn may restructure entire sectors.

Instead of pre-defined clusters, the regional policy in Tampere is now focusing on porous thematic areas, stimulating novel combinations of knowledge to shape new industrial and residential areas that would have to be built anyway. The green growth policy in the region now relies on such new

ways of promoting economic development. In Tampere region, the green growth-oriented platform policies are based on intensive interaction between the main parties from planning to execution, coordinated by the City Government and the Regional Council. The main ambitions are concretized on selected platforms, which are concrete development cases and even land plots rather than digital markets, and various actors may join in as long as they follow the specific cases' pre-defined requirements. Thus, various actors are mobilized to operate on a platform to construct an ecosystem around the designated theme. Tampere Kolmenkulma eco-industrial park and a new residential area Hiedanranta are examples of these physical platforms and ecosystem constructions. Kolmenkulma is a land-use project in which an industrial park is planned to become a home for companies operating in various fields of cleantech. The ambition is to maximize interaction between individual businesses for increased material and energy efficiency (to construct conditions for industrial symbiosis) and the development of eco-friendly concepts by sharing energy resources and services. For example, a diverse set of firms use waste materials with clean-tech solutions in their processes. As the material flows are used in many ways by different actors, they also form an ecosystem around these materials. By early 2021, 18 companies have (re)located here. On its part, Hiedanranta is planned to serve "as a development platform for experiments and projects that promote smart technology, sustainability and circular economy solutions" embedded in a living residential area. Several triple helix projects have contributed to its development and the first tenants (companies) mark the start of a 30-year growth plan. In both cases, the policymakers led the development processes, organized interaction and communication between various actors, and formulated the pre-requisites for the green business.

Clean technology, one of the cornerstones in the green transition, is often a solution area of the electronics and engineering industries. These two are also the key industries of the Tampere region and their knowledge and applications are used for green activities and operations in for example industrial renewal, health sector, education, building, infrastructure like waste and water management, energy, and mobility. However, for the region's electronics and engineering industries the fusion with other industries is just a new phase in their evolution, as they both have long term industrial paths. Current clean technology is then based on long-held technological capabilities of the region. Moreover, the contemporary situation is an outcome of long-term policy efforts aiding the industrial development in different times, and where the clean-tech oriented platforms and ecosystems make up the latest version. And a core element running through all these policy versions has been the grass-roots level *place leadership* exercised through the regional council and city government, generating a multitude of collective development processes and reflective learning based on these (Sotarauta and Suvinen, 2019). In the latest version, the combined policy and land-site platforms also serve to integrate globally oriented actors into a specific place where they can even develop stable experimental relations benefitting both the local community, each other, and themselves.

3.6 Complex combination of public procurement and bioeconomic expansion

The regional council of Scania has since 2009 had as a political target for all its activities, and public transport in particular, to become free from use of fossil fuel by 2020. In 2010, the county administrative board (national government's regional branch) of Scania published climate mitigation goals for Scania and pointed strongly to regional production of biogas as an important part of the solution. This was mostly based on the availability of substantial quantities of raw materials and production capabilities already developed in the region. Municipal authorities had since 2005 collaborated on promoting biogas production and use through their regional public-private Biogas Syd

network, using an organization model found in practically all Swedish regions. Municipal responsibility for waste treatment (with a ban on bio-waste landfills), and an abundance in the region of agriculture production side streams suitable for processing as biogas substrate, had for some time been used to establish decentralized capacities for producing biogas and fertilizer in local, self-sustained, circular systems. Biogas production could be said to be a regional speciality, with a limited but functioning distribution system (including filling stations for gas driven vehicles) in place, adequate legitimacy in the population (and the political constituency), and both technical skills and university research in place to support its further development. With a regional council decision in 2009 to use biogas in city buses, the regional and the municipal councils acknowledged their common interests and drew up a roadmap in 2010 for Scania to become the leading biogas region in Europe by 2030.

Over the following years, the regional council has played two major and complementary policy roles in the development of the biogas industry in its region: customer and co-ordinator of business development.

The first role, as a customer, amounted to using the regional administration's public transport department's purchasing power. Public transport in the region is separately branded but is in fact governed by a committee of regional council members. They decided that their buses should run on biogas and that they should procure the gas from production in the region (within existing regulations). Politically, the movement away from fossil fuel was a must, and the concept of using bio-waste from the region to run its buses was easy to accept and explain to the public, particularly since this was also expected to bring more jobs to the region.

The second role was as a co-ordinator of business development for building a supply of biogas not only for the buses of the region, but also for the ambition to become Europe's leading biogas region by 2030. This effort involved building value chains for biogas from substrate providers to final consumers in the public and private sectors. Much of the investment was done by commercial actors with state support for biogas promotion through the KLIMP²⁴ program. The regional co-ordination was organized through the regional administration's collaboration with Biogas Syd.

