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Abstract

In the pursuit of strict climate policy targets the German government has decided that several lignite power plants have to be closed down by the year of 2019. One of the most affected regions is the Lusatia mining area in Eastern Germany. Here the question is raised how economic restructuring induced by climate policy can be achieved without bringing havoc on an entire region. We aim to give a first answer by developing a multi-level perspective (MLP) model for supporting regions towards more entrepreneurial activities. Based on different literature streams we suggest a model for strategic niche management towards an entrepreneurial socio-technical regime, which consists of the mid-level in the MLP as the dependent variable and resulting thrusts of strategic niche management as independent variables. The findings are illustrated by the case of Lusatia but are of general nature and can also be applied to other regions.

Zusammenfassung

Zur Verfolgung klimapolitischer Ziele hat die deutsche Bundesregierung beschlossen, bis zum Jahr 2019 mehrere Braunkohlekraftwerke stillzulegen. Davon betroffen ist auch die Bergbauregion Lausitz im Osten Deutschlands. Unsere Studie zielt darauf ab, ein mehrschichtiges Perspektiven-Modell für die Forcierung unternehmerischer Aktivitäten auf regionaler Ebene zu entwickeln. Auf Basis von einschlägiger Literatur zu unternehmerischen Wachstumsfaktoren und Ökosystemen sowie zu strukturationstheoretisch begründeten Mehrebenen-Modellen der regionalen Entwicklung schlagen wir ein Modell für strategisches Nischenmanagement für ein unternehmerisch geprägtes sozio-technisches Regime vor. Das sozio-technische Regime ist in diesem Modell die abhängige Variable, während die verschiedenen Schwerpunkte des strategischen Nischenmanagements unabhängige Variablen darstellen. Die Ergebnisse, die anhand der Fallstudie der Lausitz illustriert werden, sollen generell auf Regionen anwendbar sein.

Introduction: The Need for a Socio-Technical Transition in Lusatia

In the pursuit of strict climate policy targets the German government has decided in the year 2016 that several lignite power plants with a combined electricity generation capacity of 2.7 GW, 1.4 GW of which are produced by companies in Eastern Germany, have to be closed down by the year 2019. Various policy makers request further shut downs and an exit of the lignite mining and electricity production which entails 15 GW of total installed power generation capacity in Germany by 2030 or 2035. Other interest groups argue for a longer phase-out period. The mostly affected regions and regional eco-systems are Lusatia mining region (Lausitzer Revier), Rhenish mining region (Rheinisches Revier) and Middle German mining region (Mitteldeutsches Revier). In the region of Lusatia (Lausitz), which is stretching from Southern Brandenburg to the Eastern part of Saxony and is separated from its Polish part by the river Lusatian Neisse, lignite mining is a dominant industry, whereas in both other mining areas mentioned above the local economic diversity is considerably higher and the resilience of these regions with respect to decarbonization seems to be much better.

The necessary change in Lusatia is thus a unique, illustrative and challenging **case** to study as the question is raised how economic restructuring induced by climate policy can be achieved without bringing havoc on an entire region. In this context research on socio-technical transitions appears helpful. Socio-technical transitions are alterations in the overall configuration of transport, energy, and agri-food systems, which entail technology, policy, markets, consumer practices, infrastructure, cultural meaning and scientific knowledge (e.g. Geels 2011: 24). Over the last years such studies have for example been conducted on the transformation in waste management in the Netherlands (Geels/Kemp 2007), sustainable mobility transitions in the UK and Sweden (Nykvist/Whitmarsh 2008) or biogas developments in Denmark and the Netherlands (Raven/Geels 2010). In all of these instances socio-technical transitions have been studied from the **multi-level perspective** (MLP). According to the MLP socio-technical systems are composed of three main levels of structures and activities called niches, regimes and landscapes. Socio-technical transitions usually denote changes on all of the three levels, often evoked by innovations in niches – the lowest level – which lead to changes in the regime – the mid-level – and further to those in the landscape – the top-level. The description of changes is analogous to Giddens' theory of structuration (1984), according to which structures determine actions and are simultaneously the result of ongoing actions. In this sense landscapes provide structure for regimes which provide structure for niches; simultaneously landscapes are affected by the regime level and regimes by activities in niches.

Smith et al. (2010) call for a combination of the MLP with other approaches. In this context we aim to combine the MLP with the framework of an **entrepreneurial ecosystem** (EE) to describe the ongoing socio-technical transition of regions like Lusatia, as we hypothesize that an influx of entrepreneurial activities would benefit the region for maintaining social and economic well-being. An EE is "a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory" (Stam/Spigel 2016: 1). Research on EEs focuses how regional contexts affect ambitious entrepreneurship (Isenberg 2011; Stam 2014; Stam/Spigel 2016).

We specifically aim to support regions like Lusatia towards more entrepreneurial activities by better understanding and describing as well as finally suggesting measures to support their regional development. The challenges of the Lusatia region are very similar to those of other regions that face an inevitable evolution from fading industrial structures which are centered for example around mining towards a future-proof EE. Thus, our **research goal** is to develop an MLP model for the entrepreneurial development of regions which undergo significant structural change.

Our **research methodology** is qualitative and follows the interpretative research paradigm. We study the case of the socio-technical transition of Lusatia in a participatory way according to Baskerville (1997) for instrumental purposes according to Stake (2000): The data for our case study has mainly been derived from participatory observation of one of the authors, Hans Rüdiger Lange, who is the managing director of "Innovationsregion Lausitz GmbH" (iRL) which is one of the central agents in the "Regional Entrepreneurial Transformation Process" of the region. While the region of Lusatia is central to our study and illustrative for our derived model, this (single) case is also instrumental in deriving a model for the entrepreneurial development of regions in general, i.e. Lusatia is not the sole focus of the research (Stake 1995).

The remainder of our paper is **structured** as follows: We start with a literature review on EEs and the MLP. We then combine the two views and show that the domains of an EE according to Isenberg (2011) may be interpreted as the elements of the socio-technical regime according to Geels. This combination leads to our hypothetical framework for describing the entrepreneurial development of regions. We will then apply the framework in an illustrative way to the region of Lusatia and present data which has been gained from the operations of the iRL over the last years. Finally we will summarize our contribution of a conceptual model and will reflect on limitations of our approach and avenues for further research.

