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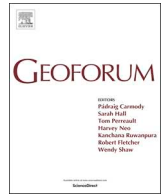
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Agency and actors in regional industrial path development. A framework and longitudinal analysis

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ABSTRACT

Despite significant interest in regional industrial restructuring in economic geography, surprisingly, scarce attention has been paid to the changing role of agency over time. The current paper develops a framework for understanding the role of multiple types of actors and the agency they exercise for regional industrial path development. The framework is employed in a longitudinal study of industry development in Värmland, Sweden, from forestry towards a bio-economy. The analysis highlights how actors exercise very different types of agency in different periods of regional industrial path development.

1. Introduction

The topic of structural changes in the economic composition of regions is central in current debates in both academia and policymaking. Contributions on path development processes in different regional contexts have provided insights into how and where new regional paths emerge, and the reasons for other regional paths not emerging (Martin, 2010; Simmie, 2012). Similarly, policymaking is increasingly focused on understanding the opportunities for stimulating new regional paths, most prominently exemplified by the Smart Specialisation program of the European Union (Foray et al., 2012; McCann and Ortega-Argilés, 2015).

Existing accounts have emphasised the idea that new industries in a region develop out of existing industries through a branching process (Boschma and Frenken, 2012) as well as through combinations of unrelated knowledge and resources (Grillitsch et al., 2018). The birth and development of new industries are often seen as occurring due to the presence of dense regional networks and structures, a combination of different knowledge bases, vibrant entrepreneurial culture, and innovative firms. However, despite this interest in preconditions and processes related to structural change, little is known about the micro-level processes that drive industrial restructuring. As argued by Boschma (2017; 358), “little to no attention has yet been paid to the role of agency, and the different types of agents that may drive regional diversification.” Similarly, Uyerra et al. (2017) argue that there has been little theoretical and empirical work that connects the behaviour of

individual agents to institutional change and regional development.

Having said this, there is a burgeoning interest in the role of agency in regional structural change both in the quantitative and qualitative traditions of economic geography. Recent quantitative papers make associations with the occurrence or appearance of certain types of firms and industrial diversification. For instance, Neffke et al. (2018) find that unrelated diversification is mostly associated with new establishments, especially if they have non-local roots. In a similar vein, Elekes et al. (2019) find that foreign firms have a higher deviation from a region’s average capability match than local firms and are thus a agents for structural change, in particular in more peripheral regions.

In the qualitative tradition, recent papers zoom in on regional change processes and how particular types of actors have affected such processes. Such research provides complementary insights to the papers mentioned above. For instance, while on average incumbents are associated with reinforcing regional specializations; there are some that incorporate disruptive innovations in their operations (Kumaraswamy et al., 2018; Zietsma et al., 2018). Other papers have focussed on how other types of actors affect regional change processes such as public policy actors (Dawley, 2014; Miörner and Trippl, 2017), intermediaries (Howells, 2006), or fringe actors (Fredin et al., 2018; Zietsma et al., 2017).

If regional structural change, however, is understood as a process in which different types of actors are engaged in different ways over time, and where the synergies or contradictions of such engagement matter, studies focussing on a particular type of actor or agency have

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limitations. Only very recently, there have been attempts to capture this interplay more comprehensively both conceptually and empirically (Grillitsch and Sotarauta, 2019; Isaksen et al. 2019; Mackinnon et al. 2019). We contribute in the qualitative tradition to the efforts of comprehensively capturing the interplay about the ways different types of actors shape regional industrial paths over time.

In the current paper, we address this gap by developing a framework for understanding the role of multiple types of agents and the agency they exercise for new path development. Following the Dictionary of Human Geography, human agency stands for “*the ability of people to act, usually regarded as emerging from consciously held intentions, and as resulting in observable effects in the human world*” (Gregory et al. 2009; pp 347). We focus on agency in the context of green regional path development and pose the following main research question for the paper:

How does agency and the actors involved vary over time in the greening of industries in a regional context?

Empirically, we analyse path development processes in the Swedish region of Värmland, specifically the transition towards a bioeconomy. A strong specialisation in forestry-related industries characterises Värmland, traditionally focused around a number of large pulp and paper mills. While the region has historically focused on traditional pulp and paper products such as packaging materials, a broadening out towards a wider bioeconomy, resulting in a larger variation in biobased products, has been evident in recent years (Grundel and Dahlström, 2016; Henriksson, 2016). Thus, the ongoing structural transformation towards a bioeconomy in Värmland provides a suitable setting for analysing how actors constrain and facilitate the greening of industries.

Conceptually, we develop an analytical framework that integrates four different elements. Our point of departure is the literature on preconditions for new industry development, which clarifies how regional path development processes may take multiple forms, including upgrading of existing industries, diversification into related industries, and the emergence of technologically unrelated industries (Grillitsch et al., 2018; Hassink et al., 2019; Isaksen et al., 2018; Isaksen and Trippel, 2016). Green industry path development can take all of these forms (Grillitsch and Hansen, 2019), and require multiple types of change agency. Thus, we draw on insights, which foregrounds how actors construct and exploit opportunity spaces for regional development by identifying change strategies and demolishing, renewing, and building new structures. In this, we focus on three types of change agency: Schumpeterian innovative entrepreneurship, institutional entrepreneurship, and place-based leadership (van Grunsven and Hutchinson, 2016; Grillitsch and Sotarauta, 2019). While change agency is central to regional path development processes, there is also a need for attention to structural maintenance work that focuses on strengthening existing structures and specialisations. Thus, we complement the focus on change agency with insights on structural maintenance agency, which may constrain the development of new industrial paths (Henderson, 2019).

The final element in our analytical framework is to introduce a distinction between agency and agents. While agency is fundamentally concerned with actions or interventions to produce a desired effect, agents point to the actors that exercise agency. Recent work has drawn attention to the need for a broad conceptualisation of change agents in new path development processes. Experienced practitioners and public policy agents play central roles in transforming regional institutional arrangements (Mörner and Trippel, 2017; Isaksen and Jakobsen, 2017), and the interplay between regional policy actors and private sector actors change between phases of regional development processes (Holmen and Fosse, 2017). Thus, employing a broad perspective on influential agents in new path development processes appears to be particularly important to understand regional industrial restructuring in a long-term perspective.

The empirical and conceptual approach allows us to make a number of related contributions concerning the role of agency in regional path

development. Firstly, existing work has often attributed specific types of agency to specific types of agents, e.g., attributing Schumpeterian innovative entrepreneurship to firms (e.g., Neffke et al., 2018) or place-based leadership to local governments (e.g., Hambleton and Howard, 2013). The distinction between different types of agency and agents in our conceptual framework avoids such *a priori* assumptions and allows for a more nuanced understanding of the relation between agency and agents in regional path development processes. This includes an appreciation of the possibility for agents to exercise multiple types of agency simultaneously, or for changes in the types of exercised agency over time.

Secondly, the paper contributes by expanding the types of agency and agents considered in regional path development processes. Regarding agency, previous work focuses on different types of change agency, while the role of structural maintenance agency is overlooked, which is arguably unsatisfying for the understanding of regional industrial change. Regarding agents, we include the role of fringe agents, e.g. outsiders with limited power and resources, which have traditionally been ignored in the literature on innovation systems and regional path development (e.g. Autio, 1998) even if they might influence such processes in unforeseen and unexpected ways (Fredin et al., 2018).

Finally, the paper also contributes with a thorough empirical analysis of agents and agency in regional path development, thereby responding to recent calls for empirical work on agency in regional development (e.g., Asheim et al., 2016; Uyerra et al., 2017). We address this call by a thorough investigation of how patterns of agency change over time in the transition towards a bioeconomy in Värmland, Sweden.