Three sets of goals were pursued through these combined efforts by a multitude of actors in the region: to reduce greenhouse gas emissions, to reduce biological waste through the recycling of agricultural side streams, and to create new economic growth from new export based on the capabilities developed to solve the two first issues.

The regional strategy met with three major barriers as the context rapidly changed. The first one was a political change of heart in 2015, when regional politicians decided that electric buses would provide an even better solution for public transport than biogas. Several factors contributed to this loss of legitimacy and subsequent change in procurement policy, including the belief that the imported gas may have been mixed with natural (fossil) gas, the lower energy usage by electric motors, the lower city environment performance of noisy combustion engines, the increasing normality of battery-electric vehicles, and – possibly most important when compared with another region where a similar biogas preference endured – the loss of biogas as a local solution recycling local waste and bringing new jobs to the community by local entrepreneurs (Mutter, 2019; Jolly and Hansen, 2021; Mutter and Rohracher, 2021). The biogas volume used in public transport in Scania

²⁴ Climate investment program.

has actually grown rapidly until 2020, whereas battery electric solutions were set to be taking most of the growth after 2018²⁵; but investments in production capacity depend on long term stable market relations. The Scania regional council has of course not withdrawn its roadmap, but they seem to be underlining their co-ordinating role more emphatically than before.

The second barrier was that different national support rules for biogas in Denmark and Sweden effectively ruled out domestic, let alone regional, suppliers to the operation of biogas buses in Scania on the basis of price, once Danish surplus biogas production from 2017 became available for export to nearby regions. Denmark practiced production support and Sweden practiced customer support. This situation might last for a few years until national support schemes were harmonized, but these years would be critical in the formation of a major biogas industry in Scania. Because of public procurement rules, the public transport system would not be able to favour regional provenance over the substantially lower price of Danish supply in future contracts. This effectively meant that the large regional biogas producers stood in real danger of losing their largest customer, given the way that the roadmap strategy had been implemented. The small producers who produced for their own use were not disturbed by these perturbations.

The third barrier can be stated or explained in at least two different ways. The symptom was that reliance on a single customer (public transport) for the growth proved risky. A standard economic explanation is that a single customer does not constitute a market, and other customers should have been approached or even created. A deeper, but more tentative, explanation looks at the roles needed for (regional) policy agents in order to actually create such a broader market. The Biogas Syd network seemed a perfect organization to give a flying start to Scania's projected position as the leading biogas region in Europe. Region Scania's administration had elected a co-ordinator role – albeit a very proactive one – in developing biogas capabilities that could make it a commercially viable activity. Using terminology of smart specialization strategies, the effort of creating capabilities with a viable economic foundation throughout the entire value chain amounted to a collective entrepreneurial discovery process – or perhaps better an entrepreneurial development process (Mariussen *et al.*, 2019). In cases where individual firms cannot together perform all necessary activities in a value chain, even after individualized public development support, public authorities have an important job in filling the gaps to release the value potential of having a complete value chain. This may require much more offensive measures than co-ordination and brokering of financial, technical, and model support to individual firms. Biogas Syd had been established to generate local recycling and energy solutions for farmers and not for business models that addressed larger markets. Entrants were now required to service a larger system through a commercial relationship. The public transport procurement had basically quadrupled the biogas demand in the region over a few years, and this increase could be said to provide a home market for the producers to use as a stepping-stone towards the leading role in Europe stipulated by the roadmap. However, several techno-economic issues loomed. One was the quality of available raw materials, after the local farmers had provided for their own needs. Another was about scale, which would be important for costs, which again might be decisive for entry into foreign markets. A third one may have been the prevailing business model of previous Biogas Syd solutions, each of which addressed the needs of a small and fixed number of customers rather than a competitive market. These were very different issues from the ones that had been successfully handled in the setting up of local solutions. Local owners had set up a large production facility in Jordberga in 2013, but it was basically set up on the

²⁵ frida.port.se

premise of being a factory in the value chain of a single customer and at a price that became too high.²⁶ This is not to say that it would have been possible to overcome the two other barriers mentioned with a different policy agent role. We are merely pointing to the need to look at how innovations take place, not just at whether they reach some standard stage or not.

Although the regional climate goals have been more or less achieved on time, with a lesser reliance on the biogas industry in Scania than initially expected, the expected green growth from the biogas industry has not (yet) materialized. The complementarity of the Scania regional council's roles in the development all but disappeared once it was clear that regional biogas procurement would become next to impossible.

However, the industry has developed by other means, in particular because the Jordberga production facility was acquired in 2017 by the Finnish company Gasum, which profiles itself as a leading biogas expert, proponent, and provider in the Nordics, with treatment of biodegradable waste as one of its prime assignments.²⁷ This company is owned by the Finnish state and is thus implementing a public policy of green growth by different means, in particular with a stronger mandate than the coordination mandate originally taken by the Scania regional council. It lies beyond the scope of this report to go deeper into this development.