Literature Review: Combining Entrepreneurial Ecosystems with the Multi-Level Perspective

Entrepreneurial Ecosystems

Definition

An entrepreneurial ecosystem (EE) in general can be described as a geographic area that is typically characterized by the creation of many new ventures which not only consist of, but are also influenced by a vast number of stakeholders such as firms, the government, supporting industries, universities, mentors, investors and the media (Feld 2012). Often those systems witness the co-existence of cooperation and competition among firms (Romero-Martinez/Montoro-Sanchez 2008). The underlying rationale of every entrepreneurial ecosystem is that entrepreneurial activity is fostered by the exploitation and development of respective resources and processes in the region (Hechavarria/Rabow 2014: 7). In short, an EE is defined as "a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory" (Stam/Spigel 2016: 1).

Explanatory Approaches and Theories

Over the years many different explanations for the development of entrepreneurial ecosystems have been given. Originating in economic theory, one approach explains the creation of those ecosystems through the agglomeration of resources which results in economies of scale. Consequently, in regions with many ventures the fixed costs for specialized inputs can be shared among the firms, leading to lower costs for each individual company and hence to economic advantages (Marshall 1920). Another explanation is based on the belief that horizontal networks result in beneficial effects through the exchange of experience, information and specific skills making it possible to react flexibly in times of turbulences and change. Hence, an open exchange culture is developed resulting in increased values for the network members (Saxenian 1994). The development of entrepreneurial ecosystems can also be explained by Florida's approach (2002): According to him creative people such as entrepreneurs, artists, musicians, professors and engineers are the main drivers for the creation of an entrepreneurial environment because creative class members are supposed to have a greater interest in neighbourhoods which are open to innovative, new ideas, are tolerant, pleasant and diverse.

Driving Factors

A variety of factors which influence the development of regional EEs has been discussed in literature (Davidsson 1995; Florida 2003; Mack/Mayer 2015; Roundy 2016). Overall, micro and macro factors can be distinguished (for a summary of factors see Table 1): **Micro** environmental factors on the one hand are defined as those variables that are closely linked to the business operations of involved companies and their stakeholders like customers, competitors, media, shareholders, suppliers and employees (Grant 2010: 60-61; Hiriyappa 2008: 30; Pîndiche/Ionita 2013: 328-330). Especially when it comes to employees, research points out the particular importance of the entrepreneurial actors themselves including, among others, their knowledge, education, experience, skills, values and beliefs (Davidsson 1995; Pitelis 2012; Qian et al. 2012; Witbooi/Cupido/Ukpere 2011). Furthermore, the particular importance of an entrepreneur's creativity, talent as well as social competences such as tolerance has been carved out (Florida 2003; Witbooi et al. 2011). Entrepreneurial activity is further related to the support of suppliers, distributers, customers and their demand (Witbooi et al. 2011; Stam 2014). Thus, at the meso/interorganizational level the interrelationships of players and the dynamics of EEs are considered.

Here, the literature is highlighting that the (trans-)formation towards an entrepreneurial ecosystem is strongly connected to the presence of informal forums of entrepreneurship, entrepreneurial programs, different networks, mentors and intermediaries that can provide moral support, trainings and are working as connectors (Guerrero/Peña-Legazkue 2013; Mack/Mayer 2015; Mason/Brown 2013; Morgan 1997; Motoyama et al. 2014; Spigel 2015). Looking beyond the entrepreneurs, regional transformation literature also highlights that an access to novel ideas has to be provided to bring innovations to an area (Venkataraman 2004).

On the other hand, **macro** environmental factors describe those forces that are not only directly influencing the specific industry that a particular company is belonging to, but those of the broader environment. Those factors are typically framed within the PESTEL model, encompassing political, economic, socio-cultural, technological, environmental and legal factors (Grant 2010: 60-61). With respect to regional entrepreneurship, the literature mainly refers to political forces such as policy efforts in favour of entrepreneurship by the government, but also through other regional development institutions in order to establish the formal ground for entrepreneurial activity (Mack/Mayer 2015; Spigel 2015). For this to become effective an entrepreneurial vision for the region has to be in place (Smith et al. 2013). In order to foster entrepreneurial development, the economic drivers are particularly important. Therefore, the literature emphasizes the influence of the industry composition, the presence of large firms, the firm density, physical infrastructure and the presence of providers of services and resources (Georgellis/Wall 1999; Mason/Brown 2013; Spigel 2015).

The particularities of these factors are mainly a result of the history of entrepreneurship in each region and will in return influence the labor market conditions, the level of unemployment and the region-specific opportunities in a particular area (Georgellis/Wall 1999; Davidsson 1995). For the purpose of qualified employees the presence of universities is also crucial (Mason/Brown 2013; Qian et al. 2012). All in all, the composition of these factors can lead to local success stories (Mack/Mayer 2015). Moreover, the entrepreneurial activity further depends to some extent on the available technology (Morgan 1997; Georgellis/Wall 1999). With respect to socio-demographics the total population as well as the population density, the regional heterogeneity and the regional culture can either support or hinder the transformational process of a region (Davidsson 1995; Georgellis/Wall 1999). Finally, the research is also underlying that a transformation towards an entrepreneurial region is only possible with the necessary financial support in form of, for example, start-up and growth as well as risk capital.

