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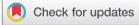
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Beyond the *Single Path View*: Interpath Dynamics in Regional Contexts



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abstract

Recurrent economic and financial crises, globalization, digitalization, and climate change are posing major challenges for regional economies to constantly renew their industrial structures. Over the past few years much progress has been made in understanding how new path development unfolds in a regional context. Earlier contributions to the path development literature have acknowledged that multiple industrial paths developing within a region are interdependent and coevolving. However, most conceptualizations and empirical analyses to date have mainly been focused on one new path or path development activities in one nascent industry only. Potential relationships between emerging paths have received little attention, and, as a consequence, little is known about how new paths shape each other's evolution. This article draws on recent contributions that broaden conventional perspectives on regional structural change and develops a framework to analyze the dynamic interdependencies between multiple new regional growth paths. We explore the nature of interpath linkages and discuss the role of agency in creating or shaping the relationship between linked paths to be either supportive, competitive, or neutral toward each other. By means of illustrative empirical examples, we show that interpath relationships in a regional context are a significant phenomenon to be considered in regional structural change and conclude by discussing policy implications and identifying avenues for future research.

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Regions across the world are confronted with the constant challenge to renew their industrial structures and to develop new growth paths to compensate for the stagnation and decline of mature industries. Recurrent economic and financial crises, globalization, digitalization, and climate change are further intensifying this pressure. This has sparked interest into the factors that favor and hinder processes of *new regional industrial path development* (or *path creation* as it is also termed in the literature), which is referred to in this article as “the emergence and growth of new industries and economic activities in regions” (MacKinnon et al. 2019, 114).

Arguably the question of which economic activities settle and become industries in which regions and why some regions appear to be better at attracting new industrial growth paths than others is at the core of economic geography (Storper and Walker 1989; Chapman and Walker 1991). Over the past few years much progress has been made in understanding how and where new regional industrial paths emerge and develop over time. An industrial path can be defined as “a set of functionally related firms and supportive actors and institutions” (Steen and Hansen 2018, 191; see also Binz, Truffer, and Coenen 2016). This article focuses on emerging paths, that is, industries that are in an early path development stage (Martin 2010).

A growing body of literature in evolutionary economic geography (EEG), innovation studies and adjacent academic fields has produced new insights into the forms, mechanisms, and geographic patterns of new path development. EEG frameworks, most notably the development of a *path as a process* model (Martin 2010) and the literature on related and unrelated diversification (Boschma 2017) have proven to be powerful approaches in this regard. Recent work has forged a link between EEG and the regional innovation system (RIS) concept to better understand why some types of regions are more likely than others to develop new growth paths (Isaksen and Trippel 2017; Trippel, Grillitsch, and Isaksen 2018). Other scholars have proposed a stronger integration of EEG with the global production network (GPN) approach (MacKinnon 2012), geographic political economy frameworks (Dawley 2014; Dawley et al. 2015), and the technological innovation system (TIS) concept (Binz, Truffer, and Coenen 2016) to incorporate a wider

set of factors into analyses of new path development (Hassink, Isaksen, and Trippel 2019; MacKinnon et al. 2019).

Earlier contributions to the path development literature have identified the analysis of multiple industrial paths developing within a region as a promising field of research (Martin and Sunley 2006, 2010), not least because there is clear evidence that regions, in particular those with diversified economic and institutional structures and strong innovation capacities (Isaksen and Trippel 2016; Xiao, Boschma, and Andersson 2018), tend to host a variety of new path development activities in different fields. Simmie et al.'s (2008) analysis of the Cambridge region (UK) is telling in this regard. The authors identify not fewer than fifteen new industrial paths that developed in four waves between 1971 and 2001 in that region. They investigate local conditions and a range of factors affecting the emergence (as well as stagnation, resurgence, and decline) of different paths, paying however insufficient attention to the extent and ways in which multiple paths influenced each other over time.

The vast majority of conceptualizations and empirical case studies have adopted a *single path view*, that is, they have been focused on one path or new path development activities in one industrial sector only. This focus has only recently been criticized (Steen and Hansen 2018; Hassink, Isaksen, and Trippel 2019; MacKinnon et al. 2019) and a comprehensive discussion of interpath dynamics and an outline of respective implications for empirics and policy are still missing. With this article, we seek to stimulate the debate over interpath interactions.

EEG studies of industrial diversification aiming at uncovering regularities or patterns of co-occurrence by means of extensive research designs have indeed been concerned with path interdependencies. However, they focus either on existing industries, exploring to what extent they are related to each other (related versus unrelated variety) or investigate in which ways emerging paths are related to the existing industrial base (related versus unrelated diversification) (Boschma and Frenken 2011; Boschma 2017). As a result, less attention has been paid to the relation between simultaneously emerging regional industrial paths, and as a consequence little is known about how they shape each other's evolution.

Inspired by contributions at the intersection of EEG and RISs to explain new path development, this conceptual article aims to shed light on the meaning and nature of relationships between multiple new regional industrial paths. While our framework is broad enough to include any form of interpath relationships, we intentionally focus on emerging paths to specifically understand challenges and potentials in regions that experience diverse new path development activities. We explore the nature of interpath linkages and suggest that agency may create or shape supportive, competitive, or neutral relationships between linked paths. We also discuss the policy implications and challenges that emanate from this perspective. Understanding interpath relationships provides a sound basis for a broader, more integrative innovation policy approach, and points to the need to proactively build connections and balance competition and cooperation between emerging paths.