²⁶ A German company had actually positioned itself between producer and customer, with contracts both ways that permitted it to benefit from imported Danish biogas instead of locally procured gas.

²⁷ <https://www.gasum.com/en/our-operations/biogas-production/biogas-plants/jordberga-biogas-plant/>

4 CROSS-CASE ANALYSES

4.1 Looking for patterns across cases

At this point, we will compare cases on a number of variables in order to identify differences and similarities. Even exploratory studies should be able to identify good candidates for more systematic explanation.

A major distinction between the cases studied is whether the initiative comes from greening the activities under the responsibility of the regional council and then is used to create growth in the region (as in section 4.2, or whether the initiative comes from creating growth in the region and then is used to direct this growth towards the greening of activities within the region and beyond (as in section 4.3). All regional councils may have policies coming from both angles; our selection of cases is meant to illustrate the variety of policies rather than the variety of regional councils. Other important variables for comparison are industry or sector (section 4.4), and the classical distinction between structures and agency in explaining change (or lack thereof; see section 4.5).

4.2 Decarbonization policies that create regional growth

When the initiative comes from the greening side, it is in our cases mainly expressed as a way of decarbonizing the activities under the council's direct or indirect control. The councils in question have mapped their dependence on fossil fuels and on other uses of fossil hydrocarbons. Since regional councils in Norway and Sweden are responsible for public transport, it is no surprise that this will be the target of many policies. Since the councils furthermore to a great extent rely on private contracts for operating (and to some extent also owning) the buses, trains, trams, ferries, other boats, and other vessels used to provide those services, public procurement is bound to be a major strategy for achieving decarbonization. The main question in our report, then, is how this can result in green growth in the region.

Biogas was a more mature solution for buses than battery electric propulsion when biogas was selected for the Scania buses, and definitely a green step forward from the existing biofuel supplements to fossil petroleum fuels. There existed a distributed biogas capability in the region at the time, hence it seemed a perfect match, suited to make Scania the leading biogas region of Europe by 2030. However, the biogas capability was essentially created around a number of decentralized circular economy sites, and the quantity required for the buses made it necessary to scale up production, including the construction of new value chains and business models for greater market competition in commodity production. Then, because of the general maturity of such solutions in Sweden and Europe, the regional supply solution was vulnerable to external competition. In particular, the misalignment of Danish and Swedish state support rules for biogas gave supply from the neighbouring Denmark an extra advantage that more than offset the extra logistics costs, at a crucial time of the build-up of production capacity in Scania. Furthermore, the regional council's decision to switch to battery electric technology over time, together with the (at least temporary) price advantage of biogas from Denmark, gave the growth impetus a setback. The Finnish state owned Gasum company has bought the major Scania gas producer and has most likely found a sustainable business model that will also create economic growth in Scania on the basis of the substrate supply generated by agriculture, food industry, and household waste. Somewhat ironically, the local circular economy capabilities did not transition well into the capabilities required to succeed in the market of non-fossil commodity supplies to replace the fossil commodity supplies currently still dominating the energy requirements of bus transport.

The Hordaland county council was aiming at a transition from fossil diesel to low- or zero-carbon alternatives on its ferry routes. Although tenders were technology neutral, battery electric propulsion in full or hybrid (based on existing hydroelectric resources) quickly became the de facto standard solution for short-range ferry routes, thereby indirectly skipping a probably more mature but less sustainable solution of bio-diesel. The county council found a way to enlist the capabilities of industry in the wider region to move the technological frontier and provide stable solutions to the ferry operation. This involved interplays between commercial industrial actors already accustomed to providing not only traditional ferries, but vessels of many kinds with a number of innovative features from a flexible network of configurable value chains (Steen *et al.*, 2019a; Bugge *et al.*, 2021). Fortunately, a single successful proof of concept – the world's first all-electric ferry – had recently been produced in this network and was procured by a state authority, thus reducing the risk on the part of the industry (Sjøtun, 2018). Demands from the more profitable offshore petroleum sector were expected not to rise to former heights again, hence the industry was ready to target new niches. It may also have helped the reorientation of this industry from the fossil fuel system to the renewable energy system that ferries suited to the fjords and sparsely populated archipelagos of Norway's western (and northern) coastline do not exactly constitute a global market. However, several of the firms involved have gone global with their new offerings. What was not so straight forward, was the economics of the requisite changes in the power supply system to enable charging of the ferries both onshore and at docks of remote islands. The county council's choice of absorbing this risk themselves may very well have been a deciding factor in creating the intended greening and related regional growth. However, it has come at a cost, with political negotiations still ongoing to redistribute these pilot costs more equitably over the transition effort in toto.