The remainder of this paper is organised as follows. We start with an overview of the role of strategic agency in regional path development, and subsequently, develop the theoretical framework of the study. The next section discusses the research method used for the study. The fourth section presents the analysis of the role of agency in path development processes in Region Värmland. Here we trace the development from pulp and paper industry towards a broader bioeconomy in three distinct temporal phases. Finally, the fifth section concludes the paper by discussing and summarising the main theoretical contribution of the study, policy implication, and scope for future research.

2. Theoretical Framework

2.1. Preconditions for new industry development

In economic geography, a vast amount of literature investigates the question of how regional preconditions affect the future development of industrial paths (Neffke et al., 2011). The question brings together the evolutionary idea of path-dependence and lock-in (Grabher 1993; Martin and Sunley, 2006) with the body of work on regional innovation systems (Asheim and Coenen, 2005; Tödting and Trippel, 2005). One of the major contributions of the regional innovation systems literature has been to connect theoretically certain types of regions with common challenges and opportunities for innovation and new industrial path development. The most widely used typology rests on Tödting and Trippel (2005) differentiating in peripheral, old-industrial, and metropolitan regions. These regions are related to key innovation challenges related to organisational thinness, lock-in, and fragmentation, respectively.

In recent years, the focus shifted from innovation per se to new industrial path development (Dawley et al. 2015; Isaksen and Trippel, 2016; Grillitsch et al. 2018) as the driving force for regional structural change and green industry development. New industrial path development can take many forms (Martin and Sunley 2006). Grillitsch and Asheim (2018) differentiate in upgrading, diversification, and emergence. Upgrading refers to qualitative changes in existing industries. Diversification captures processes, “*where knowledge and resources from existing industries are used in new industries*” (ibid, p. 1641). Emergence is about the development of new industries that are technologically

unrelated to existing industries in the region.

The question of structural change comes to the fore when previous growth paths are exhausted, turning them into what has been referred to in the literature as old industrial regions (Cooke, 1995; Tödting and Trippel, 2004; Hassink, 2010). Such processes typically unfold as a result of the embedding of local industries in global production networks in the course of industry life cycles (Klepper, 1997; Ter Wal and Boschma, 2011). As industries and technologies mature, the source of competitiveness shifts from innovation to cost. Standardised production typically relocates to low-cost economies, and existing firms shift focus from product to process innovations, with the aim to reduce cost and the consequence to reduce the workforce. The need for developing new economic activities becomes paramount. While industrial life cycles are an important cause for structural change, change is also advocated by policy makers and in the public discourse in order to address global warming (Schot and Steinmueller, 2018; Grillitsch et al., 2019a,b). Accordingly, industrial path development should not take any direction but lead to a greening of the economy (Grillitsch and Hansen, 2019).

Specialised regions, such as our case study region, have some distinct features such as a strong but usually rather homogeneous knowledge base, networks that are rather rigidly and hierarchically organised in value chains, and institutions that are adapted to the field of specialisation – all of which contribute to negative lock-ins (Grabher, 1993; Tödting and Trippel, 2005). Vested interests are strong due to the accumulated past investments in knowledge, networks, and support infrastructure in the field of specialisation. Change strategies towards new green industries are thus most promising that allow reusing existing capabilities either by upgrading existing industries or by diversifying in new but higher value-added economic activities (Grillitsch and Hansen, 2019).

2.2. Change Agency

These change strategies, however, have to be devised and implemented by regional stakeholders and a deeper understanding of ‘agency’ is considered a missing link in the understanding of regional growth (Rodríguez-Pose, 2013; Uyarra et al., 2017; Asheim et al., 2016; Boschma et al., 2017). An important analytical distinction has been made between agency as the underlying capacity to act, and the actors who exercise the agency in distinct temporal and spatial contexts (Emirbayer and Mische, 1998; Abdelnour et al., 2017). Agency is essentially focused on actions or interventions to produce a desired social effect, but is also temporally embedded as agency is informed by the past but oriented towards the future (Garud et al., 2010; Cattani, Ferriani and Lanza, 2017; Sotarauta and Suvinen, 2018).

A distinction has been made in the literature between types of agency that transform existing structures and such that reproduce them (Coe and Jordhus-Lier, 2011). In the context of regional path emergence, Isaksen et al. (2019) differentiate between firm-level agency and system-level agency. Firm-level agency captures new firms and intrapreneurial activities of existing firms. System-level agency captures actions aimed at changing the regional innovation system. This framing is conducive as it builds on the regional innovation systems literature and differentiates between its core activity “innovation of firms” and the supporting “system”. However, for the purpose of this paper, it is problematic that types of agency overlap with types of agents. Firm-level agency directly relates to certain types of actors (firms, start-ups, entrepreneurs) who conduct innovative activities, whereas system-level agency may relate to many actors (potentially firms and entrepreneurs including) who pursue other activities affecting the system.

We argue that we need to differentiate between types of agency and types of actors (cf. Emirbayer and Mische, 1998; Abdelnour et al., 2017). Following this idea, Grillitsch and Sotarauta (2019) develop the Trinity of Change Agency typology, bringing together three types of change agency, which have distinct theoretical roots and claim to produce distinct effects for regional industrial path development. First,

Schumpeterian innovative entrepreneurship as mindful deviations from existing paths and willful attempts to create new paths by seeking new opportunities. Second, institutional entrepreneurship, which involves challenging existing institutional norms, raise legitimacy, and institutionalise alternative practices and norms. Third, place-based leadership is about coordinating and pooling efforts and resources for the stimulation of new regional development opportunities. Together these three types of transformative agency are presumed to play an important role in the emergence of new growth paths and are clearly distinguished from other types of agency that are agnostic, resisting, or opposing change.

Schumpeterian innovative entrepreneurship aims at path-breaking innovations and is a key driver for structural change (Shane and Venkataraman, 2000; Feldman et al., 2005). Recent studies in economic geography have discussed the role of innovative entrepreneurship in regional industrial path development and diversification. Innovative entrepreneurship is about acting on perceived opportunities by combining different knowledge bases, often from distinct institutional fields (Strambach and Klement, 2012) and creating new value-added activities. Innovative entrepreneurs take risks to enter new terrain and thereby support regional industrial renewal processes (Rypestøl, 2017; Neffke et al., 2018; Grillitsch, 2018). However, Schumpeterian innovative entrepreneurship alone is often not sufficient to develop new regional growth paths and may require institutional change and the collective mobilisation of efforts from various actors. Therefore, institutional entrepreneurship and place-based leadership are important types of transformative agency to be considered (Grillitsch and Sotarauta, 2019).

Institutional entrepreneurship is concerned with actions and strategies aimed at changing existing institutions or introducing new ones (Battilana et al., 2009) and thereby create new opportunities such as the development of new industries (Sotarauta and Mustikkamäki, 2015). Institutional entrepreneurship is typically an iterative learning process where unplanned events and developments require actors to adjust their strategies and learn from failures. Institutional entrepreneurship usually engages multiple actors, with potential incongruous visions and aims, who work together to transform dominant institutional arrangements (Sotarauta and Pulkkinen, 2011; Sotarauta, 2016; Sotarauta and Suvinen, 2018). Institutional entrepreneurship plays an important role in the emergence of new industries (Binz et al., 2016).

Place-based leadership is a form of collective leadership to coordinate regional development efforts with a wide range of actors, extending from the individual private interests to the benefit of the region as a whole (Sotarauta, Beer and Gibney, 2017). Place-based leadership essentially focuses on coordinating potentially conflicting visions and discourses about the future of the region, mobilising heterogeneous actors in order to pool competencies and collective resources for a common goal, and negotiating with different actors at the municipal, regional, national and transnational scales to support the regional growth agenda (Normann et al., 2017).