The remainder of this article is organized as follows. The first section starts out by providing a short overview and critical appraisal of current accounts of new path development and multiple (regional) industrial paths. This is followed by a discussion of recent advances made in the EEG and innovation studies literature, which offer a more comprehensive understanding of regional industrial path development and—as will be shown—serve as a stepping stone for a broader conceptualization of interpath dynamics. The second section examines conceptually—and illustrates by empirical examples—the nature and strengths of interpath linkages, and asserts that

emerging regional paths are more often than not linked to other regional paths. In the third section, we explore the role of agency in shaping supportive, competitive, or neutral relationships between new paths. The concluding section discusses implications for innovation policy and suggests avenues for further research.

New Regional Industrial Path Development and Interpath Dynamics

Since Martin and Sunley's (2006) seminal article on path dependence and regional economic evolution, EEG has made significant progress in explaining processes of regional economic change. This section provides an overview on current debates of new path development, specifically focusing on emerging paths. We also provide a synthesis of what is known from the EEG literature on the relationship of multiple industrial paths, and how this might be enriched by more recent work on new path development and findings from innovation system studies.

34

Current Accounts of New Regional Industrial Path Development and Relatedness

Key contributions to evolutionary economics have been made by theorists of path dependency (David 1985; Arthur 1989) who emphasize historic events and attribute change in economies mainly to external shocks. Martin (2010) deviates from these canonical perspectives and suggests viewing path development as an ongoing process where change is understood as inherent. By integrating path dependency in an evolutionary perspective on industrial change (Martin and Sunley 2006, 2010), current EEG models acknowledge that new paths build on assets inherited from previous ones. The process through which new industrial paths emerge out of technologically or skill-related preexisting industrial structures (termed *regional branching* or *related diversification*; Boschma and Frenken 2011; Neffke, Henning, and Boschma 2011) has received enormous attention over the past few years. More recently, scholarly work has begun to explore the role of *unrelated diversification*, that is, the development of new industries that are unrelated to the existing regional industrial base (Boschma 2017).

A number of EEG contributions do recognize the possibility or even inevitability of multiple industrial paths developing within a region (Martin and Sunley 2006; Simmie et al. 2008; Martin 2013). Martin (2013) suggests that such multiple paths ought to be seen as interdependent, and potentially mutually reinforcing and coevolving. Martin and Sunley (2006, 411) define as a key question whether different paths can coexist within a region and what the nature of "interpath coupling" is. They also question the aggregate effect of the interrelatedness and interdependency between multiple paths for regional path dependency and suggest that "path interdependence" may occur "where the path-dependent trajectories of particular local industries are to some degree mutually reinforcing" (Martin and Sunley 2006, 413).

Path interdependencies are also recognized in scholarly accounts of related variety and in the literature on regional diversification. By looking at trade data, sector classifications, patent data, labor flows, or co-occurrence (see Content and Frenken 2016 for a detailed overview on data sources in related variety studies), path interdependencies in the form of related variety between established industrial paths have been described and analyzed. Whereas related versus unrelated variety captures the extent of how industries that exist in a certain region are related to each other, related

versus unrelated diversification observes in which ways emerging regional paths are related to established ones (Boschma and Frenken 2011; Boschma 2017).

These accounts of interpath dynamics are not without their shortcomings. First, potential relationships between multiple new paths have so far been neglected in the literature on new path development and industrial diversification. Second, existing concepts only consider positive relationships between paths whereas negative path interdependencies are left out (Boschma et al. 2017; Hassink, Isaksen, and Trippel 2019). Third, interpath linkages are narrowly conceptualized. Technological and skill relatedness take center stage at the expense of other forms of interpath relations. What is more, conventional perspectives appear to view interpath relations as being static and are thus poorly equipped to provide a meaningful assessment of dynamic interactions between several paths.

The article looks at the relationship between emerging paths, since this is a largely disregarded aspect in the literature. As will be argued in “Toward a Broader Understanding of Linkages between Multiple (Regional) Industrial Paths,” in analyses of interpath dynamics, it is vital to consider further assets beyond knowledge and skills, and to acknowledge that assets may have local and external sources. With our framework, we intentionally take into account the possibility of negative interpath relationships and correspondingly not only look at positive linkages between paths but also recognize rival relationships. In light of this, it is of vital importance to attribute assets, as well as markets, a prominent role in discussions about interpath dynamics.

Toward a Broader Understanding of Linkages Between Multiple (Regional) Industrial Paths

This article aims to deepen the analysis of new path development by looking at relationships between new industrial growth paths in a regional context. Before doing so, we first need to specify what the key characteristics and challenges of the early development stage of a new path are, what assets are needed, and which activities and processes are usually involved. The early path development stage may be seen as unfolding in different phases, each with different conditions, triggers, and challenges (Gustafsson et al. 2016). Martin (2010) divides the early path development stage into a *path creation phase* and a subsequent *path development phase*. The former is characterized by experimentation and competition among local agents. The latter is based on local increasing returns and network externalities. He asserts that new path development is about identifying, harnessing, and converting historically evolved local conditions to match new market opportunities. Similarly, Boschma (2017) argues that new industrial paths are embedded in region-specific capabilities; they result from activities by entrepreneurs who draw on and combine existing capabilities.