Regional councils may also have other ways of drastically reducing their indirect climate gas emissions, such as by switching their large volume consumption of fossil-based products to alternatives with a smaller lifecycle carbon footprint. In the other case from Scania presented here, public procurement of new alternatives for hospital consumables with a medium difficulty of finding non-fossil alternatives was attempted in two ways, both intended to create growth in the region. In both cases, intermediaries were charged with mobilizing firms in the region that were willing to go through the necessary innovation steps in order to be able to deliver competitively. In the first instance, the regional council's own innovation support company lined up with some of its closest network firms to test out alternative products in a comprehensive manner. As part of this process, the council staff discovered that there were some companies beyond their horizon that came up with other suitable offers, some of which also required less innovation activity. They also discovered that an important barrier was the reluctance of many smaller firms to enter markets governed by public procurement regulations, not just because of the rules themselves, but also because of the risk of developing products with very low demand outside a procurement where the winner basically takes the whole market niche. Therefore, in the second round, the role of the intermediary was moved to the forum of the CEOs of the number of well-functioning cluster support organizations in the region, who could cast the net wider and perhaps also translate better between the needs of the hospitals (or the entire county council services) and the capabilities of firms in the region.

We draw three important lessons from these cases.

1. The regional growth effect of decarbonizing the consumption under the regional councils' control depend on the pre-existing relevant capabilities of industry in the region, and on how

these are mobilized. The key term here is probably "relevant". The Hordaland industry was ready and able to take a significant step, provided the risks on the infrastructure side were handled by the county council. The relevant capabilities comprised both technical, economic, organizational, and business model aspects. The wide variety of firms in Scania turned out to be able but not necessarily so ready to develop and provide a wide gamut of consumables, but they needed some learning in approaching the public sector as customers. The Scania biogas network showed a widespread legitimation and practice of local circular economies by means of biogas production, but their capabilities were locked into this development path, and the difficulty of the break-out process was underestimated.

2. Some important external factors also distinguish these cases, and our data do not allow us to say which forces were the more important, since they pulled in the same direction as the capability issues discussed above. The Scania biogas growth case was at least temporarily set back by both the prioritization of a new technological solution (battery electric) and by an unfortunate misalignment of support schemes for biogas in Sweden and neighbouring Denmark. The Scania consumables case was relatively risk-free, but also low in its growth ambitions. The Hordaland ferry case was shielded by the relatively small market size, which made it less attractive to foreign competitors. However, partial solutions in this market also turned out to be attractive in other, foreign markets.
3. Particularly when a regional council is a forerunner, it must be ready to accept a significant financial risk, as will usually any forerunner. The risk may come from the actual procurement side, since firms will usually not accept contracts where they take all the risk related to the cost of producing something that has not been made before. The risk may also come from the fact that although public actors over time will have to share the public sector cost of large transitions such as the current greening of society, institutional inertia will almost certainly guarantee that state support mechanisms are not aligned with the new paths of regional forerunners.

4.3 Growth strategies that contribute to a more sustainable future

When the initiative primarily comes from, or is promoted by, the growth side, it finds different expressions in the cases we have studied. Among our cases, we have discovered three very different policies or strategies to make this happen. The main question for this section, then, is how growth initiatives in a region can be used to improve sustainability.

In the Värmland (or forest) case, the green aspect was more or less given because the industrial foundation was a renewable biological resource under no immediate threat of overtaxation. It would take a lot for growth in this domain not to be green. Rather, the issue was more one of how to create this growth at all. The region's paper industries had survived the global crisis and restructuring, and they had found profitable positions in their global niches. To move beyond this, second generation innovation policies were applied to move the resources into a bio-economic direction, in the meaning of using new biotechnologies emanating from research for the creation of higher economic value from the forest. Those policies included supporting relevant research in the region's university and using a strong cluster organization to create arenas for building capabilities for upgrading. Notable for this case was also the importance of place-based leadership for initiating crucial change processes.

Place-based leadership also played an important role in the second case, where existing firms in various industries in a specific location were recruited to change their practices into an industrial symbiosis encompassing energy and side streams. Officers of Trøndelag county set up training for industry-supporting consultants in their region to act as intermediaries for propagating ideas of a circular economy and thereby translating those concepts from an academic to an industrial practice. Some circulation points were lost in translation and now come back, creating opportunities for new research. Notably, however, a significant job of the intermediaries was to recruit a leading investor industrialist in the local community to champion the first projects. As is sometimes the case with greener practices, they are not always very profitable, and available financial support instruments for their development and implementation were directed either to create higher growth or to support unprofitable green investments.