Micro factors	**Macro factors**

- Entrepreneurial actors
  o Knowledge
  o Education
  o Experience
  o Skills
  o Values (Entrepreneurial Values Index)
  o Beliefs (Societal contribution, financial pay-off, social status)
  o Creativity
  o Social competency
  o Talent
  o Tolerance
  o Role models
  o Leadership
 	
- Entrepreneurial activity
  o Extent of coordinated entrepreneurial activity
  o Networks
  o Mentors
	- Politics
	  o Policy efforts
	  o Governmental support
	  o Regional development support
	  o Entrepreneurial vision for the region
	  o Formal institutions
	
	- Economy
	  o Industry composition
	  o Presence of large firms
	  o Firm density
	  o Access to large markets/open markets
	  o Economic cycles affect
	  o Creation and co-creation of organizations
	  o Local success stories
	  o Physical infrastructure
	  o History of entrepreneurship
	  o Labour market conditions
	  o Level of unemployment

o Entrepreneurial recycling o Moral support o Training o Entrepreneurial connectors o Informal forums of entrepreneurship o Entrepreneurial programs o Intermediaries - Access to novel ideas - Suppliers - Distribution - Customers - Demand	o Service providers o Resource providers o Region-specific opportunities - Ecology o Supporting ecosystems - Geography o Regionally correlated disturbances - Technology - Socio-demography/Culture o Regional heterogeneity o Regional culture o Presence of universities o Safety nets o Information-rich environment o Total population • Population density • Previous period population growth - Finance o Sufficient sources of capital o Availability of start-up and growth capital o Risk capital

Table 1: Summary of Driving Factors for Entrepreneurial Ecosystems (Source: Own literature review)

Domains of the Entrepreneurial Ecosystem

Even though research agrees that specific factors are necessary to let regional entrepreneurship flourish, the focus of the main drivers differ greatly among different scholars (Venkataraman 2004; Witbooi et al. 2011; Spigel 2015). One highly-regarded framework which combines the different aspects of an entrepreneurial ecosystem has been proposed by Isenberg and is called “Domains of the Entrepreneurial Ecosystem” (Isenberg 2011). Isenberg describes an entrepreneurial ecosystem according to the six domains of: enabling policy and leadership, availability of appropriate financial support, a conducive culture, quality of human capital, a range of institutional supports and venture friendly markets for products. All of these six domains consist of a number of different sub-elements. When it comes to culture for example Isenberg points out, that an entrepreneurial supportive culture can be developed through previous success stories or societal norms such as risk tolerance, a great level of creativity and high ambition.

A significant aspect for an entrepreneurial region is also the human capital that depends on the labour availability, either skilled or unskilled, along with the educational institutions that lead to the academic background of the available workforce. According to Isenberg entrepreneurs are better off in markets which contain favourable networks including companies of different sizes, but also diaspora networks. In addition, it could be of great advantage to serve early customers for a proof of the concept to get first reviews, for example. Apart from financial support, coming from various sources such as micro loans, different venture or public capital funds, debt or angel investments, an entrepreneurial ecosystem depends also to a large extent on leadership qualities and governmental policies regarding, for instance, regulatory framework incentives, venture friendly legislation or research institutes. Support for an entrepreneurial ecosystem can be further given through non-governmental institutions such as entrepreneur-friendly associations, other businesses including a broad spectrum from investment bankers to IT experts as well as through a favourable infrastructure with respect to, for example, transportations, telecommunications or energy supply.

An overview of all six domains with important sub points can be found in Figure 1. All of the mentioned factors are connected and influencing each other in a complex and unique manner. Hence, there is not one overall applicable generic way to describe the development of entrepreneurial ecosystems. In order to find ways to support the development of one particular entrepreneurial ecosystem it is therefore necessary to consider the unique environmental conditions, settings and circumstances of each region.

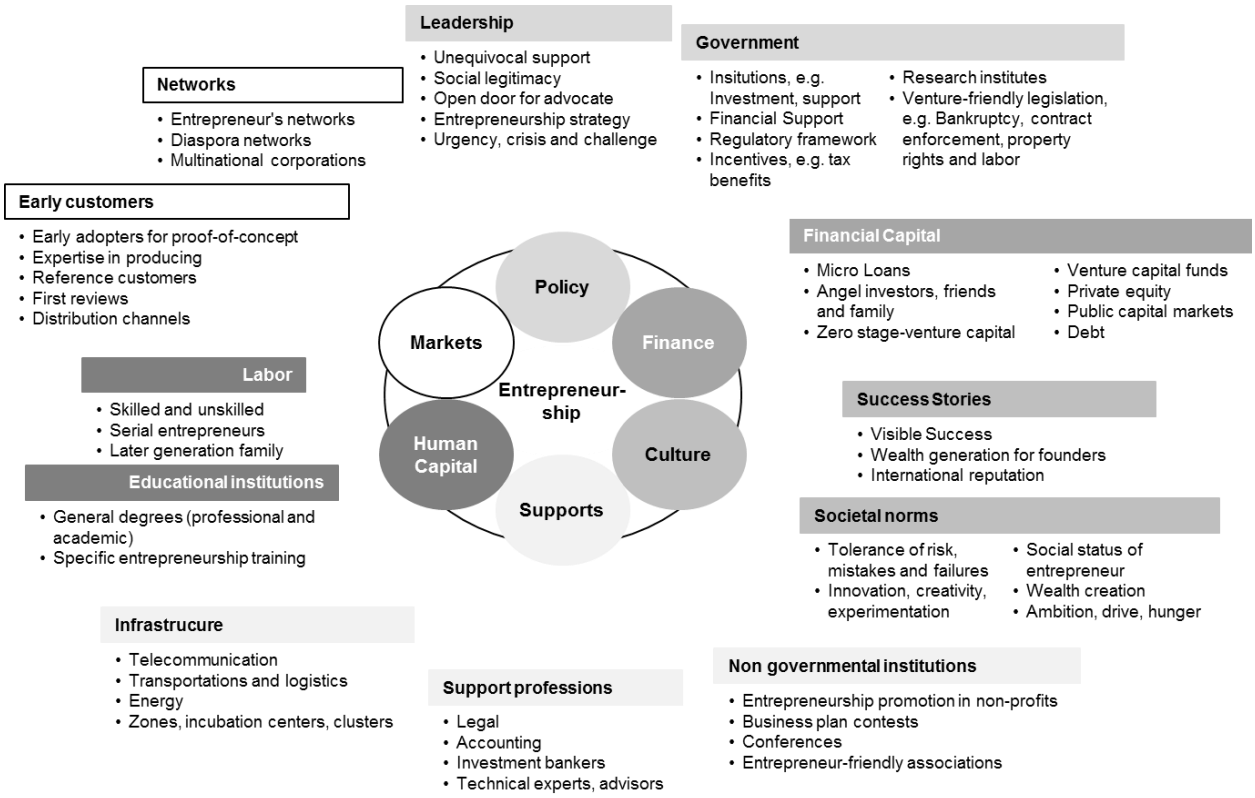

Figure 1: Domains of the Entrepreneurship Ecosystem (Adapted from Isenberg 2009, 2010, 2011)

Isenberg's framework is comprehensive, yet lacking a dynamic view on the development of EEs. The framework is not focussing on transitions and the root causes of these. For regions like Lusatia a transformative view in the direction of an EE could be helpful though because a major, sustainable transformation of the industry structure needs to be captured. In this context the MLP can serve as a valuable complementing view as will be described below.