In conventional EEG frameworks, the early stage of path development is thus often a matter of the deployment and conversion of existing local assets and capabilities. Recent work suggests that repurposing of existing assets is often complemented by other activities that also lead to a modification of the regional asset base. Scholars have pointed to the significance of creating new assets locally and importing and anchoring nonlocal industrial and knowledge assets, financial investment, and legitimacy (Tödtling and Trippel 2013; Dawley 2014; Dawley et al. 2015; Binz, Truffer, and Coenen 2016; Neffke et al. 2018; Trippel, Grillitsch, and Isaksen 2018).

Following Martin (2010) we argue that new paths encompass a *path creation and path development phase*. We relate with emerging EEG perspectives by acknowledging that the capabilities and assets needed for new path development may come from local

and external sources (Trippel, Grillitsch, and Isaksen 2018), or they may still have to be created regionally or locally in the early path development phase(s). We incorporate two more approaches to broaden EEG perspectives on regional structural change, namely, (1) emerging perspectives that extend the focus on assets beyond industrial and knowledge-related ones (Maskell and Malmberg 1999; MacKinnon et al. 2019; Trippel et al. 2019) and (2) the role of different actors engaging in local and nonlocal market formation to enable the development of new paths (Binz, Truffer, and Coenen 2016; Binz and Truffer 2017).

36 First, in line with emerging perspectives, we advocate a broader understanding of local conditions (Martin 2010) and territorial capabilities (Boschma 2017) than that suggested by established EEG perspectives. These place-based characteristics could involve a variety of local assets, ranging from natural resources to infrastructural factors, technological and other forms of knowledge, skills, capital, innovation capacity, institutional endowments, and networks (Maskell and Malmberg 1999; Dawley 2014). Acknowledging that various new regional paths may be linked through their dependence on broadly defined assets and/or markets, we accord with recent work that argues for taking into account other forms of relatedness than technological and skill relatedness, including institutional relatedness, natural resource relatedness, and market relatedness (Carvalho and Vale 2018; Hansen, Klitkou, and Tanner 2018). Second, we widen the EEG perspective to actors who engage in market formation beyond the firm, and recognize that markets for radically new technologies and products are also actively supported by state actors (Kemp, Schot, and Hoogma 1998; Dewald and Truffer 2011; Karnøe and Garud 2012; Binz, Truffer, and Coenen 2016).

Arguably, two or more paths may interrelate at several dimensions, including diverse firm and nonfirm actors, networks, institutions, and markets. Originating from our analytical interest in the role of agency in shaping interpath relations, we highlight modification processes of broadly understood assets and markets. In this way, we acknowledge that new path development may involve a broad set of activities undertaken by heterogeneous actor groups. Developing new paths is not only about the creation and diffusion of sector-specific knowledge and skills. The literature reviewed above suggests a broader conceptualization to include a wide range of activities (those aiming at institutional change, sourcing, mobilizing, and anchoring of diverse other local and nonlocal assets, as well as the creation of local and nonlocal markets) that may be essential in nurturing a new growth path.

This allows for considering other types of interpath linkages than those discussed in conventional EEG perspectives. Both, positive and negative impacts (in the form of competition for scarce assets or markets) may be frequent phenomena. Similar ideas can be found in the TIS literature. Bergek et al. (2015) point to a coevolution of several TISs in the form of competition or complementarities. In that sense, the composition and success of possibly related industries in regions decide upon their actual situation at a particular time. Moreover, interrelationships change over time, and we agree with Bergek et al. (2015) who consider the early phase of a TIS as being particularly predisposed to the influence of other TISs. This can be explained by the fact that emerging paths often have difficulties in terms of their initial performance and cost competitiveness.

A precondition for interactions between emerging technologies or TISs is that they either provide similar outputs, that is, they fulfill the same function, or they are horizontally related because they draw on the same inputs in the form of assets (Sandén and Hillman 2011; Bergek et al. 2015). Sandén and Hillman (2011) point to the important differentiation between nonexclusive goods (e.g., nonpatented

knowledge) or such goods that are in abundant supply. They further specify that neutral relationships (i.e., simple coexistence of paths) may be found, resulting, for instance, from different geographic orientation.

Our approach puts emphasis on interpath linkages resulting from the access to markets and the assets available within a RIS. RISs vary in terms of assets and organizational constellations (actors and networks) and thus in their capacity to actively support new growth paths. More precisely, they differ in their capacity to (1) modify the local asset base and to import and anchor nonlocal assets (Binz, Truffer, and Coenen 2016; Tripl, Grillitsch, and Isaksen 2018) and (2) access local as well as nonlocal markets (Binz and Truffer 2017). Complementing the RIS perspective, which sheds light on the *availability* of assets and the market potential within the region, by an industry perspective, allows considering also the *transferability* of assets across space (for example, spatially *sticky* tacit versus codified, globally available knowledge; Asheim and Isaksen 2002) and varying opportunities to access distant markets (see, e.g., Binz and Truffer 2017). As Binz and Truffer (2017) remind us, industries differ substantially in the extent to which they rely on regionally available assets and regional markets. Distinguishing between local (prevalence of doing–using–interaction mode) and global (dominance of science–technology–innovation modes) *innovation subsystems*, on the one hand, and local (customized markets) and global (standardized markets) *valuation subsystems*, on the other hand, Binz and Truffer (2017) identify four ideal-type system configurations: (1) spatially sticky systems (both the innovation subsystem and the valuation subsystem are locally configured), (2) production-anchored systems (local innovation subsystem combined with a global valuation subsystem), (3) market-anchored systems (global innovation subsystem combined with a local valuation subsystem), and (4) footloose systems (both innovation and valuation subsystems are globally configured). Since our interest is in interpath linkages in a regional context, our analysis does not capture footloose industries. It is, however, also worth mentioning that in the early phases of path development—which is in focus in this article—many industries show a relatively strong reliance on regional assets and markets (see, e.g., Feldman 2000; Binz and Truffer 2017).