The final case, from Tampere, can be said to deviate from second generation innovation policy in that it does not set up fixed roles in a (regional) innovation system but rather stimulates the formation of resilient ecosystems at a small(ish) scale, with possibly hitherto unknown functions and roles (or divisions of labour between agents). They do this by setting up physical platforms for industrial (re)location or residential areas to be equipped for living lab-like experiments, together with a series of green policy rules for firms and inhabitants wanting to settle there. In fact, regional and municipal policy makes it difficult to build new activity in and around Tampere outside these platforms. This is also coupled with an attempt at rebranding what many technology providers in the region do as cleantech. The entire development, significantly, is guided by place-based leadership. Even though green growth in this manner is not expected to be quick, the greenness of the entire system appears to be infused in how the platforms work and how the local leadership is capable of picking up and amplify weak signals to that effect.

Three interesting cases hardly give reason for firm recommendations. However, we venture the following lessons:

1. The introduction of new concepts (like circular economy) requiring both socio-cognitive, behavioural, and structural changes will probably benefit from bottom up-policies, including the support for experimentation, rather than from top-down policies for the implementation of specific solutions (see also Schot and Steinmueller, 2018).
2. Local leadership by individuals with a good standing in the community – not necessarily in a very visible role – can be important in generating acceptance for experimentation requiring broad participation to find acceptable, let alone profitable, solutions. The role of regional (or municipal) agents in this matter is to make sure the right people actually do become champions of concrete experiments involving unfinished concepts or solutions.
3. The roles of intermediaries depend on the context – from keeping people out of each others' way to jolting them together, and knowing when to choose either tactic.²⁸

4.4 Intra- and intersectoral differences and similarities

Let us briefly look at differences and similarities in our cases related to what sectors or industries they are aiming at.

²⁸ This conclusion stems from data present but not thoroughly displayed in the case descriptions above. It is also consistent with other GONST findings (Klitkou *et al.*, 2020) and related research (Finne *et al.*, 2008; Finne and Aasen, 2019).

The Scania biogas case and the Värmland forest case can both be said to belong to the bioeconomy – not just in the banal sense of using biological raw materials, but in the sense of contributing to a structural change in the entire economy from its reliance on non-renewable to renewable (biological) resources. However, whereas the growth engine in Scania was a hike (although temporary) in local demand (albeit from a single customer), the growth expected engine in Värmland was closer to future scientific breakthroughs that industry would most likely benefit from using in a technology push momentum.

Then let us next look at public sector transportation. Both the electric ferry case and the biogas bus case belong here. In both cases, the decarbonization effort was matched with technologies for which there were capabilities with a growth potential in the region. The less mature battery ferry solution was in many ways the outcome of a more interesting policy than the more mature biogas bus solution was – but also very costly for the council. The openness to international suppliers in a relatively mature market added a dimension to the Scania bus case that was not a factor of concern in the ferry case. Timing is also important: In a few years, hydrogen solutions might have been a more potent choice for the ferries, but the window of opportunity for investing in new ferry propulsion technology was rather short.

There is an interesting difference between providing green solutions for others and implementing them – also in terms of policies for place-based policies for regional green growth (Capasso *et al.*, 2019). We distinguish between providing green technologies and green materials or consumables, because the market dynamics are so different for knowledge intensive one-off or at least bespoke technological solutions and for global commodity trade. The former has come to be known as cleantech. This is a category that evades economical statistical schemes established on the basis of similarities in products or production. Cleantech refers to its functions in production rather than to its structural or material properties. Firms delivering cleantech exist in a number of industries and have customers in a number of other industries, not all of them delivering green commodities.

Both the machinery and electronics firms in Tampere discovering their cleantech identity, and the battery ferry producers in Hordaland, could be said to be cleantech providers, as could possibly also the machine builders in Värmland. The policies that drive the growth opportunities of these firms are as diverse as those aimed at driving the growth opportunities of producers of green commodities such as paper containers or biogas from local sources. However, even if both driver sets are varied, they are not the same. They seem to depend more on the nature of the firm, its production, and its markets, rather than on whether its output contributes to the greening of the economy or not.

4.5 Structural and processual explanations

In GONST work focusing on institutional entrepreneurship at the regional level in transitions to new, sustainable industrial paths, the importance of agency (*i.e.*, actions and interventions by individuals rather than by organizations) has come to the forefront (Sotarauta and Suvinen, 2019; Sotarauta *et al.*, 2020). In particular, place-based leadership undertaken by highly respected individuals with or without a formal institutional position can be important in setting new developments in motion, based on local needs and options, and realigning them based on continuous assessments.

We also note that such leadership and initiative may come from the political side as well as from the administrative side in the regional authorities, or from private actors. Even though most of the initi-

atives in the policy cases we have studied came from administrations and were adopted by the political assemblies without much discussion, the political side occasionally also took the lead and went for the most effective rather than for the most efficient alternatives.

This is not to say that industrial and institutional structures do not matter. Place based leadership of this kind may be particularly effective precisely in periods of structural transition, but roles and relations between leaders may vary. Furthermore, such leadership would be rather ineffective if it did not have (or did not acquire) institutional backing. Interestingly, all our three growth driven cases relied on local leaders for the new ideas to gain sufficient momentum to be considered by industrial incumbents in particular, as we have already described above.