Transitions according to the Multi-Level Perspective (MLP)

The history of innovation studies for sustainable development – and the aspired transition in Lusatia may be regarded in this context – can be explained as a process of linking broader analytical frameworks to successively larger problem framings (Smith et al. 2010). The challenge for innovation rests with the societal changes induced by innovative activity and the consequences of this for environmental and social sustainability. This needs a broader problem framing, which implies the need for comprehensive analytical perspectives (Geels 2011). For this reason, researchers that are engaged with socio-technical transitions have developed the multi-level perspective (MLP) as an analytical frame for transitions seen as non-linear processes. The basic

ontology behind the MLP stems from the sociology of technology, where three inter-related dimensions are important: (i) socio-technical systems, the tangible elements needed to fulfil societal functions, (ii) social groups who maintain and refine the elements of socio-technical systems, and (iii) rules (understood as regimes) that guide and orient activities of social groups (Geels/Kemp 2007). The MLP enhances this view and highlights three functional levels – 'niche', 'regime' and 'landscape' – with increasing structuration and coordination of activities, ranging from individual technologies and grassroots movements to larger-scale social structures and institutions (Nykvist/Whitmarsh 2008). Niches can be seen as a micro-level phenomenon, interacting with the established regimes at the meso-level, within a macro-landscape (Geels/Kemp 2007).

Technological niches are the **micro**-level where radical novelties emerge, which are initially unstable socio-technical configurations with low performance (Geels/Schot 2007). In historical empirical studies of transitions niches have been identified as the typical loci for radical innovation, operating at the periphery, or outside, of the dominant meso-level regime (Nykvist/Whitmarsh 2008). In 'protected spaces' such as R&D laboratories, subsidized demonstration projects or small market niches, the main actors like entrepreneurs, start-ups, or spin-offs, small networks of dedicated actors and often outsiders or fringe actors, work on radical innovations (Geels/Schot 2007).
Niche actors hope that their promising novelties are eventually used in the regime or even replace conventional methods, technologies or products (Geels 2011). Niches that provided seeds for substantial transitions historically had to overcome the constraining influence of regimes, branch out, link up with wider change processes, and drive transformations in those same regime structures over the longer term (Smith et al. 2010).
Because the existing regime is stabilized by many lock-in mechanisms and because niche-innovations show mismatches with existing regime dimensions like the lack of appropriate infrastructure or the regulations or consumer practices, further development and market success are quite challenging and difficult (Geels 2011). In a way, niches act as 'incubation rooms' for radical novelties, shielding them from mainstream market selection (Geels/Kemp 2007).
But these niches get their chance if expectations become more precise and more broadly accepted, if the alignment of various learning processes results in a stable configuration and if networks become larger; especially the participation of powerful actors may convey legitimacy and resources to niche innovation (Geels 2011). Generally, niches are rather sources of transformative ideas and capabilities than elaborated blueprints (Smith et al. 2010).

The **meso**-level in the multi-level perspective is the socio-technical regime (Geels/Kemp 2007). Regimes are described as structures constituted from a co-evolutionary accumulation and alignment of knowledge, investments, objects, infrastructures, values and norms that span the production-consumption divide (Smith et al. 2010). The regime forms the 'deep structure' that is accountable for the stability of an existing socio-technical system (Geels 2004). Since the rules, structures, and culture are manifest in slowly changing regulation, prevailing norms and worldviews, and practices draw chiefly on existing competencies and past investment, system innovation or substantial change is restricted (Nykvist/Whitmarsh 2008). Changes in regimes tend to be incremental and path dependent (Smith et al. 2010). Regime rules can be seen as both medium and outcome of action (see the idea of the "duality of structure" by Giddens 1984). Actors enact, instantiate and draw upon rules in concrete actions in local practices on the one hand, and on the other hand rules configure these actors, too (Geels 2011). Movements within the regime open windows of opportunity for niche alternatives to compete for attention and influence. Sources for these dynamics derive from partially autonomous developments within regime components, such as firm R&D or government regulations, which generate misalignments and realignments and incremental responses, as well as in response to landscape developments, or through interaction with other associated regimes (Smith et al. 2010).

The **macro**-level of the MLP is formed by the socio-technical landscape, which refers to aspects of the exogenous environment that is beyond the direct influence of actors (Geels/Kemp 2007). Both niches and regimes are situated within such a broader landscape of social and physical factors that provides a macro-level structuring context (Smith et al. 2010). The content of the socio-technical landscape is heterogeneous and includes aspects such as economic growth, broad political coalitions, cultural and normative values, environmental problems and resource scarcities as well as demographical trends and macro-economic patterns (Geels 2011). With respect to dynamics, which are crucial for technological transitions, landscape changes are a source of pressures for change on the regime level; they prompt responses from within the regime, and they generate opportunities for niches (Smith et al. 2010).

The MLP accentuates that both **internal** niche dynamics and **external** regime and landscape developments are important for wider breakthrough and diffusion (Geels/Kemp 2007). Even though each transition is unique, the general dynamic pattern is characterized by transitions resulting from the interaction between processes at diverse levels: (a) niche-innovations build up internal momentum; (b) changes at the landscape level create pressure on the regime; and (c) destabilization of the regime creates windows of opportunity for niche innovations (Geels 2011).