2.3. Structural maintenance

Finally, *structural maintenance* points to actions that contribute to reproducing existing structures. As emphasised by Martin and Sunley (2006, p. 406), “[t]he past thus sets the possibilities, while the present controls what possibility is to be explored.” Thus, agency is often strengthening existing structures and specialisations due to a number of different lock-in mechanisms (Klitkou et al., 2015). These include learning effects, i.e., that specialisation leads to increasing returns from learning about existing products and processes, and economies of scale where earlier investments in production equipment lead to increasing returns from further investments in existing production systems.

While existing studies have focussed on the role of change agency and institutional work to support new regional path development

(Grillitsch and Tripl, 2018; Grillitsch and Sotarauta, 2019), institutional maintenance has been identified a key form of institutional work, which focusses on reproducing existing norms and beliefs through day to day practices and ensuring support of existing institutional arrangements (Lawrence and Suddaby, 2006). Instead of supporting novel activities, institutional maintenance work involves resisting novel activities and adapting to change incrementally in the context of regional path development (Henderson, 2019). Institutional maintenance work involves actions such as introducing new practices to create deterrence for change, supporting the persistence of existing institutional routines, and using narratives to support the routinization of existing practices and adherence to rules. Actors maintain their privileged positions by countering pressure for change, responding to competitive threats by engaging in minor compromises with challenging actors and still maintain their core practices (Hampel et al., 2017; Zietsma et al., 2018). Thus, there is also a need for attention to maintenance agency alongside change agency, which can create competition and constrain the development of regions to sustain new path development (Henderson, 2019).

2.4. Actors of Change – Actors of Structural Maintenance

The literature on regional innovation systems highlights the need for considering a wide spectrum of actors to understand the development of industries and regions. Essentially, multiple types of actors may exercise the various forms of agency outlined above (Karnøe and Garud, 2012). Further, an actor, or group of actors, can simultaneously be engaged in several types of agency or may exercise different types of agency over time. Classical work on regional innovation systems differentiate between *firms* (i.e., the business sector), *facilitating organisations for innovation and entrepreneurship* (e.g., universities, educational facilities, knowledge transfer centres, incubators, cluster organisations, etc.), and *public policy actors* (e.g. regional, national, and international policy makers) (Autio, 1998. Tödtling and Tripl, 2005). In addition, it has recently been argued that other actors, also labelled *fringe actors*, such as civil society organisations or user associations should play a larger role, in particular to ensure the societal benefit of innovations (Van Wijk et al., 2013; Bertels et al., 2014).

As regards *firms*, a core distinction exists between start-ups and incumbent firms. Radical industrial change is typically attributed to new firms and entrepreneurs, whereas incumbents tend to introduce incremental innovations promoting existing industrial paths (Neffke et al., 2018). Yet, some incumbents show ambidextrous behaviour by being open to and resisting change at the same time (Patala et al., 2019). While many incumbent firms are resistant to change (Karlton and Sanden, 2012; Smink et al., 2015; Steen and Weaver, 2017), some incorporate disruptive innovations in their operations and move into new industries to exploit new opportunities and engage in defensive maintenance strategies to avoid disruption (Kumaraswamy et al., 2018; Zietsma et al., 2018). Incumbents that invest in new managerial competencies, establish new specialised divisions and business units, and actively engage in creating new markets are more likely to drive the development of new industrial paths (Hansen and Coenen, 2017).

Facilitating organisations for innovation and entrepreneurship (facilitating actors) include a variety of actors, including universities, educational facilities, business development organizations, industry organizations, cluster organisations, science parks, and incubators. These actors play an important role in developing new capabilities or maintaining existing ones. They are often intermediators facilitating the flow of knowledge and supporting the innovation process by matching complementary actors and resources (Howells, 2006). Knowledge support organisations also play a role in incentivising entrepreneurial activities through seed financing and advice. They can play a powerful role in framing regional policy issues through careful storytelling and mobilising legitimacy and resources for new regional initiatives, drawing on both regional and extra-regional resources (Isaksen and

Tripl, 2017).

Public policy actors can act as risk-takers when they support new regional initiatives and push new agendas forward against opposition from other actors in the regions (Boon et al., 2015; Holmen and Fosse, 2017; Mjörner and Tripl, 2017). Similarly, other accounts have highlighted that regional policy agents support and facilitate the development of new regional industrial paths by promoting new ideas in front of regional and national decision-makers and prioritising them for political support (Dawley, 2014; Dawley et al., 2015). However, public policy actors may also be a source for structural maintenance if they cooperate with elites to keep the status quo, for instance, by subsidising the leading industry (Grabber, 1993).

Fringe actors understood as outsiders with limited power and resources can play an important role in shaping regional development paths in unforeseen and unexpected ways (Fredin et al., 2018; Zietsma et al., 2017). Actors such as civil society organisations, user associations, and environmental movements can be a source of radical change as they have a greater degree of freedom in challenging existing regional institutional structures (de Bakker et al., 2013; Bertels et al., 2014). Thus, even if the agency of fringe actors is often dispersed, disconnected and with limited impact due to power relations and structural inequalities (Arora et al., 2014, 2017), in some instances, civil society stakeholders can use disruptive tactics to pressure incumbent actors to radical transformation and instigate wider institutional change (de Bakker et al., 2013; Briscoe and Gupta, 2016). Strategies of fringe agents include mobilisation of public opinion, direct engagement with politicians, and other engagement actions such as protests (Aranda and Simons, 2017).

2.5. Summary of the analytical framework

Our point of departure is that new regional industrial paths are the outcome of actions taken by agents embedded in multi-scalar networks and institution. To take account of the variegated facets of change agency, we propose an analytical framework along three dimensions: time, types of actors, and types of agency (see Fig. 1).

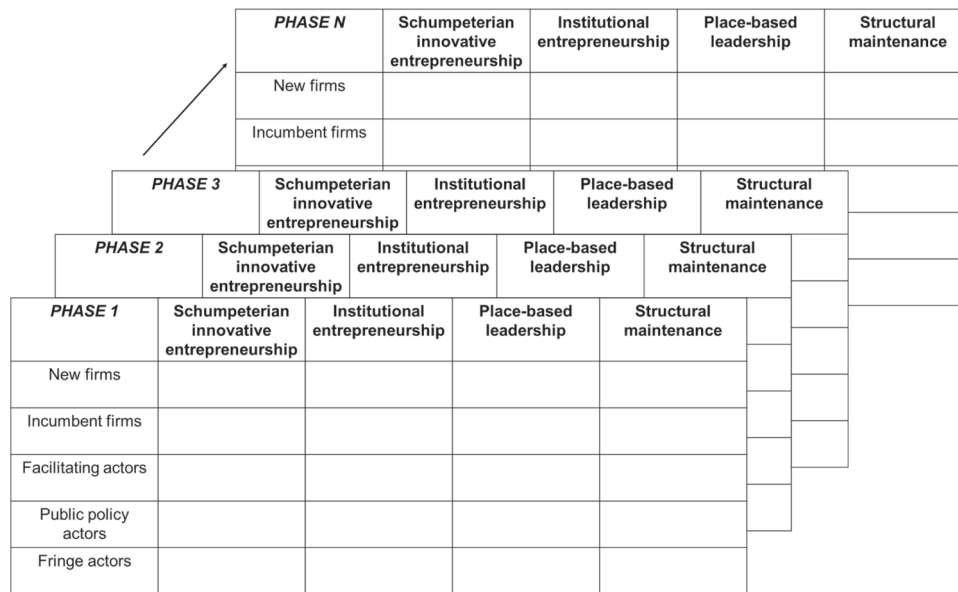
A longitudinal perspective on regional change processes allows for capturing shifts regarding the importance of particular types of change agency or change actors (Semper, 2019); thus, distinguishing between development periods characterised by different patterns of agentic processes. An open system perspective draws attention that relevant actors may be located outside the region, draw on regional and extra-regional knowledge and resources, and operate in a multi-scalar institutional framework.