This may of course be due to our sampling criterion of working with "interesting" regions. Nevertheless, policy agents for new and sustainable development directions might do well in considering both the structural contingencies of their region and the possibilities of allying with place-based leaders willing to champion the changes in question.

5 CONCLUSIONS

In this concluding chapter, we outline some commonalities in the six policy cases we have sampled. Even though we did not find many recurring patterns along "classical" variables (in chapter 4), we do have some comments on three different levels. We first look at some understated commonalities, mostly related to the position of regional policies in a multi-scalar policy mix picture. We then address the most prominent policy options displayed among the policy actors in the regions we have in our sample. Then, finally, we consider to what extent the sampled policies can be said to contribute not only to green growth in their own regions, but to a more complex sustainability transition, and some implications for regional policy for green growth in general.

We did not find strong tensions between regional councils and state government at the regional level over the responsibility for promoting green growth and hence controlling the use of instruments like the structural funds (ERDF) of the EU in their respective regions. The sectoral case studies (Andersen *et al.*, 2019) found that the removal of the responsibility for regional growth from the regional policy level in Denmark created some concerns for development both in the long and the short terms. Firms would still be supported in their green development, but not necessarily with the same profile over time that a regionally anchored vision could have given. Beyond that, such tensions were not readily visible in our policy study, possibly because the policies we studied had taken the current situation for granted, and possibly because the relevant regional branches of the state agencies in our sample had also taken a fairly strong place-based position rather than just implementing a standardized state policy.

What we did find, however, was that state policy instruments did not always match with the needs of the green growth initiatives developed and implemented by regional councils. This observation goes beyond the ubiquitous quest for more money. The strongest expressions of this policy mix mismatch were in the forerunner case of ferries in Hordaland, where the county council was left between incompatible state charging mechanisms, so to speak, and in the Scania biogas case, where the incompatibility was between instruments of two different countries. Other examples of a lesser magnitude appeared in other cases as well.

This experience points to at least two different stable solutions: A total top-down system redesign or an experimental (but scaffolded) bottom-up transition process. The first one is to predesign transition processes centrally, with funding and other incentives, based on expert advice and political consensus, and give regional authorities a lesser influence on direction and design. Implementation can still benefit from regional or local proximity to the target populations. The other one is to harness the creativity in developing regional (or even local) place-based solutions and give experimentalist forerunners a position to generate experiences on which new national instruments should be based after systematic review. In this solution, it would be most helpful to scaffold the experiments with some sort of compensation for their risk, at the very minimum amounting to an ex-post application of said instruments once they have been developed for future initiatives. The two strategies may have different merits for different domains or different degrees of standardized technological and regulatory solutions. In practice, both regional councils and others will have to live with a mixture of bottom up and top-down approaches. This will require active coordination by many parties, a fact that is sometimes overlooked by designers of specific instruments.

The relationship between the green and the growth agendas differed from what we expected. The conservationist or protective side of the green agenda had already been assimilated by the growth

side before policies were devised. Growth initiatives, whether primary or secondary, had found areas that were either opened by green policies or had received a boost through the new emphasis on renewable resources etc. Furthermore, none of the initiatives were aimed at significantly reorienting existing non-green systems, only gently replacing them through changing public sector customer preferences.

Given all the observations in the preceding paragraphs, regional authorities in our sample can be said to perform three functions in creating green growth.

Number one is to create growth opportunities in their region when they set out to decarbonize the activities for which they themselves have a responsibility or can exercise control, as operators, customers, regulators, and influencers. To what extent they are able to actually turn these mandatory changes into regional growth opportunities, seems to depend primarily on (adaptation of) existing capabilities in the region. However, strategies for mobilizing those capabilities and stretching them into a new growth path can be decisive in actually achieving this. For this purpose, procurement experts regularly have to tap into the capabilities of their business development counterparts. Structured and prolonged interactions, often facilitated by qualified and trusted intermediaries who may find the right actors and also translate between industry and policy, seems to be a key.

Number two is to influence industry (and business) in their region to change their practices towards a more sustainable pattern. These practices usually depend more on the nature of the operations than on the specific conditions of the place where they are performed. For this purpose, it could sometimes be more efficient to operate national topic-specific or sector-specific schemes. These were developed in earlier initiatives for pushing certain technologies or solutions at various readiness levels, and they typically work better the closer the solutions come to a turn-key stage, where the subvention is for accelerating change rather than for risk relief. The operation of these schemes may have a regional organizational structure, which primarily means the agencies come closer to more members of their target groups. There may be regional differences in the scope and relevance of each agency, this can be handled within such an organizational pattern. Specific regional initiatives may also be ahead of the development of a more comprehensive scheme. The regional distribution may also be used in local collaboration across agencies.