Following Geels and Kemp (2007: 443-444), system innovations come through the interplay between processes at different levels in different phases:
“In the first phase, radical innovations emerge in niches, often outside or on the fringe of the existing regime. There are no stable rules (e.g. dominant design), and actors improvise, and engage in experiments to work out the best design and find out what users want. The networks that carry and support the innovation are small and precarious. The innovations do not (yet) form a threat to the existing regime. In the second phase, the new innovation is used in small market niches, which provide resources for technical development and specialisation. The new technology develops a technical trajectory of its own and rules begin to stabilise (e.g. a dominant design). But the innovation still forms no major threat to the regime, because it is used in specialised market niches. New technologies may remain stuck in these niches for a long time (decades), when they face a mismatch with the existing regime and landscape. The third phase is characterised by wider breakthrough of the new technology and competition with established regime, followed by a stabilisation and new types of structuring.”

In order to answer the question how and under which circumstances the successful emergence of a technological niche is possible, research on **strategic niche management** (Elzen et al. 1996, Kemp et al. 1998; Schot/Geels 2008) separates three core processes: a) expectations or visions, b) social networks, c) learning and articulation processes:

a) **Expectations** or **visions** provide guidance to the innovation activities. Firms, users, policy makers, entrepreneurs and other relevant actors participate in projects on the basis of expectations (van der Laak/Raven/Verbong 2007). These expectations are considered crucial for niche development because they provide direction to learning processes, attract attention and funding from external actors, and legitimate (continuing) protection and nurturing (Schot/Geels 2008). In order to have a major impact, these visions should be accompanied by policy measures, such as the announcement of future regulations or taxes with respect to emissions and the setting of clear policy goals (Kemp et al. 1998). These expectations are considered to be good if the same expectations are shared by more actors (expectations are converging), if expectations are specific and if the content of expectations is substantiated by ongoing projects (van der Laak et al. 2007).

b) The second core process of this approach highlights the building of **social networks** and the enrolment of more actors, which expand the resource base of niche innovations (Geels 2011). As Kemp et al (1998) state, there are many examples of actors trying to slow down or even stop the niche from developing. These could be actors with vested interests in other technologies that will generally not be interested in stimulating a new, competing technology. Those actors may participate in the developments for defensive reasons but will show no real initiative (Kemp et al 1998). Building a stable social network is important to create a constituency behind the new technology, facilitate interactions between relevant stakeholders and provide the necessary resources like money, people, and expertise (Schot/Geels 2008). In order to enlarge the niche, specific new actors must therefore often be involved in the affair, and the activities of the existing actors and their interactions ought to be changed (Kemp et al 1998). Building social networks is considered as good if multiple kinds of stakeholders are included (including firms, users, policy makers, scientists, and other relevant actors) to facilitate the articulation of multiple views and voices and when alignment within the network is facilitated through regular interactions between the actors (van der Laak et al. 2007). Further, the networks should be deep so that the members should be able to mobilize commitment and resources within their own organizations and networks, too (Schot/Geels 2008).

c) **Learning and articulation processes** occur on various dimensions, e.g. technical design, market demand and user preferences, infrastructure requirements, organizational issues and business models, policy instruments, symbolic meanings (Geels 2011). As many of the niche development barriers involve uncertainty and perceptions, learning - about needs, problems and possibilities - should thus be an important aim of niche management policies (Kemp et al 1998). A good learning process is broad - focusing not only on techno-economic optimization, but also on alignment between the technical (e.g. technical design, infrastructure) and the social (e.g. user preferences, regulation and cultural meaning) (van der Laak et al. 2007). These learning processes should contribute more to the development of niches, if they also enable changes in cognitive frames and assumptions (Schot/Geels 2008).

Over the last years there has been some **criticism** towards the MLP. For example, the MLP has been criticized for underplaying the role of agency in transitions (e.g., Smith/Stirling/Berkhout 2005). Other authors complain about the operationalization and specification of the model or methodological issues (e.g. Genus/Coles 2004). The whole approach is still open for further development. For instance, Smith et al. (2010) explicitly call for new combinations with a comprehensive aspiration and a dialogue of the MLP with other research disciplines. Especially the positive and negative influences from other regimes on the focal regime are considered to be an under-studied but promising topic (Geels 2011).

We attempt to fill this **gap** and propose the explicit consideration of the entrepreneurial ecosystems approach at the socio-technical regime layer. Therefore we integrate Isenberg's (2011) domains of the entrepreneurial ecosystems into the MLP model (Geels 2011) at the central level (see Figure 2). Starting with Geels' original six elements of the mid-level regime, in our view the lense of regarding the socio-technical regime should change towards the six domains of Isenberg's EE framework. This symbolizes a general regional development towards more entrepreneurial activities. Our conceptual model will be illustrated by the case study of Lusatia and further developed in the concluding section of the article.