3. Research Method

3.1. Background of the case study region

The region Värmland has always had a rich industrial base due to the presence of forest assets in the region. Initially, the sawmill industry developed in the region, which gradually developed into a pulp and paper industry. The combination of raw forest resources, access to water resources of the lake Vänern for transporting the timber, and generation of cheap hydroelectricity and et al. presence of iron ore contributed towards the development of Värmland. Subsequently an engineering industry emerged in the region, which saw the forest industry as its primary customer. During the earlier phases of the industry, large parts of Värmland were divided into ownership between two firms, Billerud and Uddeholm. The close geographical proximity between the forest industry and the engineering industry also facilitated innovation (OECD, 2006; Sandström and Berger, 2010).

Traditionally the region has been dominated by pulp and paper, steel, and engineering, but in the recent years, other industries such as ICT, tourism, service, food, and packaging, and design have developed in Värmland. Since the 1990s the region has experienced an ongoing



- Multiple types of actors exercising different types of agency**
1. New firms (e.g., start-ups or new public-private open test and demonstration initiatives)
 2. Incumbent firms (e.g., large, influential firms in the regional industry)
 3. Facilitating actors (e.g., universities, educational facilities, business development organizations, industry organizations, cluster organisations, science parks, and incubators)
 4. Public policy actors (e.g., municipalities, regions, regional development agencies, and national-level agencies and ministries)
 5. Fringe actors (e.g., civil society, ordinary citizens, user associations, environmental movements)

Fig. 1. Analytical framework.

Table 1
Value-added within bioeconomy in the region Värmland (Source: SCB, Statistics Sweden).

Year	Value-added within the bioeconomy (SEK million)	Net turn over within the bioeconomy (SEK million)	Gainfully employed within the bioeconomy
2009	9344	31,978	12,348
2010	10,467	34,404	12,563
2011	10,597	35,849	13,859
2012	10,954	35,608	13,574
2013	10,442	34,607	13,547
2014	10,870	33,735	13,303
2015	12,125	34,737	13,423
2016		36,598	13,357

structural change in the pulp and paper industry and experienced challenges related to profitability and retaining talented workforce in the region. Through a cluster approach, the region has expanded from the traditional pulp and paper industry into a broader bioeconomy, where bio-resources are exploited for the production of multiple types of products (Bugge et al., 2016). While the largest bioeconomy firms in Värmland are still primarily focused on pulp and paper production (Hallencreutz, 2018), a much broader portfolio of biobased products are produced today, including firms specialised in the production of building materials, compostable and biodegradable products, and environmentally friendly packaging solutions. Bioeconomy has become a key contributor to the regional economy in Värmland (see Table 1). Bioeconomy accounts for 6.2% of value-added in Sweden, while the

equivalent figure for Värmland is 13.5%, which is the highest among all the Swedish regions (Statistics Sweden, 2018).

3.2. Qualitative case study approach

We utilised a qualitative case study methodology (Gehman et al., 2018) to conduct an in-depth and historically rich investigation of the development of bio-economy in Värmland. Earlier studies have suggested that the standard industry classification schemes used by statistical offices do not capture the diversification of forest industry into new emerging products and services, and there is a lack of rigorous data about the industry due to rapid changes (Hetemäki and Hurmekoski, 2016). Qualitative approaches are also useful to study emerging regional industries, which do not fit with the existing industrial classification schemes (e.g., standard SIC and NAISC codes and patent classifications) (Feldman and Tavassoli, 2015).

Further, a qualitative case study approach allows for understanding interlinkages between agency and structure through deep contextualisation to uncover regional industrial renewal processes (Njøs, 2018; Mackinnon et al., 2019). The interplay between the role of actors and underlying institutional structures for regional path development, can be studied by using a long-term longitudinal and process-oriented approach, which can help to capture both successful as well as unsuccessful attempts at path development (Steen, 2016; Strambach and Pflitsch, 2018).

The focus of our case study was to identify the types of agency and the engaged types of actors in each of the identified phases. In order to identify the actors and the actors, we used a systematic approach (Grillitsch et al., 2019b), which is also explained in the next sections.

The steps taken are as follows.

1. Archival sources were studied in depth in order to identify actions or interventions intended to change or maintain the regional development trajectory.
2. From archival sources, individuals and organisations were identified that could be linked to these actions or interventions. If no individuals were mentioned, we investigated who was in charge of the organisations engaged in the actions or interventions. We complemented our list of interviewees by asking the regional authority Region Värmland to help us identify a balanced set of informants (i.e. both male and female experts, experts with diverse expertise in the industry, experts who had worked in in the earlier phases and contemporary phases, and performing different roles in the industry). In addition, we asked interview partners to identify additional potentially relevant informants.
3. Interviews were conducted with key informants who all had profound knowledge (present and historic) about the forest-based bioeconomy (and previously pulp and paper industry) in the region. We interviewed them among others about the drivers and hinders for a transition to a forest-based bioeconomy, the role different types of actors played in different points in time, and how these actors engaged (or worked against) this change process.

By triangulation of all the data sources, we could overcome typical challenges such as forgetfulness or ex-post rationalisation of interviewees. Also, by including the aspect of agency against change (structural maintenance), we could capture opposing voices, which might have been lost in the mainstream narrative of the regional change process. [Grillitsch et al. \(2019b\)](#) In that way, a comprehensive and robust understanding could be developed about the variations of how different types of actors engaged (or worked against) the transition towards a forest-based bioeconomy. The next section provides further details about data collection and analysis.

3.3. Data collection

We relied on extensive archival data sources, semi-structured interviews with 15 regional experts, and observations during a two-day study visit in Värmland. We focussed on interviewing key stakeholders who had considerable experience in forest-based bioeconomy and used a snowballing procedure to meet new potential interviewees. The details of the interviewees are mentioned in [Table 2](#). Since we are studying long term development of an emerging industry, we relied on using archival data sources to provide rich data and long-term historical insights into the emergence of industries ([Ozcan et al, 2017](#)). The archival data sources included a wide variety of sources such as scientific

articles, documents, newspaper articles, industry newsletters, regional strategy reports, legal documents, policy documents, and video material. In total, around 200 archival documents about the development of the pulp and paper industry in Värmland were analysed (see [Table 3](#)).

The first round of interviews was carried out in November 2017 with a field visit to the Värmland region where five face-to-face interviews were conducted. Interviews generally lasted between 60 and 90 min. We used different interview techniques such as event tracking where we tried to ask the interviewees to recollect the background information about their role in the regional industry, their prior experience and historical developments in the industry after starting the interview. We asked questions related to contemporary issues later on and ensured that we can relate the contemporary developments to the past developments. The interviews focused on understanding the combination of change strategies adopted and how opportunities for regional path development were initiated by them. We ensured to cover all types of actors from the theoretical framework in interviews to gather sufficient primary data, which we complemented with archival data.

Following the first interview round, we conducted six semi-structured phone interviews in December 2017 and January 2018. Furthermore, we conducted a third set of 4 additional phone interviews in September and October 2019 with specific actors such as large paper and packaging firm, start-ups focussing on bioeconomy, forest association, and incubator networks for business development to complement the insights gained from the earlier round of interviews. The interviews were transcribed verbatim with a clear set of guidelines by a professional transcription firm. The interviewees have had vast experience in different aspects of the value chain in the regional pulp and paper industry and have followed the development towards a bioeconomy in the region quite closely.