However, our sample contains two cases that also show the value of local or regional initiatives in this area. Both the local mobilization in Trøndelag for an industrial symbiosis and the local engagement in Tampere for the combined provision and application of products and services for a more circular economy on local value-governed platforms can be taken as evidence of the value of creating local understandings of what to do and why. It is of course simple for ferry passengers or bus drivers to travel with, or conduct, vehicles that do not create a net increase in greenhouse gases. Just as easy as it was for them to travel and to do their job two years earlier, with the old technology. Changing the attitudes, knowledge, and behaviours of the many, as may be required for an effective circular economy, probably requires much more personal and practical engagement, and might in fact even benefit from interventions by municipal rather than by regional officers. Place based leadership may be a key issue.

Number three is to create growth that responds to the needs for new products (and services), new production, and new production technology that will be needed locally or in an export market for a transition towards a sustainable society. Some of these initiatives are better served by state agencies

than by regional authorities because of the heavy development processes involved, be they R&D or investment, or because they may be solutions for a whole sector and not just for that region. Others fit the regional bill perfectly in that the region already has the requisite capabilities and other resources on which to build the new growth.

Whether or not and to what extent regional authorities are willing and capable of performing these functions is of course a question with many answers – perhaps as many as there are regions! We have, even in our small sample of presumably advanced regions, found a large number of operative policies. This goes to show that even when operating within the structural constraints of existing industrial and institutional capabilities (Grillitsch and Hansen, 2019), there is great room for place-based variation. There is also great room for place-based leadership, particularly in situations where broad changes in mindsets and behaviours are attempted.

We do, however, realize that our sampling strategy for policies has left us with regions with a great drive for green growth and a long-term history of capability building for regional innovation systems built around second-generation innovation policy (cluster initiatives, triple helix, R&D collaboration, professional intermediaries, correcting for market and system failures, etc.), mostly in reasonably good accord with national developments along similar lines. All regional councils and their administrations do not display such constant attempts at generating new good practices.

Sustainability transitions therefore meet with at least two challenges at the regional policy level. One is that not all regions are equally well equipped to drive or implement innovation processes as effectively or efficiently as leading regions. The other one is that even the leading regions may have institutionalized practices that are better at creating Schumpeterian growth opportunities than at channelling the growth impulses towards green growth paths. Not only industries can become locked in to their technological development paths; also entire innovation systems can be institutionally locked in to the dominant practices of counteracting market failures and systemic failures. Looking forward it seems reasonable to assume that innovation policy increasingly will be attuned towards green growth and other grand societal challenges. From a regional innovation and development policy point of view, one important recommendation coming out of this work on green growth in the Nordics is that policy makers (and other stakeholders) carefully consider the ability of existing regional innovation systems' ability to deliver solutions to societal challenges (problems) – both within and beyond own borders. Where possible, local and regional policy makers can make significant contributions by (contributing to) creating demand and mobilizing a diversity of actors in agenda-setting and discovery processes. While doing so, policy makers need to be mindful of potential lock-ins and also tensions between sustainability and growth. Green growth in one region may have both detrimental and positive environmental or socio-economic effects elsewhere. In sum, this suggests a need for capacity building also in monitoring of such initiatives, including systematic use of forums for coordination and learning between policy actors across regions and between regional and state policy agencies. Many such forums already exist on an *ad hoc* basis. These, too, could prove instrumental in devising and testing place-based strategies for directional and transformational innovation and contribute to the adaptation of national innovation policy in the dynamic problem-solution spaces that always can be identified in large societal transformations (Wanzenböck *et al.*, 2020).

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7 APPENDIX: REGIONAL SUBDIVISIONS AND RESPONSIBILITIES

In this section, we give a somewhat more detailed description than in Table 1 (on page 16) of what it is that constitutes regions and regional authorities in the four Nordic countries studied in GONST. The description primarily aims to contextualize the different green growth policy situations of the regional councils and it is in no way complete.

7.1 Denmark

In 2007, 13 "amt"²⁹ (counties) were merged into five "regioner" (regions) with "regionsråd" (regional councils) directly elected. They have no tax authority, and their earmarked state funding provides for limited budgetary flexibility.

The corresponding 15 "statsamt" (regional state administrations) were at the same time merged into five "statsforvaltninger" (regional state administrations) with territorial boundaries corresponding to those of the regions. The 2007 reforms also reduced the number of municipalities from 270 to 98 and transferred much power from the county level to the municipal level. In 2019, the regional state administrations were reorganized and no longer correspond territorially to the regions.

Regional councils are responsible for area planning, healthcare including hospitals, public transport, environmental planning, soil pollution management, certain tasks within culture, and certain coordination tasks within secondary education and economic development for peripheral areas. Since 2019, the remaining responsibilities for economic development have also been centralized, which means that regional councils no longer have the right to initiatives in questions of economic growth, whether green or not. However, initiatives in circular economy typically may involve public-private collaborations, which has left the county councils with an opening to remain on the green growth arena.