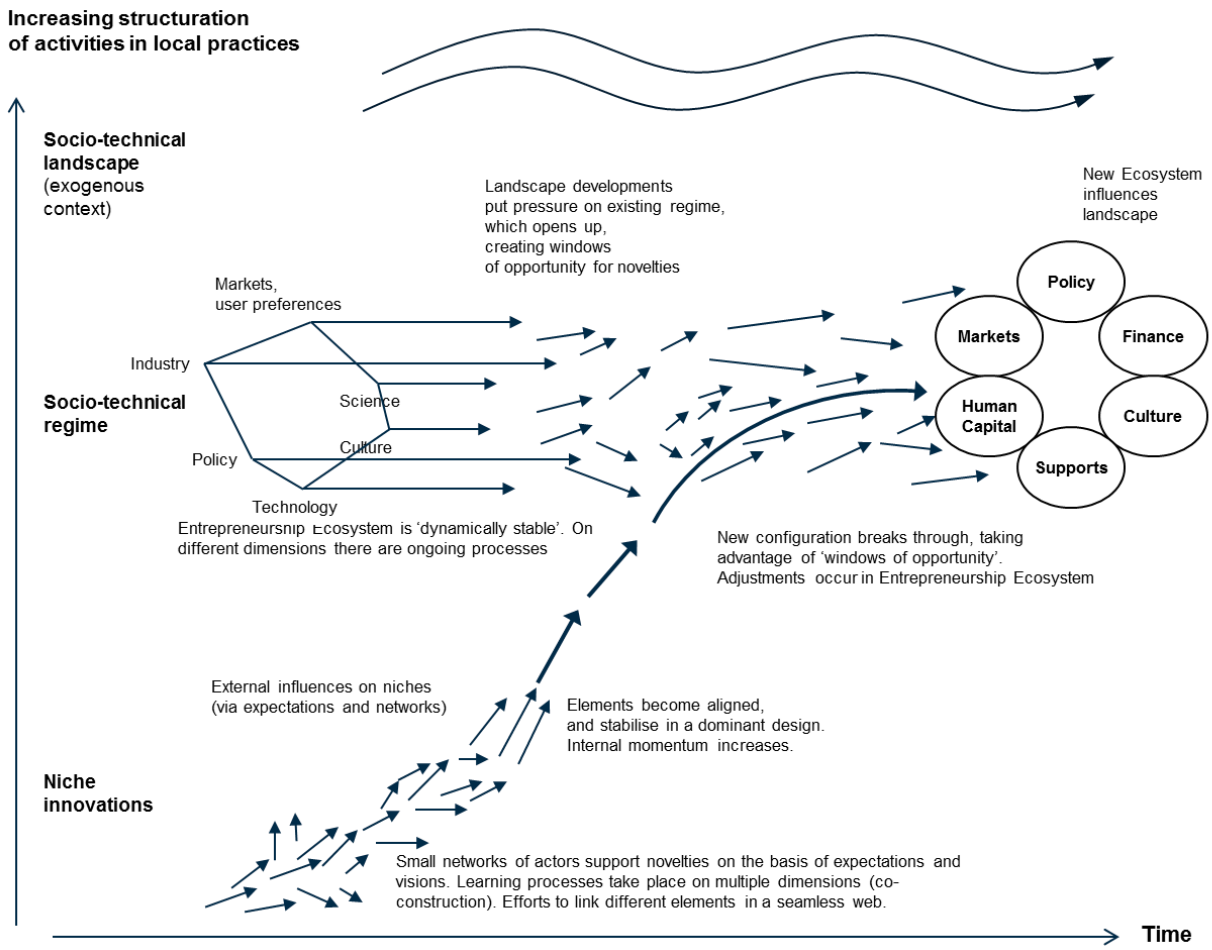

Figure 2: Multi-level perspective on transitions with respect to the entrepreneurial ecosystem (Adapted from Geels 2011 and Isenberg 2009, 2010, 2011)

The Case of Lusatia: Fostering Niche Innovations (in the MLP) for a Socio-Technical Transition (towards an EE)

The Lusatia region became industrialized in the middle of the 19th century with the advent of the textile industry. In the first quarter of the 20th century lignite coal became the crucial energy source for extended industrial manufacturing sectors like aluminium, chemical production and energy generation (Bayerl 2011).

In times of the German Democratic Republic (GDR) Lusatia was a central energy district which drew considerable resources and where large economic units for mining and energy generation were situated. The economic structure was centrally planned and dominated by large state-owned entities. With regard to Isenberg's domains of EEs, the GDR economic system was not supportive of entrepreneurial activities (see second column in Table 2). In the transition period after German reunification economic businesses were privatized and some institutional frameworks for more entrepreneurial activities were established. Yet, the focus on large and scale-driven mining and production of energy determined the economic structure of the region. Key industrial players dominated the industrial processes, and suppliers were rather dependent on these. In comparison to other areas in the Eastern part of Germany, Lusatia benefited from this industrial base and was able to show comparably better economic figures. Entrepreneurial competencies like product innovation and diversification or sales and marketing remained underdeveloped though (see third column in Table 2).

With the downturn of fossil energy production and the upcoming shutdown of lignite power plants, Lusatia now struggles with the same problems as other Eastern German regions: Productivity and GDP per inhabitant in Eastern Germany lag behind versus Western Germany (Brenke 2014: 6). The level of innovativeness is considerably lower in the East of Germany – for instance, only about one quarter of small and medium-sized enterprises came up with new production techniques or products in recent years (Borger/Müller 2014: 2).

Another major problem is the demographic change. Eastern Germany does not only have to handle a lower number of young employees than its Western complement, but also has a lesser concentration of highly skilled graduates. Due to the missing job opportunities, Eastern Germany struggles with a high number of talents leaving this area for career opportunities elsewhere (Brenke 2014: 6; Borger/Müller 2014: 2). Finally, the socialization of people in Eastern Germany is less determined by an entrepreneurial mind set than in the West.