Observations were also carried out during a two-day study visit in Värmland focused on bio-economy development. About 40 video recordings were carried out during the event capturing the main discussions, providing rich material to understand the various regional policy debates. The event was also useful in personally meeting regional stakeholders and identifying informants for more in-depth interviews.

3.4. Data analysis

We adopted a multi-scalar perspective to regional path development as decisions and activities taking place at one scale often influence developments at other scales. Each regional case analysis is peculiar as, in some cases, regional agents operating within the region are the key actors driving change within the region while in other cases actors operating at different scales could be the key regional change agents.

We identified the boundaries of the Värmland case study and

Table 2
Semi-structured interviews.

Interview No.	Professional designation and type of organization	Date of interview
1	Strategist, regional growth development, regional development agency	24th November 2017
2	CEO, regional cluster organisation	27th November 2017
3	Director, business development, research institute	28th November 2017
4	Strategist, energy and environment, regional development agency	29th November 2017
5	Professor, regional university	30th November 2017
6	Consultant, pulp and paper industry	14th December 2017
7	Innovation Manager, municipality and project coordinator, open testbed initiative	20th December 2017
8	Consultant for cluster development	22nd December 2017
9	Mill Director, pulp and paper firm	5th January 2018
10	Researcher, regional university	12th January 2018
11	Former CEO of pulp and paper firm and business consultant	25th January 2018
12	Project manager, Bioeconomy Incubation network	10th September 2019
13	Director, Technology Centers, Large paper and packaging firm	26th September 2019
14	Chairman, Women's forest association network	1st October 2019
15	Managing director, SME specializing in biobased materials	4th October 2019

Table 3
Overview of the different data sources.

Sources of data	Type of data	Use in data collection and analysis
Semi structured interviews	15 semi-structured interviews in total in 2 different time periods 11 semi-structured interviews (November 2017–January 2018) 4 follow up interviews (September 2019 and October 2019)	Tracking the role of actors and their actions in bioeconomy development and understanding the key drivers and barriers to bioeconomy development; capturing the different actions played by the actors in different phases of the regional industry development
Participant observations in forums including analysis of PowerPoint presentations	Powerpoint presentations by different experts in the 2-day policy event on Bioeconomy development in Karlstad, Värmland; 40 video recordings of the discussions by the experts to familiarize the important discussions regarding bioeconomy development	Establishing contact and trust with the informants working towards bioeconomy development in Värmland; enhancing familiarity with the regional context and understanding the viewpoints of the regional actors; setting up follow up interviews with the experts after meeting them in person
National and regional strategy reports on bioeconomy development	Reports by national and international organizations (Nordregio; Vinnova; OECD; European Commission) on regional strategies in different Nordic regions focussing on bioeconomy development; smart specialization report by regional organizations such as Region Värmland	Tracking information about regional and national strategies and policies for promoting bioeconomy development
Consultancy reports	Reports produced by consultancy organizations depicting background information about the regional industry in Värmland and future trends (e.g. Kontigo AB; Technopolis)	Gathering information about the size and scale of the regional pulp and paper industry and firms involved in bioeconomy development in the region
Company reports and press releases	Reports and press releases on latest industry trends by firms such as Nordic Paper, Stora Enso, Rottneros and the SME's operating in the region	Collecting information provided by the large- and small-scale firms involved in bioeconomy in the region; useful for triangulating with information provided by the representatives of different firms during the interviews
Websites	Websites of key regional organizations like Paper Province, region Värmland, Karlstad University, Nordic Paper, StoraEnso and startup firms (e.g. Modvion; Renewcell) operating in the region	Useful for collecting background information about the different regional actors and preparing the interview guide for carrying out the semi-structured interviews
Academic articles, reports and thesis	Research articles, master and doctoral thesis and reports by scholars working in Karlstad University and other universities (Centre for cluster Observatory, Stockholm University) on different aspects of bioeconomy development (e.g. role of civil society, role of regional universities) in the region	Gathering background information about the region before carrying out the semi-structured interviews; triangulate accounts presented by other academic researchers with the information provided by the interviewees

examined if extra-regional actors operating at, e.g., the Swedish national level, or at the EU level played a critical role in our case study. Even though some extra-regional actors (e.g. Region Värmland EU office in Brussels, Ministry of Enterprise and Innovation in Stockholm) had relationships with actors operating within Värmland, they did not play a central role in the regional path development process. Thus, the focus of the empirical analysis is on developments within the Värmland region and the role of regional agents in the path development process.

To develop the case study account, we relied on process research (Langley et al., 2013) and qualitative data analysis (Gehman et al., 2018) to develop a case study account of the development of bioeconomy in Värmland. We first worked towards developing a deep understanding of the broader regional and historical context (e.g., Zietsma and Lawrence, 2010) and focused on dividing the archival and the interview data into successive time periods and phases in order to observe distinct patterns (Langley et al., 2013). The description in each phase was developed by ordering the raw data from field notes, interview transcripts and archival data sources. We identified the key regional change agents from the summarised raw data and focused on understanding their roles and strategies in transforming the regional industry from existing activities in the pulp and paper activities to bio-economy. Relevant quotes from the transcribed interviews, which depicted instances of regional agents challenging or reinforcing regional structures, were identified for the case study account.

During the second stage of data analysis, our focus was on capturing the temporal dynamics, i.e. engagement of different actors over time by being sensitive to the changing roles and actions and the distributed and interactive actions between different actors (Kamøe and Garud, 2012) shaping the regional path development process. We were interested in capturing the work being done by the actors and the intentional and unintentional consequences of it (Lawrence and Suddaby, 2006). Further, while analysing the data, we were also aware of the fact that not every action was taken by the actors to transform the institutional arrangements would result in success. The data analysis occurred

iteratively as we went back between emerging theoretical concepts and the emerging data multiple times to make sense of the regional path development process. As our initial interpretations emerged, we checked for consistency of the account by iterating again and gathering additional data. (Gehman et al., 2018; Semper, 2019).

A particular concern was to ensure that the interpretations were correct, which we tried to ensure by cross-referencing different archival material. Furthermore, to cross-check and verify our interpretation of the developments in the region, we also submitted the draft manuscript to the expert interviewees and asked them to review the empirical account and suggest potential modifications. The draft was submitted to the different expert interviewees to ensure that we had not missed any important events, the role of key actors and other important background information about bioeconomy development in Värmland.

The next section provides a detailed empirical analysis of bioeconomy development in the Värmland region in different temporal phases of regional development in Värmland, i.e. (1990–1999; 1999–2011; 2011–2018)

4. Case study analysis

4.1. Phase 1 (1990–1999): Deepening existing specialisations

The first phase was characterised by structural maintenance exercised by incumbent firms, new firms, and public policy actors, which contributed to deepening specialisation of the regional pulp and paper industry. Conversely, the different forms of change enabling agency were largely absent, leading to a period characterised by path extension.

Structural maintenance

The pulp and paper industry historically in Värmland started to grow due to easy access to timber, efficient water transportation as well as access to cheap hydroelectricity. The Värmland region had a

significant presence of pulp and paper mills and engineering firms building machinery for the paper firms in the past (Karlsson et al., 2001). As the number of pulp and paper mills grew, the region soon attracted process equipment and other suppliers, making Värmland a unique centre for process innovations that would later be used by the pulp and paper industry all around the world (Sölvell, 2009; Interview 11).