We argue that agency can play a major role in shaping interpath collaboration and competition (or its avoidance) for markets and assets within or outside the RIS. Before elaborating in more detail on intentions and outcomes of agency in the context of interpath relationships, we first shed light on the nature and strength of interpath linkages in regional contexts.

The Nature and Strength of Interpath Linkages in Regional Contexts

Our point of departure is to consider the nature and strength of interpath linkages in a regional context being determined primarily by the respective paths' reliance on markets and broadly understood regional assets. To unpack the nature of interpath linkages in a regional context, we thus follow Sandén and Hillman (2011) and Bergek et al. (2015) and differentiate between two key dimensions, the market dimension (demand side) and the asset dimension (referring here to assets required for developing novel products and solutions, reflecting the supply side). Incorporating both dimensions into the analysis is crucial and well in line with recent calls in the innovation studies literature to complement conventional *production-side driven explanations* of innovation-based path development by accounts of the demand side and processes through which novel products or technologies become a valuable solution for users

(Jeannerat and Kebir 2016). Binz and Truffer (2017) note that market access, financial investment, and legitimacy are key elements of such valuation processes. In our analysis, the market dimension is reflected in the question whether or not two or more paths produce the same output (or function), that is, goods, services, or solutions that target the same market. The asset dimension refers to place-based characteristics in the form of input factors needed in the development and production process of goods, services, or solutions, including, for instance, natural resources, technological and other forms of knowledge, skills, financial capital, and so on). In line with Sandén and Hillman (2011), we distinguish between scarce and abundant (nonexclusive) assets. If scarce regional assets are accessed by actors in one path, they cannot be used in other paths. Examples are skilled labor, private risk capital, or real estate. Abundant assets imply that their use in one path does not restrict their use in other paths (e.g., nonpatented knowledge, place-based values or norms). We argue that the specific characteristics of new paths concerning these two dimensions crucially influence the nature of interpath linkages and (potentially) resulting relationships between emerging paths (see Table 1).

38 The strength of linkages between several emerging regional industrial paths depends on how strongly they rely on the same markets and/or the same scarce or abundant assets. Paths that rely on the same markets and on the same scarce assets are *very strongly linked* (box A in Table 1). Paths that target the same market but do not require the same scarce assets are *strongly linked*. They may use the same abundant assets (box B, Table 1), different scarce assets (box C, Table 1), or different abundant assets (box D, Table 1). Paths that are linked through the market dimension have an inherently competitive relationship. By means of agency, the competitive relationship can either be further reinforced to the benefit of one (or several) path(s), or it can be weakened and turned into a neutral relationship. Empirical findings provide evidence that strongly linked paths can also enter supportive relationships (cf. “Shaping Interpath Relations: The Role of Agency”).

Paths that offer solutions to different markets but rely on the same scarce assets are *strongly linked* through these assets (box E in Table 1). The inherently competitive relationship may, by means of agency, be shifted toward supportive, more competitive or neutral relationships. Another category of linkages is among paths that rely on different markets and draw on the same abundant assets (box F in Table 1). They are *weakly linked* and their relationship may be neutral in general but can, under certain circumstances, also be turned into a supportive one.

Linked paths in a region may affect each other in manifold ways. The first scenario, where different paths have very strong linkages, refers to emerging industries that draw on the same scarce assets and provide for the same market (box A in Table 1). An example is the emergence of different renewable energy paths in Germany (Jacobsson and Lauber 2006). Biogas, wind, and solar power all profited from financial resources, guidance, and legitimacy provided by the state with the feed-in tariff regulation¹ and offer products for the same market (energy) (Bergek et al. 2015). Both scarce assets (particularly national financial resources available in all German Bundesländer) and the focus on the same market signified very strong interpath linkages (highly competitive relationships) between the emerging renewable energy paths.

¹ The feed-in tariff regulation has been designed to accelerate investment in renewable energy technologies by offering guaranteed prices for fixed periods of time to renewable energy providers based on the cost of electricity generation per technology (Couture and Gagnon 2010).

Table 1

Interpath Linkages and Relationships

	Same Scarce Assets	Same Abundant Assets	Different Scarce Assets	Different Abundant Assets
Same market Linkages	A Very strongly linked (through both markets and assets)	B Strongly linked (through markets)	C Strongly linked (through markets)	D Strongly linked (through markets)
Relation- ships		Competitive relationship <i>Agency oriented at:</i> <ul style="list-style-type: none"> • further strengthening competition • creating supportive relationship • neutralizing relationship 		
Different markets Linkages	E Strongly linked (through same scarce assets)	F Weakly linked (through same abundant assets)	G Unlinked	H Unlinked
Relation- ships	Competitive relationship <i>Agency oriented at:</i> <ul style="list-style-type: none"> • further strengthening competition • creating supportive relationship • neutralizing relationship 	Neutral relationship <i>Agency oriented at:</i> <ul style="list-style-type: none"> • creating supportive relationship 	Neutral relationship	Neutral relationship

In the second scenario where paths draw on the same scarce assets, but provide for different markets (box E in Table 1), interpath linkages are still strong in nature. Much depends on the extent to which several paths are in need of the respective regionally available assets. Miörner and Trippel (2017) provide an example of two new paths (the digital gaming industry and the new media industry) in Southern Sweden that serve different markets but are strongly linked through a dependence on the same scarce human assets, namely, software specialists.