Domain of Isenberg's EE	GDR economic system (around 1980)	Post reunification economic system (around 1995)	Emerging entrepreneurial system (now, around 2017)
Enabling policy and leadership	Lusatia is reorganized after 1945 into the "energy district" which groups together mining related counties.	Post-unification restructuring shuts down old power plants and modernizes a core of energy business via the VEAG company; headquarters are relocated from Berlin (electricity) and Senftenberg (mining) to Cottbus; on an administrative level, the historical states of Brandenburg and Sachsen are formed.	Climate policy on national level leads to shut down of power plants in Jänschwalde. Politicians on state level still call for continuity in mining business. Discussions about restructuring programs start in 2017. Change of paradigm is still in the making.
Availability of appropriate financial support	Planned economy allocates massive resources to the region. At the end of the GDR, the general lack of resources leads to rapid degradation of industrial infrastructure with high environmental costs.	Private investments via utilities Eon, RWE, etc. prior to being forced to sell shares to Vattenfall. The closed mines are taken over by LMBV, a restructuring and land reconstruction agency for devastated mining areas in public ownership.	Ample discussion. First financial assistance dedicated for structural change to be available beginning in 2018.
A conducive culture	Official programs and policy provides recognition and cultural status to miners and industrial workers in general. Cities and industrial units are amongst the most favorited in the GDR.	The region buys into this renewal (high unemployment rate: > 25%); region claims to be an „energy region", refounded universities call themselves "energy universities" (Cottbus, Senftenberg, Zittau), counties and cities invest into new lignite technology (Cottbus, Senftenberg).	In comparison to former energy infrastructure new initiatives seem still fragile and small. Entrepreneurship remains still at relatively low levels.
Quality of human capital	Qualifications are centrally organized, vocational higher education institutes in the region (Bergingenieurschule, Energiehochschule).	Oversupply of highly qualified personnel, companies in the region can choose from a wide range of experienced and large pool of young people.	School graduates at about 50% of 1990 levels. Challenge to keep high qualification level of entry classes. High demand in the job market.
A range of institutional supports	Large economic units of national importance are situated in the region (Kombinat Schwarze Pumpe, Mining in Senftenberg). Special incentives (pay, housing) attract young people to the region.	All levels (state, region, counties, and cities) are united in attempts to keep employment in the region. In the 2010s EU funding for CCS (carbon capture and storage) technology.	In the making. Politics and regional players still in a formation process; no overall structure in place; on national level central commission is to be formed in 2018; various regional actors (iRL, WRL, WiRe eV). Merger of two universities Cottbus and Senftenberg in 2011.
Venture friendly markets for products	Planned economy. Successive elimination of entrepreneurship and private businesses.	1998 – 2006 is a period of overcapacities after market liberalization in 1998. Period of high energy prices 2006 – 2010 leads to new investments (Boxberg plant R, CCS project). Since then falling prices due to build up of renewable capacities.	Energy sector dominated by elements of central planning. High political uncertainties and signs of overregulation make it difficult for newcomers (high regulatory risks). Overall economy in a boom cycle.

Table 2: Innovation system profile of Lusatia (Source: Slightly adapted from Lange/Tomenendal 2017: 74)

At this point initiatives to foster entrepreneurial activities become important. Various regional and national actors have started to provide institutional support for more innovation and economic growth in the region. The "Innovationsregion Lausitz" (iRL) is a key player in this respect. It has been founded in the beginning of 2016 by business associations and higher education institutions of Lusatia with the purpose to i) formulate a regional strategy to cope with the challenge of decarbonization of the lignite mining region, ii) help affected businesses to adapt through workshops and iii) identify and foster growth projects. The iRL has set up the "Lausitz Lab" which is an incubator and accelerator for new ideas and has developed a grassroot approach called the **"Regional Entrepreneurial Transformation Process" (RETP)** (Lange/Tomenendal 2017). Central to the approach is the organization of exchange and collaboration forums with diverse regional actors.

In particular, the Lausitz Lab has set up a collective search process for growth options of Lusatian companies. Ideas for growth projects are collected, analyzed and developed further jointly by Lausitz Lab employees and the firms. As of May 2017 (after 12 months of operation) 90 projects have been identified. Examples of projects are:

- Power to gas industrial plants with gas applications in transport or chemistry
- Design and development of an electrical storage system (rotating mass)
- Boats powered with non-fossil fuels (hydrogen, electricity)

The portfolio of suggested growth projects is managed via a performance indicator system with the aim to steer and prioritize the allocation of resources for support from the Lausitz Lab. The companies have the possibility to develop their projects further in cooperation with Lausitz Lab. Project ideas are communicated in an anonymized way to regional audiences, and the staff of Lausitz Lab offers interested firms to connect to potential business partners with complementary skills and capabilities. Four workshop formats structure this process. They are centered around the themes of strategy development, product innovation development, business model optimization and design sprints (Lange/Tomenendal 2017: 76).
In addition, "story telling salons" are organized with multiple actors in the region to support the creation of a collective identity and commitment towards entrepreneurial development (Richter/Rohnstock 2016). The network and transparency function is regarded as a crucial value contribution of the RETP by regional players.

In the light of Isenberg's EE framework Lusatia is still far from an "ideal state" of an effective EE (see fourth column of Table 2). Now, with respect to the MLP the activities of iRL and Lausitz Lab can be regarded as strategic niche management in order to push the socio-technical regime of the region towards more entrepreneurship. iRL takes measures to support the three core processes for niche innovations (see Table 3).
In essence the iRL strives to incubate and accelerate innovative ideas for business growth and to foster an entrepreneurial mind set of all players in the region. Key instruments are the participation of diverse stakeholders and the organization of continuous, business-growth-oriented exchange.

Three core processes for the successful development of technological niches	**Success factors of the three core processes**	**iRL measures**
Expectations / visions	- Same expectations are shared by more actors (expectations are converging). - Expectations are specific. - The content of expectations is substantiated by ongoing projects / experiments.	- iRL is the focal point for regional entrepreneurial development and is supported by broad base of stakeholders (see box below). - Specific expectations are communicated through by-laws and publications of the iRL. - Projects are supported by the Lausitz Lab.
Social networks	- Broad network (including firms, users, policy makers, scientists, and other relevant actors) - Deep network so that the members should be able to mobilize commitment and resources within their own organizations and networks - Alignment within the network is facilitated through regular interactions between the actors.	- Broad network of related stakeholders from different backgrounds: o Regionaler Wachstumskern Westlausitz o Regionaler Wachstumskern Spremberg o IG Metall o IG BCE o Bundesverband Erneuerbare Energien o Pro Lausitzer Braunkohle o Unternehmerverband Brandenburg-Berlin o Hochschule Zittau/Görlitz o Evangelischer Kirchenkreis Cottbus o envia Mitteldeutsche Energie AG o Vattenfall Europe Mining & Generation AG o BASF Schwarzheide GmbH o BTU Cottbus Senftenberg - Regular interactions between the actors are facilitated.
Learning and articulation processes	- Broad focusing not only on techno-economic optimization, but also on alignment between the technical and the social spheres - Learning and articulation should enable changes in cognitive frames and assumptions	- The iRL offers a broad and frequently used platform with lots of moderated workshops. - This approach encourages all included stakeholders to share ideas, views and experiences, e.g. at “story telling salons”

Table 3: Strategic niche management approach by iRL (Source: Own analysis)

Concluding Discussion: Evoking a Socio-Technical Regime Change towards Entrepreneurship by Six Thrusts from Strategic Niche Management

Derived from the different literature streams and experiences in Lusatia we suggest a **model** for Strategic Niche Management Towards an Entrepreneurial Socio-Technical Regime (see Figure 3).