In the 1990s, many businesses in the paper and pulp industry succumbed to fierce competition from firms in South America and Asia. Increasing cost pressure and consequently, the need for economies of scale, high environmental requirements, and structural changes in the industry forced the regional industry to reconsider its business practices (Interview 8; Interview 11; Manickam, 2016). The dominant approach taken by the industry was to deepen specialisation in the production of packaging materials, as it was not able to match global competition in the printing paper market (Sörensson and Jonsson, 2014; Interview 11).

The main emphasis in innovation efforts by key firms such as BillerudKorsnäs, Nordic Paper, and StoraEnso was to increase energy and production efficiency to improve profitability (Interview 6). Furthermore, investments focused on extending competitiveness in packaging materials, which had, for long, been a stronghold in Värmland. As one of the interviewee's remarks:

“By pure luck, it was not a skilled decision, but the mills in Värmland never went into printing and writing or other printing grades or newsprint, neither fluting board and some specialty papers. So, we are not affected by the Internet. So, that is the biggest thing here in Värmland, which means then, since, I mean, we have been making liquid board [used for packaging beverages] for 30 years, and now, when the consumption in the world of liquid board is increasing Värmland will become the world centre of producing liquid board.” (Interview 11)

An increasing number of new firms offering specialised support services further amplified the continuing specialisation of incumbent firms in packaging, which also resulted in the development of spinoffs and entrepreneurial businesses serving specialised demands in the pulp and paper industry. The development of new spinoff firms was stimulated by the needs and demands of the large forestry groups for e.g. the role of ICT consultancies oriented towards forest industries and specialised logistics and control technology (Tsuchida, 2013). Suppliers of process equipment, consultants, and service providers increasingly created a high density of competencies in the region, which matched the requirements of the pulp and paper producers (Interview 8; Interview 9). The Värmland pulp and paper mills benefitted from proximity to key suppliers such as Andritz, Voith, BTG and technology and IT consultants such as ÄF, Citec KPA, Sogeti and Pöyry, and the resulting opportunities for regular interaction and dialogue, which helped the mills to improve their production processes and competitiveness (Henriksson, 2016; Interview 11).

Due to the increasing international competition and crises in the pulp and paper industry in the region, the regional authority, the County Administrative Board of Värmland and a representative from a municipality began to consider more carefully how the pulp and paper industry could be nurtured and made attractive for skilled labor (Sölvell, 2009). The regional authorities introduced the cluster concept and undertook a number of concrete actions: firstly, they mapped all firms related to the pulp and paper industry in the region; secondly, through interviews and other forms of data collection they explored the relationship between the firms including how they were doing business with each other. The rationale behind this effort was to explore common problems faced by firms, such as labour shortages, and to identify potential ways for actors to work together in addressing these challenges. The Paper Province became instrumental in bringing together the forest value chain as well as public authorities and regional universities for developing a vision for the regional industry (Van Vught et al., 2006; Sölvell, 2009; Interview 8).

4.2. Phase 2 (1999–2011): Promoting a vision for industrial change

In the second phase, we have observed efforts to create a collaborative culture with an increasing role of public policy actors and facilitating actors in promoting a vision for industrial change. The dominant forms of agency in this phase are institutional entrepreneurship, place-based leadership, and Schumpeterian innovative entrepreneurship, contributing to establishing path diversification.

Institutional entrepreneurship

One factor contributing to the structural crisis during the 1990s was the dominant practice of individual firms rivalling on regional markets. The institutional change that was the seed for industrial change in our case refers to a change in mind-set where regional actors started to see the opportunity of competing on world markets by collaborating regionally (Interview 8).

Karlstad Municipality was a key actor who initiated an institutional change process by reaching out to key firms and the university. As an instrument to facilitate institutional change, Karlstad municipality started “The Paper Province” as a small project in 1999 and worked at convincing other partners about the potential of a collaborative regional approach for global competitiveness. The Paper Province developed into a unique business cluster connecting different pulp and paper firms, SMEs, university and training institutes, public organisations including VINNOVA and the Swedish Agency for Economic and Regional Growth, regional authorities, and civil society groups in the region (Interview 2). Some of the large member companies included firms like Andritz, BillerudKorsnäs, Metso, Mondi, Stora Enso, Tetra Pak and Voith (Sörensson and Jonsson, 2014).

Another focus of the Paper Province was to reframe the crisis into an opportunity for developing new products and markets, i.e., to shift from a defensive strategy of protecting old business models to an offensive strategy of developing innovative solutions. In this regard, The Paper Province promoted a pragmatic and experimental approach to find new solutions to the problems in the industry with limited resources available. The idea was to shift from endless debates and discussions rooted in rivalries between firms to concrete and joint actions to make things happen (Interview 8). This process of institutional entrepreneurship led to a change in mind-set as compared to phase 1, and consequently, to collective efforts to support the transition to a bio-economy as evidenced in the next sub-section on place-based leadership.

Place-based leadership

The antecedent to place-based leadership was a change in mindset where regional actors saw the benefit of collaboration. The change in mind-set was then a fertile ground to identify and negotiate common interests, coordinate regional development efforts, and pool resources for a common goal. Key actors were public policy actors, in particular, Region Värmland, which collaborated with facilitating actors, in particular The Paper Province and Karlstad University, for supporting the pulp and paper sector by creating new meeting places and developing new incentives and co-operation between the different regional stakeholders (Interview 1; Interview 5).

In 2000, the County Administrative Board (Länsstyrelsen) identified forests and the forest-based industry as a business area with strong potential for promoting regional growth. In 2005, a new regional strategy called Sustainable Regional Growth was launched, which identified the pulp and paper industry as a central area of future development (Interview 1; Olsson, 2007). The Regional Growth Programme initiated in Värmland offered a suitable context for sustainable regional development. Support and funding for the regional growth programme were secured from the County Administrative Board, County council, and Regional Värmland (Van Vught et al., 2006).

The Paper Province, with support of Region Värmland, started various initiatives to promote experimentation and testing, such as Packaging Greenhouse, Packaging Arena, and Energy Square (Chen,

2009). Furthermore, Region Värmland collaborated closely with Karlstad University, which in its own right, pursued place-based leadership by actively strengthening educational and research fields with links to regional industries. Karlstad University engaged in co-operative research on pulp and paper technology, as well as material and chemical engineering (Van Vught et al., 2006; Interview 5).

During 2005–2006, a study conducted on regional development in Värmland in connection with the OECD educational initiative “Supporting the Contribution of Higher Education Institutions to Regional Development” created a formal network between Region Värmland and Karlstad University. The regional engagement of Karlstad University was strengthened, leading to an agreement with Region Värmland on co-financing ten professorships from 2010 to 2014 in sectors and topics of importance to the regional industry. Region Värmland also established facilities for better interaction with the university and enhancing research co-operation (Interview 1; Tsuchida, 2013).

Schumpeterian innovative entrepreneurship

In this phase, Schumpeterian innovative entrepreneurship emerged to develop new value-added products based on lignin. The dominant form of action were demonstration projects, which, interestingly, were driven not driven by firms but facilitating actors. For instance, Innventia, a research institute, set up a demonstration plant to showcase the effectiveness of a lignin extraction process, which was a first step towards the development of new lignin-based products. (Interview 3; Interview 7).

Karlstad University also supported new entrepreneurial initiatives. From 2010, the Grants and Innovation Office established at Karlstad University focussed on increasing collaboration between the university and the business sector as well as with three other Swedish universities. The idea of stimulating innovation collaboration was to support new entrepreneurial initiatives within the university as well as across the regional boundaries (Kempton, 2015).