The five regional state administrations were oriented towards family welfare and health and did not have any relevance for neither green development nor economic growth. Regional growth strategies were the responsibility of six "Vækstfora" (growth forums) under "Danmarks Vækstråd" (Danish Growth Council), in collaboration with the regional councils. In 2019, the growth forums and the growth council were disbanded and the EU structural funds that had been their cornerstone funding have since been operated from a single national point under "Danmarks Erhvervsfremmebestyrelse" (the Danish Board of Business Development), without any formal relations to the regional councils. However, several of the regionally located "væksthus" (growth houses) that previously operated initiatives on contract with the regional growth forums under the policies determined jointly by the regional councils and the growth forums, have continued their operations as "erhvervshus" (business houses) based on contracts with the now centralized board of business development. To some extent, these are through their history adapted to regional industrial structure.

7.2 Finland

Historically, the Finnish "maakunta"/"landskap" (regions) have been fairly stable for a hundred years.³⁰ However, in their current administrative form, the regional councils were established in

²⁹ In this section, the terms in "quotation marks" are in the national language in question. In the case of Finland, a slash separates the Finnish/Swedish language terms.

³⁰ The latest reform in 2011 reduced the number from 20 to 19.

1994. Regional councils are statutory joint municipal authorities. One of the regions is an autonomous region with its own parliament and has its council elected by its population, the remaining 18 have their councils elected by the municipal councils as their co-operation forum. Based on the Regional Development Act, the regional councils are authorities responsible for regional development. Planning of regional councils is divided into regional development and planning. Main aims of regional councils are to promote regional development initiatives, regional balance, and environmentally sustainable development. In addition, the regional councils develop EU regional policy, deliver EU structural funds, and also implement them. Regional councils have no tax authority and receive their funding from the municipalities.

"Läänit"/"län" (provinces) that each covered one or more regions and which the State Provincial Offices administrated, were reduced in numbers from 12 to six in 1997 and entirely abandoned in 2010, in favour of seven "aluehallintovirasto (AVI)"/"regionförvaltningsverk" (Regional state administrative agencies) and 15 "ely-keskus (ELY centres)"/"närings-, miljö- och trafikcentraler" (Centres for economic development, transport and the environment). Both the ELYs and AVIs are regionalized offices of the state, and they perform duties of the central government in their area. Their main functions are to advice, follow-up, and report, and to provide licences/permits. Most of the ELY Centres act in the fields of 1) business and industry, labour force, competence and cultural activities, 2) transport and infrastructure, 3) environment and natural resources. The AVIs operate mainly in basic services like social and health care, work and occupational safety and health, education, corporate governance enforcement, real estate agents, alcohol and tobacco sales, water and environment, etc.

7.3 Norway

In 2019, the merger of 19 "fylkeskommuner" (counties) to 11 was completed.³¹ The county councils are elected directly. They have state funding, some of which is earmarked and some of which is more flexible, and some of them may also have other sources of revenue (*e.g.*, land rent), but they cannot levy taxes.

The corresponding merger of "fylkesmann" offices (regional state administrations) followed a similar timeline and resulted in ten organizations later renamed "statsforvaltere" (county governors).

The main responsibilities of county councils include area planning, secondary education, public transport, culture, and community development. The latter includes business development, which also covers some related R&D, although the funding for that is increasingly moved to state agencies with regional offices under partial county council control. This arm's length control distance stretches the institutional capacities of the county councils as competent policy makers and overseers.

County governors mostly have control functions within a number of areas, including services of the county councils, and also a significant environmental protection mandate. They also harbour regional development activities for agriculture and aquaculture, hence overlapping with the county councils, although with basically regionally undifferentiated policy mandates.

³¹ One pair had already merged the year before.

The major policy instruments for both green development and economic growth are operated by national organizations. However, the business oriented "Innovasjon Norge" (Innovation Norway) has a regional organization where also county councils individually are part of their governance structure. "Norges forskningsråd" (The Research Council of Norway) has a regional strategy emphasizing regionality in some of its instruments and also maintains a regionalized office structure to be closer to businesses (and universities) around the country.

7.4 Sweden

Over a 20-year period up to 2020, the 21 elected "landsting" (county councils), each covering a "län" (county), changed the names of both the councils and their territories to "regioner" (regions), without major changes of territorial boundaries. They can levy taxes.

These regions still correspond territorially to the "län" (counties) governed by state government through their "länsstyrelser" (county administrative boards).

The main responsibilities of regions are with health and public transport. Some are charged with regional growth and development.

The main responsibilities of the county administrative boards include sustainable planning, energy and climate, natural environment, etc. Some are charged with regional growth.

Questions of regional growth have not been uniformly distributed between government at the two scales (regional and national).



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