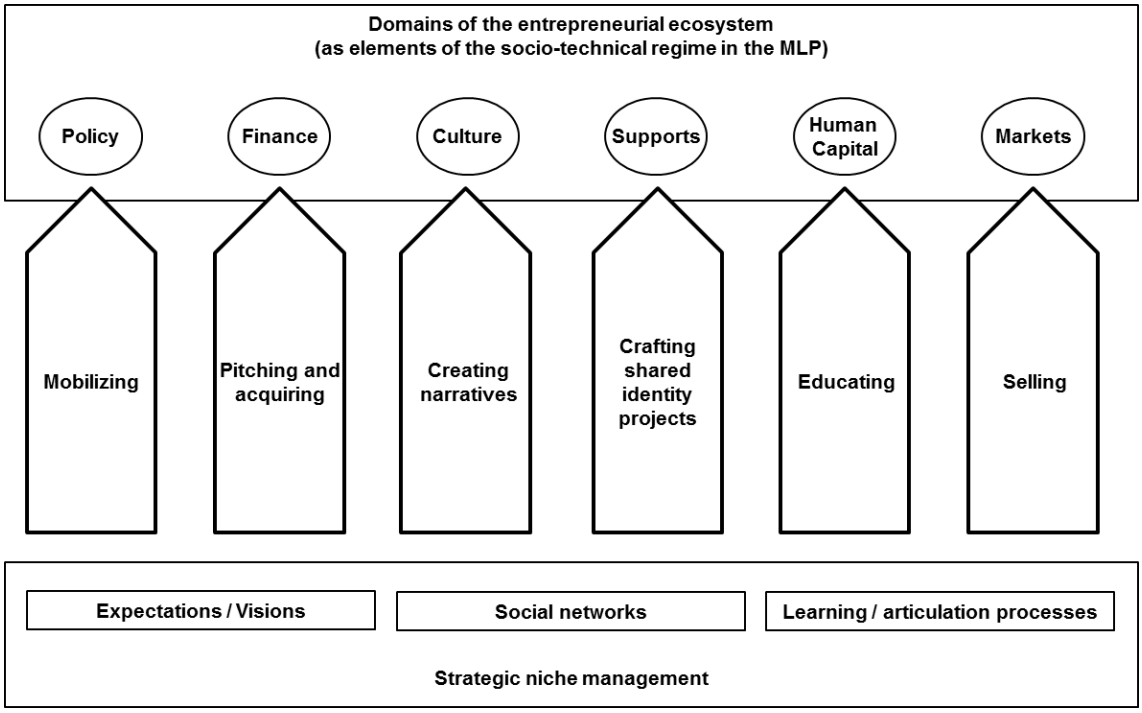

Figure 3: Model for Strategic Niche Management Towards an Entrepreneurial Socio-Technical Regime (Source: Own development)

Our model consists of the mid-level representing the socio-technical regime in the MLP manifested as an EE according to Isenberg (2009) as the dependent variable and resulting thrusts of strategic niche management, which can be interpreted as specific cluster initiatives according to Tomenendal/Lange (2014) as independent variables. These thrusts are linked to the three processes of strategic niche management introduced above. The thrusts are:

- **Mobilizing**: For achieving “enabling policy and leadership” regional players need to be mobilized to become agents of change themselves rather than pure “recipients” of political decisions. It is a sign of the entrepreneurial character of regions that the agents aim to be self-sustained and take control of their joint destiny.
- **Pitching and acquiring**: To gain appropriate financial support the regional agents pitch and try to acquire funding for specific projects. These projects could for example be start-ups, growth projects of established companies or research and development projects, mainly led by the local universities.
- **Crafting shared identity projects**: To ensure a range of institutional supports a collective regional identity which highlights entrepreneurial elements is important; this in turn is fostered by shared identity projects of regional actors. Such projects serve the individual self-development of people and strengthen the common quest for innovation in the region.

- **Creating narratives**: In pursuit of a conducive entrepreneurial culture, (common) narratives on entrepreneurial activities and successes are very powerful. A common language for entrepreneurship and told stories lead to the identification with common goals and activities which in turn strengthens the motivation and ambition to become successful as an entrepreneur.
- **Educating**: A high quality of human capital can be achieved by educating young people, but also more senior professionals in the course of lifelong learning. Contents and formats of education programs should take into account the required competences for entrepreneurs and suitable, modern formats.
- **Selling**: Finding markets for the innovative regional products is a decisive challenge which can be met by agile business development processes and a relentless marketing push.

The six strategic thrusts correspond to the six domains of EEs. They are closely linked to the three core processes of strategic niche management. Obviously, the thrusts of mobilizing, crafting shared identity projects and creating narratives are especially linked to the processes of expectations/visions and social networks, and the thrusts of educating and selling are especially linked to the processes of learning and articulation. All of these elements are also to be found in our illustrative case study and are in line with the reviewed literature. In their comprehensive form we **contribute** them here as a conceptual model for the entrepreneurial development of regions, evoked by grass root movements. In this respect the six thrusts presented in Figure 3 are a further specification of the emergence of a new, EE-oriented socio-technical regime which is located in between the two bottom layers in Figure 2. Responding to Smith et al.'s (2010) call for a dialogue of the MLP with other research disciplines we suggest a model for Strategic Niche Management towards an Entrepreneurial Socio-Technical Regime, which consists of the mid-level representing the socio-technical regime in the MLP as the dependent variable and resulting thrusts of strategic niche management as independent variables.

With regard to **limitations** of our work, the specification of elements and their relationships need further research. Also, the significance of elements with regard to specificities of regions needs further analysis. The generalizability of our results beyond the case of Lusatia is to be elaborated on, and a large-scale test of the model is yet to be performed. All of these points were not in the scope of this article, though. We encourage future research in this area, considering our hypothetical model for the entrepreneurial development of regions, regarding the development as a mid-level, socio-technical transition derived from and illustrated by qualitative case study research in Lusatia.

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