4.3. Phase 3 (2011–2018): Diversification into higher value-added activities

In phase 3, the dominant forms of agency shifted from institutional entrepreneurship to place-based leadership by a variety of regional actors and Schumpeterian innovative entrepreneurship driven by new firms but supported by incumbents. These activities led to a diversification into higher value-added activities. In addition, we observe institutional agency of fringe agents aiming at revaluing forest resources.

Place-based leadership

As regards place-based leadership, public policy actors and facilitating actors have played a key role. In 2012, Region Värmland introduced the new regional cluster strategy ‘Värmland model 2.0’, which focused on upgrading and enhancing existing competencies by increasing national and international co-operation (Goddard et al., 2013; Grundel and Dahlström, 2016). Further, in 2012, the Paper Province was successful in mobilising long-term funding for new bio-economy initiatives from VINNOVA’s Vinnväxt programme. This funding aims at experimenting with new bio-economy initiatives and enables the region to capitalise on its existing strengths as a leading pulp and paper cluster (Interview 2). Furthermore, the new Vinnväxt initiative called ‘Paper Province 2.0’ received funding from various partners to support a bio-based economy. The financing for Paper Province 2.0 came from VINNOVA and other regional co-financiers such as Region Värmland, County Administrative Board, Karlstad University, municipalities in Värmland, County council, the forest board, and the member firms in the Paper Province. The objective of this initiative has been to stimulate greening and diversification of the pulp and paper sector in Värmland and transformation of the economy to a more bio-based and circular

economy, to position Värmland as a large-scale demonstrator of forest-based bioeconomy (Interview 2; Interview 5; Grundel and Dahlström, 2016).

Place-based leadership has thus focused on coordinating regional interests and mobilising resources to not only upgrade the existing industry but also diversify into new fields of higher-value added activities. Furthermore, these activities have been complementary to Värmland’s Smart Specialisation strategy, which identifies the forest-based bio-economy as one of its most important priorities. Värmland’s Research and Innovation Strategy for Smart Specialisation (VRIS3), was approved in 2015 in close co-operation between Karlstad University, regional clusters and related industry with the aim for developing the potential of the region by supporting areas prioritised based on identified strengths, market demand, potential to meet societal challenges and gaining international competitiveness (Interview 1; Henriksson, 2016).

The establishment of the Academy for Smart Specialisation in 2016 underpinned the smart specialisation strategy. The academy is a collaboration between Karlstad University and Region Värmland to support new industrial path development. In this context, the academy invested in key areas such as forest-based bioeconomy, digitalization of welfare services, and advanced manufacturing. The Academy for Smart Specialisation has been designed to be integrated into the university’s research and education strategy and thereby reinforce the university’s goal to collaborate with society actively (Academy for smart specialisation, 2016; Henriksson, 2016). In the spirit of smart specialisation, this initiative builds on existing strengths but aims at diversifying into new promising industrial paths (Interview 1).

Building on the developments in phase 2, when the first demonstration plant in Bäckhammar was implemented, new regional initiatives were realized, assisting firms in developing new concepts for lignin fuel. Innventia, Kristinehamn municipality, and The Paper Province collaborated to develop the LignoCity initiative with the purpose of creating a space for the identification and promotion of new ideas on alternative lignin applications (Interview 3). The demonstration plant constructed in 2007 was reused and rebuilt for the open test bed initiative LignoCity. Lignin is used for producing new types of fuels, materials, and chemicals. Lignocity aims at helping firms to test, evaluate and refine new ideas and bridge the gap between experimental initiatives and actual commercial applications (Interview 3; Tomani, 2017). Further, the Karlstad Innovation Park established by the Karlstad University, Karlstad Municipality, Region Värmland, and Värmland County Council is working on creating interaction between research activities and entrepreneurship in the region and develop shared networks (Kristensen and Mikkola, 2016). The Sting Bioeconomy and Kickstart network Värmland supported by the Paper Province, is creating an enabling business-friendly environment for start-ups and spinoffs from existing large firms operating in forest-based bioeconomy in the region. During the earlier phases of the regional industry, there was a lack of trust between the different stakeholders for cooperation. The Kickstart network has been influential in developing regional structures for co-operation for the start-ups in the region. The Kickstart network has supported start-ups in the region by (1) providing them with resources and expertise to scale up through organic growth; (2) helping them set up collaborations with large industrial firms and (3) supporting industrial exits, which allow for further-development of the start-up’s technologies (Interview 12).

Furthermore, regional business development officers in Värmland have highlighted current bio-economy initiatives to civil servants and officials in the Ministry of Enterprise and Innovation to get attention and mobilise support from the national government. At the European level, Region Värmland has attempted to lobby for supportive policies by having representatives from the region participate in policy debates concerning the development of the bio-economy (Interview 1; Interview 4).

Schumpeterian innovative entrepreneurship

Largely thanks to the developed support structures for innovation and entrepreneurship in phases 2 and 3, we observed an increased activity in Schumpeterian innovative entrepreneurship. Of central importance was a more collaborative culture, including changing roles for public policy actors and Karlstad University, identification of and funding for strategic areas for diversification, and establishment of supporting initiatives such as the Academy for Smart Specialisation, LignoCity and The Sting Bioeconomy and Kickstart network.

While new firms have been the main drivers of Schumpeterian innovative entrepreneurship, incumbent firms have also provided support to and engaged in new ventures. Schumpeterian innovative entrepreneurship has contributed in particular to two forms of new path development: i) technological upgrading where new technologies make a significant change to existing products or processes, and ii) diversification based on combinations of related and unrelated knowledge.

For example, Modvion develops wind tower technology by replacing steel and concrete constructions with an environmentally-friendly wood-based material. Re:newcell develops solutions for converting used cotton and other natural fibers into new biodegradable pulp, which can be fed into the textile production cycle (Interview 2).

Cellcomb focuses and specializes in developing environmentally friendly absorbent products for the healthcare, food, and the hygiene industry. A key reason for the firm to stay within the Värmland region is due to the presence of knowledge and competencies about the forest industry available in the region, access to suitable locations for setting up plants and the support received from the cluster organization Paper Province, Business Värmland and the Karlstad University for collaborating on different initiatives (Interview 15). Another promising firm, Drinor focuses on solutions that allow for higher utilisation of biomass through an innovative mechanical dewatering process. As argued by one interview partner, there is a huge potential for innovative start-ups to utilise the waste streams from the regional industry, but challenges remain, as most of the start-ups have yet to develop commercially viable products and services (Interview 2).

The large paper and packaging firms in the region, such as BillerudKorsnäs have gained a positive image as a leading firm in the development of new renewable materials, semi-chemical fluting, liquid packaging board, and in using different waste streams to produce new materials. Central to this development has been the creation of specialized technology divisions for developing new renewable materials with funding for long-term research and development activities. The firm has also initiated a number of flagship projects for the development of new renewable materials and allocated significant resources for these projects. Associated with this, BillerudKorsnäs has changed the skill and competence-base by hiring new specialist staff with advanced technological skills and doctoral degrees and experience in business development to support the new initiatives and create new markets (Interview 13).

Similarly, the region's other large pulp and paper firms have continued exploiting their current business operations around packaging but also investing in new technologies, reducing energy consumption, and creating value-added products from waste streams (Interview 6; Interview 9; Interview 11). The large firms have also collaborated with each other while lobbying together on important issues facing the industry as members of cluster organizations. In some instances, they have also supported generic research and development activities with the other large firms in national research platforms (Interview 13).

Even though incumbents have not had a short-term business incentive to diversify, firms such as Nordic Paper have been co-operating in different testbed initiatives for extracting lignin and for producing other high value-added products (Interview 3; Interview 7). Other firms have been investing in pilot projects concerning biorefinery development and new board machines for packaging solutions. They have been interested in open innovation environments where they have collaborated with start-ups for novel R&D activities (Interview 9). The

incumbents have been less willing to collaborate on activities that potentially compete with existing core product groups for raw material supply (Interview 8). Overall, therefore, the incumbent firms have taken a supportive but not very proactive role in Schumpeterian innovative entrepreneurship (Interview 1). However, incumbents are potentially important for start-ups for their competencies, networks, and resources.