In further scenarios, multiple emerging paths draw on (same or different) abundant assets or different scarce assets but offer products to the same market (boxes B, C, D in Table 1). As noted above, being linked via markets leads to competitive interpath relationships. The cases of alternative transport fuels in Sweden (discussed in "Shaping Interpath Relations: The Role of Agency") and of the Australian urban water sector are exemplary for competition over markets. The case of the urban water sector in Australia suggests that as a response to extreme dry weather conditions, two paths (recycling technologies for wastewater and large-scale seawater desalination plants) have emerged to provide the needed water (Fuenfschilling and Truffer 2016). Market competition shaped path development activities even more when the multiyear drought ended and thus the market declined.

When two or several paths rely on the same abundant assets but not on the same markets (box F in Table 1), they may be weakly linked by the particularities of their environment, characterized through the composition of abundant assets. Exemplary is the rise of creative industries, ranging from media, advertising, design, and fashion in mixed-use urban neighborhoods. The type of knowledge needed by creative industries is characterized by a strong tacit component and is referred to as symbolic knowledge (Asheim 2007). It is "incorporated and transmitted in aesthetic symbols, images, (de)signs, artefacts, sounds and narratives" (Asheim 2007, 226). Creative industries draw on abundant assets, such as cultural facilities, public transportation, streets with great walkability, but also youthful in-migration found in highly diverse environments (Jacobs 1961; Spencer 2015; MacKinnon et al. 2019) where symbolic knowledge can circulate and be exchanged between actors.

Arguably, emerging regional paths are rarely *unlinked* (boxes G and H in Table 1), which would mean that they rely on neither the same markets nor the same scarce or abundant assets. Unlinked paths refer to the mere coexistence of multiple emerging paths in a region that develop independently of one another. New industrial paths remain unaffected by the rise and growth of other paths in the region. Their relationship is neutral.

The strength of interpath linkages may change over time as the characteristics of the paths themselves change, their markets evolve, or needed assets may be used up or newly added to the regional asset base (Sandén and Hillman 2011; Musiolik et al. 2018). Besides changing context conditions (as in the case of the Australian urban water sector), agency is an important driver of shifting linkages to specific relationships.

Shaping Interpath Relations: The Role of Agency

In this section we seek to unravel the important role of agency in shaping the relationship between linked paths. After discussing scholarly contributions on agency and purposive behavior, which have recently been integrated into EEG and innovation system frameworks (Sotarauta 2016; Isaksen and Jakobsen 2017; Carvalho and Vale

2018; Isaksen et al. 2018), we analyze the rationale for and the actions aimed at establishing specific interpath relationships.

Agency concepts have only recently been taken up in EEG and innovation studies (Strambach and Halkier 2013; Martin and Sunley 2015; Boschma et al. 2017). Drawing on the seminal work by Emirbayer and Mische (1998), recent contributions on agency suggest considering not only the past and the present but also ideas and visions of the future (Steen 2016; Sotarauta and Suvinen 2018; Grillitsch and Sotarauta 2019). Emirbayer and Mische (1998) argue that actors who encounter problematic situations that require the exercise of imagination and judgment, gain a reflective distance from received patterns, which allows for greater imagination, choice, and conscious purpose. Assuming that the dominant temporal orientation of actors belonging to emerging paths is the future, agentic orientation does “not merely repeat past routines” (Emirbayer and Mische 1998, 983), but rather invents “new possibilities for thought and action” (Emirbayer and Mische 1998, 984). Of particular importance for setting directions in emergent paths are therefore actors’ expectations about future development in agentic decision-making processes. Agency for new path development has been conceptualized as being intentional or purposive (Sotarauta 2016; Sotarauta and Suvinen 2018). Nevertheless—and in line with Emirbayer and Mische’s (1998) assessment that besides purpose, routine and judgment are also important agency dimensions—the strategies of agents to develop specific outcomes at the system level are said to be dependent on initial asset constellations (Musiolik et al. 2018).

Garud and Karnøe (2003) employ the notion of bricolage (see also Carvalho and Vale 2018) to accentuate that multiple actors take part in innovative activities, the development of complementary assets, and microlearning processes. The concept of distributed agency has recently been incorporated in conceptual discussions of path development (Boschma et al. 2017; Isaksen et al. 2018). Agency involves a broad range of actors including firm and firm-related actors, as well as organizations of collective agency from the state, governance, and community, who “anticipate, react and transform” regional development processes strategically (Bristow and Healy 2014, 928–29). The existence of long-term links between heterogeneous actor groups in the form of networks enables them to join forces (Musiolik, Markard, and Hekkert 2012) to eventually shape markets and modify the region’s asset base.

Agency that nurtures new path development is understood by taking a RIS perspective, which is crucial when considering interpath relationships in a regional context. Literature on regional restructuring suggests that new path development calls for RIS changes and modification of the regional asset base (Tödting and Trippel 2013), brought about by what in this strand of literature is called *system level agency* (Isaksen and Jakobsen 2017; Isaksen et al. 2018). Changing assets or market configurations in the RIS can exert influence on more than one path. This is due to the fact that the region’s support structures containing research and education programs, a specific skill base, dominant policy approaches, and institutional set-ups may be used—as emphasized throughout this article—by several paths. What is more, several paths may also produce for the same market. Furthermore, the RIS perspective enables consideration of multiple actors involving firm and nonfirm actors such as research and educational institutes, policy actors, as well as support organizations for analyzing path development activities (Trippel, Grillitsch, and Isaksen 2018; Hassink, Isaksen, and Trippel 2019). These actors can either belong to one particular regional industrial path, or—what we want to specifically emphasize—they come from different industrial paths and undertake agency through interaction.

Building on the arguments raised above, our conceptualization of interpath relationships takes into account the role of agency in molding assets and/or shaping markets to the benefit of path development. We understand RIS transformation as a result of asset modification and market creation. Such processes may be initiated by actors from one emergent path (see, e.g., the case of the gaming industry in Scania; see “Toward Neutral Relationships”) or they might result from interpath collaboration (Musiolik et al. 2018) as is the case for several renewable energy paths in Germany (see “Toward Supportive Relationships”). We specifically focus on agency undertaken by multiple actors who build, access, and deploy assets or shape markets with the aim of fashioning interpath relationships. Since internal and external influences play a role in shaping new path development, that is to say, new paths are part of complex multiscalar processes of industry formation (Markard and Truffer 2008; Binz and Truffer 2017), local as well as nonlocal linkages might be strategically used to mold relationships to other new paths.

42 As a result of agency, the relationship between linked paths may take various forms (cf. Table 1). When paths are linked through reliance on the same scarce assets, actors from one path may strengthen competitive pressure on other paths, or they may create supportive relationships by joining forces to modify these assets. The same strategic options are available when several paths compete for the same market. Paths that are weakly linked via the same abundant assets but do rely on different markets may join forces to modify the locally available abundant asset base. Neutral relationships do not only exist if paths are unlinked (see “The Nature and Strength of Interpath Linkages in Regional Contexts”), they might also be the result of neutralization strategies undertaken by actors belonging to one or several linked paths.

To exemplify potential rationales and strategic options to shape interpath relationships, we further elaborate on the cases of linked paths described in “The Nature and Strength of Interpath Linkages in Regional Contexts.” They show that as a result of agency, the strength of interpath linkages may increase or decrease over time, which may also be affected by the evolution of the respective paths. Interpath relationships may shift being supportive, competitive, or neutral (as in the case of renewable transport fuel paths, which initially supported each other in creating markets, were later subjected to market competition, and finally neutralized their relationship), or the three forms may even occur simultaneously (as in the case of renewable energy paths, which compete for financial resources and at the same time collaborate to strengthen legitimacy and to create markets).

Toward Supportive Relationships

Actors nurture new path development by purposely modifying assets and markets and thus transforming RIS structures. If such actors belong to different but linked emerging paths, establishing cooperative relationships to improve the support structure to meet their specific needs may be an obvious strategy. They might jointly create additional assets or modify existing ones through, for example, new educational programs or research activities at universities, work together to initiate institutional coevolution and change, or join forces to increase demand.

A prominent example for collaboration between actors from multiple paths refers to the German feed-in tariff. Despite the fact that different renewable energy paths—that is wind power, solar, biogas—competed for the same public financial resources (cf. “The Nature and Strength of Interpath Linkages in Regional Contexts”), evidence suggests that wind and solar associations and advocacy coalitions, including

conventional industry associations as well as independent environmental organizations,² at one point decided to work together “to initiate, maintain and strengthen the feed-in tariff” at the national level (Bergek et al. 2015, 56; see also Jacobsson and Lauber 2006). Accelerated by the nuclear accident in Chernobyl in 1986, the German parliament exerted pressure on the government to make funding available for demonstration and research projects (Jacobsson and Lauber 2006). Later, massive demonstrations organized by broad coalitions of metalworkers, farmers, and church groups, as well as environmental activists and solar and wind associations, led to a reapproval of the feed-in law and thus not only substantially strengthened legitimacy, value, and vision-building for all renewable energy paths but also removed uncertainty resulting in further market expansion (Jacobsson and Lauber 2006). The Renewable Energy Sources Acts in 2014 and 2017, however, replaced feed-in tariffs by a system of tendering, which undermined the potential for supportive relationships between solar and wind paths. Similar observations have been made by Sandén and Hillman (2011, 411) in Sweden for renewable transport fuels where during the path creation phase, farmers’ organizations purposely joined forces to lobby “for more favorable policies, such as general tax exemptions that were to benefit several ... fuels, mainly ethanol, biogas and rapeseed methyl ester.” Moreover, the authors provided evidence that various actor groups and networks (including firm actors, associations, and advocacy groups) that had been formed around “ethanol and methane vehicles helped one another to stimulate the build-up of a market for ‘clean vehicles’” (Sandén and Hillman 2011, 411)

An example that demonstrates that different paths that are weakly linked by abundant assets may also establish a supportive relationship is provided by MacKinnon et al. (2019) for the creative industries in Berlin. Diverse start-ups, freelancer and other innovative entrepreneurs from media, creative arts, and entertainment, information and communication technologies, education and research, and tourism created alternative and experimental spaces where these new actors could meet and benefit from building connections to established players such as major research universities, corporate headquarters, and philanthropic foundations. The Berlin state complemented these activities with respective campaigns and branding activities. As a result, abundant assets, such as alternative cultural norms and practices, have been created through various activities undertaken by actors with similar objectives, and in this way successfully supported the development of diverse cultural and media-related paths in the city.