Alternative industrial paths: Institutional entrepreneurship of fringe actors

In contrast to the strong partnership in the Värmland region between business, academia, and the government, the links are rather weak to civil society actors, forest associations, female forest organisations and owners, and ordinary citizens. As remarked by one interviewee

“So, I think that there is a lack of connections between the industry and the civil society [.....]. The paper industry is an industry, which is far from civil society. The products are not directly sold to the consumer. The value chain is quite long before the finished product reaches the consumer.” (Interview, 10)

Thus, in general, actors beyond dominant business clusters, academia, and the government have had a low influence on the definition of priorities in regional development documents. The association of forest women in Värmland (Skogskvinnorna) has advocated for more equality in the traditionally male-dominated regional industry and has argued that new initiatives are needed to enhance the attractiveness of the industry for young female engineers. New recent initiatives have started such as the Gender Academy (Grundel and Dahlström, 2016; Interview 10). The association has helped female forest owners in negotiating better deals with the large firms in the region when selling wood, and has also provided inputs on topics related to forest resource management through meetings with regional government authorities, regional firms, and cluster organizations (Interview 14).

Furthermore, there are civil society initiatives (in line with trends in other European countries) aimed at defining the value of forests differently, for instance in terms of nature and landscape conservation, ecosystem services such as carbon capture, wildlife protection, or resource for tourism and recreation (Interview 10). These actions of fringe actors have so far not influenced the dominant development trajectories. A broader discourse on regional development priorities with current fringe actors could both open new pathways but also limit the exploitation of others (Interview 5; Interview 10).

5. Conclusion

The current paper sets out to examine the role of public and private actors in constraining and facilitating greening of industries in a regional context, as, arguably, limited attention has hitherto been given to micro-level processes in studies of regional industry development (Asheim et al. 2016; Boschma, 2017; Uyarra et al., 2017). While quantitative (Neffke et al. 2018; Elekes et al. 2019) and qualitative (Mackinnon et al. 2019) work on the topic is emerging in economic geography, we still have an insufficient understanding of how various types of actors perform different forms of agency in regional path development processes.

To this end, we pose the question ‘How does agency and the actors involved vary over time in the greening of industries in a regional context?’ and develop a framework for understanding how multiple types of agents and the agency they exercise influence new path development processes over time. First, our analytical framework focuses on change enabling types of agency, i.e., Schumpeterian innovative entrepreneurship, institutional entrepreneurship, and place-based leadership (Grillitsch and Sotarauta, 2019) as well as on agency that contributes to maintaining existing structures. We suggest that paying attention to all four types of agency allows for a complete understanding of the dynamics of new path development processes. Second,

Table 4
Predominant types of agency and influential agents.

	Schumpeterian innovative entrepreneurship	Institutional entrepreneurship	Place-based leadership	Structural maintenance
New firms	Phase 3			Phase 1
Incumbent firms	Phase 3			Phase 1
Facilitating actors	Phase 2	Phase 2	Phase 2	
Public policy actors		Phase 2	Phase 2Phase 3	
Fringe actors		Phase 3	Phase 2Phase 3	Phase 1

our framework calls for attention to a broader set of actors involved in exercising the various forms of agency (Semper, 2019).

Our empirical analysis of path development processes in Värmland illustrates the significant variation in the roles played by different types of agents over time (see table 4). For example, incumbent firms exercised structural maintenance in the first phase, place-based leadership in the second phase, and Schumpeterian innovative entrepreneurship in the third phase. Further, the analysis highlights how a type of actor may carry out multiple types of agency at the same time, e.g., facilitating actors in the form of universities and research institutes, which exercised both Schumpeterian innovative entrepreneurship and place-based leadership in the second phase. This highlights that there is not a simple answer to the central research question of the paper: the roles of different types of actors in regional path development processes are contextual. A specific type of actor may exercise structural maintenance agency in one development phase and different types of change agency in the following phase. A core implication of this finding, and contribution of the paper, is a caution towards assigning specific agency roles to specific types of agents involved in path development processes. The framework developed in this paper avoids such assumptions and allows for conceptualising the multiple roles that different types of agents may take in regional path development processes by exercising different types of agency. The framework also explicitly points attention to forms of agency (structural maintenance agency) and types of agents (fringe agents), which are generally overlooked in the analysis of regional path development processes.

Following this, a central policy implication is that policymakers should not necessarily attribute specific types of agency to specific actor groups. Rather than for instance assuming that new firms are necessarily the central sources of Schumpeterian innovative entrepreneurship, we suggest that policymakers should consider a broader spectrum of actors and identify which agents are working for or against change in a given time and place, what strategies they pursue, and what effects their doing has on regional structural change. For instance, while so-called fringe actors did not significantly affect the path development process in our empirical case, other recent contributions highlight the variety of actors that may drive or influence path development (Holmen and Fosse, 2017; Fredin et al., 2018), and the attention of policymakers should reflect this. Further, policymakers should pay attention to changes in the role of different types of actors over time – the actors driving change agency today, will not necessarily do so tomorrow. Finally, we propose that policies supporting new path development processes should not only focus on supporting change enabling agency, but also weakening agency that contributes to structural maintenance.

The main limitation of our study has to do with the difficulty to investigate regional processes retrospectively, which concerns in particular the developments in the 1990s. For the first phase of industry development (the 1990s), we had to rely on the triangulation of archival data and recollections by expert interviewees, which overall provided a less fine-grained picture about the actors involved and the agency they exercised than the picture we obtained in the later phases. For the later phases, we could collect richer data in terms of the variety and amount of available archival data sources, the two rounds of semi-structured interviews with different informants, as well as observations. A triangulation of all these data provided us with a comprehensive understanding of agency during phases 2 and 3 (from 1999 onwards).

A way of reducing bias from accounts provided through the semi-structured interviews could have been to conduct longitudinal interviews over multiple time-periods to understand how complex processes unfold over time in an emerging industry. However, conducting multiple interviews with the same informants in two different time periods is not always feasible. Informants may not be prepared to be interviewed multiple times due to busy schedules. Informants may change jobs and new experts may enter the industry. Due to switching positions and confidentiality commitments, informants may be restricted in unveiling relevant information. Some of the expert interviewees in our sample also had worked in different positions in the past which was useful to find information about the earlier phases.

Our paper develops a more detailed understanding of the variation of agency over time in a regional context by taking a process view of agency and using a longitudinal analytical frame to shed light on the actions of actors in different temporal phases (Semper, 2019). We see at least two promising avenues for future research. First, we encourage more comparative research to arrive at more generalizable mechanisms for regional path development. Future research would include analysing the role of agency in industry development processes across a number of regions with varying characteristics. It could also entail cross-case analysis according to different types of path development processes – upgrading, diversification, and emergence and different stages in the industry life cycle. Second, there is a need for focusing on better understanding the relationship between change enabling and structural maintenance agency and how they co-evolve with each other during the different phases of regional path development.

CRediT authorship contribution statement

Suyash Jolly: Writing - original draft, Writing - review & editing, Conceptualization, Investigation, Methodology, Validation, Data curation. **Markus Grillitsch:** Writing - review & editing, Validation, Conceptualization, Visualization, Methodology. **Teis Hansen:** Writing - review & editing, Conceptualization, Visualization, Supervision, Project administration, Funding acquisition.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.geoforum.2020.02.013>.

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