Strengthening Competitive Relationships

Actors operating in emerging paths that draw on the same scarce assets or that seek access to the same market may opt for activities that reinforce the inherently competitive relationships. This could take two forms. On the one hand, actors from one path may actively seek to build assets for their own needs (Miörner and Trippel 2017). On the other hand, they might aim to undermine the development of other paths. Associated activities to reinforce competition could include organized lobbying. Such activities could also be aimed at de-legitimizing the rivals for local, regional, and national assets, for example, funding schemes.

² Among the key actors were the Institute of Ecology, which provided counterexpertise to nuclear power; the Förderverein Solarenergie, which developed the concept of cost covering payment in the feed-in regulation; and Eurosolar, a politically independent organization, which campaigned for the support of renewable energies within the political structure.

44 An example where agency strengthened the competition over markets between two emerging paths is the case of the recycling technologies for wastewater and large-scale seawater desalination plants in the Australian urban water sector (cf. “The Nature and Strength of Interpath Linkages in Regional Contexts”). Fuenfschilling and Truffer (2016) show how actors on behalf of both paths engaged in institutional work *for* their own path development as well as *against* the development of the competing path. For desalination plants, multinational water companies, some utilities, as well as farming and mining firms mainly advocated the water security argument, which has been considered much stronger than criticism about water quality, economic efficiency, and environmental and social sustainability. Destructive agency against desalination plants has in turn been undertaken by nongovernmental organizations and green parties who established “desalination as environmentally problematic,” by economists who framed the solution as “financially unsustainable,” and by expert economists and consultancy groups, who “advised against desalination” (Fuenfschilling and Truffer 2016, 308). Different research alliances, such as the Urban Water Security Research Alliance, the Australian Water Recycling Centre of Excellence, and the Centre for Water Sensitive Cities, together with scientific advisory boards and experimental projects (Rouse Hill and Salisbury), supported recycling technologies by constructing normative networks and mobilizing resources, advocacy, changing normative associations through the diffusion of information and technology demonstration, and theorizing water sensitive urban design. Destructive agency against recycling technologies in turn focused on a policy ban and on collectively organized political campaigns. In the small town of Toowoomba in Queensland, the strong competition over the urban water market in Australia culminated in a nondemocratic political decision that discriminated against the wastewater-recycling path (Fuenfschilling and Truffer 2016).

The case of several alternative transport fuels in Sweden described by Sandén and Hillman (2011) is also an instructive example for agency oriented toward deepening competition. Analysis of this case suggests that after an episode of interpath collaboration (manifested in joint lobbying for favorable policies and building up the relatively small market for clean vehicles [see “Toward Supportive Relationships”]), a period of increasing interpath competition for markets at the municipal level followed. Once both industries have entered the development phase, infrastructural needs forced policy actors at the urban level to focus their political attention on one alternative fuel only. This has led to a change of relationships from being collaborative toward becoming more competitive, reflected in increasing attempts by actors belonging to different paths to influence the municipalities’ choice of alternative fuels through lobbying and legitimation activities.

Toward Neutral Relationships

RIS structures can hinder path development if spatially sticky scarce assets are effectively bound in other paths. In order to escape or to reduce the resulting competition caused by other emerging paths that rely on the same assets and/or markets, actors might try to *unlink* their industrial path from others. One strategy could be to simply *change geography* in order to escape competition over markets by supplying a different region. Another strategy would be to reconfigure the RIS by creating additional assets to mitigate the scarcity of resources and thereby to ensure that several emerging paths have access to the required assets. This can take various forms, including the provision of funding, educational facilities that build human assets, or support programs that

provide infrastructural assets. Policy actors or intermediaries might strategically refrain from modifying assets in a way that benefits one path at the expense of other paths. In this way, they intentionally keep the competitive relationship weak and thus work toward a neutral relationship, thereby enabling the possible survival of a diversity of paths.

Sandén and Hillman (2011) show for the case of different alternative transport fuel paths in Sweden, that after the short period of competition at the municipal level (see “Strengthening Competitive Relationships”), the different paths have at one point neutralized their relationship through the creation of different geographic niches. Urban administrative actors being influenced by the different actors lobbying for their respective paths played a key role in this regard by prioritizing particular transport fuel paths over others, thus influencing which path has further developed in different municipalities.

As shown in “Shaping Interpath Relations: The Role of Agency,” the development of the digital gaming industry in Scania (Sweden) has suffered, amongst other things, from a competition over scarce assets in the form of policy support and human assets. Miörner and Trippl (2017) note that over time, the gaming industry has nevertheless experienced rapid growth, including high-profile acquisitions. One reason why policy makers ignored the specific needs of the gaming industry in comparison to other nascent industries was their sense that the emerging path is not a “serious business” and they intentionally refrained from creating new support organizations and initiatives (Miörner and Trippl 2017, 490). A local private entrepreneur tackled this shortcoming by establishing an annual game development conference (called Nordic Game Conference [NGC]), which marketed Scania as a “game development region” (Miörner and Trippl 2017, 491). Circumventing the regional policy level, support for NGC was mobilized at higher spatial scales, more precisely, the Nordic Game Program funded by the Nordic Councils of Ministers. In this way, a first step to neutralize the gaming industry from the scarce asset *regional policy support* had been taken. When the need for skilled workers became more pronounced, the foundation of the advanced vocational training school, The Game Assembly, improved the situation for the emerging gaming path considerably. For this permanent new facility in the regional support structure, Massive Entertainment (one of the largest gaming firms in the region), an extraregional educational body, and other key actors (such as the Swedish National Agency for Higher Vocational Education) at the national level jointly enabled the establishment of the school that helped to educate workers. This was a second important step to escape from competition with the new media industry where the scarce human assets were bound. Finally, the establishment of a privately funded cluster initiative (Game City) initiated by a group of key industrial actors who mobilized support from both big and small game development firms has helped to coordinate actors, facilitate joint initiatives within the industry, and increase the awareness of the industry among policy makers at the regional level. Agency in this respect was directed toward the creation of new assets and enabled the further development of the emerging industry by overcoming barriers emanating from competition over skilled labor and regional policy funding with other emerging paths.

Conclusions and Implications

Recurrent economic and financial crises, globalization, digitalization, and climate change intensify the constant pressure on regions to renew their industrial structures and to develop new growths paths. We have argued in this article that it is important in

the context of new path development to concentrate not just on the emergence and development of single paths alone but to consider how multiple paths emerge within a region, how they are related, and which interactions and interdependencies determine their development. With this article, we seek to open the debate and hope to stimulate further research by proposing a basic framework.

46 EEG studies have been concerned with path interdependencies between existing industries (related versus unrelated variety) as well as with relations between old and new regional industries (related versus unrelated diversification). The interdependence between more or less simultaneously emerging regional industrial paths has, however, received limited attention in EEG and innovation studies. We argue that by taking a RIS perspective, it becomes obvious that not only the existing industrial base but also early path development activities occurring in other sectors have an influence on an emerging path resulting from the common need for diverse, possibly scarce assets and the potentially limited access to shared markets. Our analysis therefore suggests that the development of regional emerging paths depends on the nature and strength of linkages to other regional emerging paths, which is determined by two dimensions: the assets they draw on and the markets that they produce solutions for. Unlinked paths, in this perspective, are a rare phenomenon.

Regional restructuring requires changes in the support structures of the RIS and the regional asset base. In this article, we argue that interpath relationships play a role in developing assets and markets insofar as agency aiming at changing both dimensions for path development can result from actions taken from diverse actors belonging to different paths. Moreover, agency at the level of the RIS means a *modification* of the regional support structure that may result in favoring specific paths over others. In concrete terms, our framework considers that regional actors have to deal with various linked (and some unlinked) new paths. Dependent on their strategic aims and regional opportunities, they choose measures, which are directed at one of three types of relationships between paths: First, they may aim to promote cross-path collaboration to foster a supportive relationship in order to develop assets and markets, to exploit synergies, or to help legitimate novel solutions. Second, actors may seek to lobby and control assets in order to maintain dominance on a market and improve the competitive position of a specific path. Finally, agents may seek strategies, which result in a neutral relationship between paths. Paths can be unlinked by changing geography, seeking assets and markets elsewhere, thereby circumventing unwanted competition.

The novel perspective on interpath relationships proposed in this article may also add to current debates on new policy approaches for innovation and structural change. New path development ranks high on the agenda of regional, national, and supranational policy actors (Asheim, Boschma, and Cooke 2011; European Commission 2012). Innovation and industrial policies—smart specialization in particular—aim for the development of new regional specializations (that is, new paths) to ensure future growth (Foray 2014; Trippel, Zukauskaitė, and Healy 2019). The selection of *domains* of competitive advantage (that is, emerging industrial paths) in smart specialization strategies, is based on a thorough analysis of the specific regional or national innovation capacity. We contend that regional or national smart specialization strategies and place-based innovation policies more generally truly benefit from considering interpath relationships. This is due to the opportunity to take into account promising interpath relationships during the policy discovery process. Competition for assets and markets can be made visible to either be used as an enabling factor for path development or to inform policy makers about necessary corrective actions.

Policy should play a strategic and proactive role in (1) balancing competition, cooperation, and neutralization between new paths; and (2) facilitating and coordinating interpath relationships. In terms of policy measures, this implies the development of diversified industrial and institutional infrastructures that support interpath cooperation or neutralization, and at the same time to find the right balance of nurturing and alleviating competition between emerging paths. Different types of regions have different rationales for strategically shaping interpath relationships. A rationale for encouraging mutually supportive relationships between linked paths may be to further integrate development in diversified regions with several linked paths. Policy instruments for encouraging supportive interpath relationships would include the facilitation of networking through, for example, innovation platforms as well as targeted support of combined applications. Explicitly bringing together actors involved in different new path development activities and removing barriers that prevent emerging paths from connecting are sound policy strategies. Supporting viable paths in diversified regions, where there are a number of different industries and that lack any particular industrial focus can be reached by fostering competition, for example, by means of competitive funding mechanisms. In specialized regions where existing industries are prone to lock-in, bringing new technologies to the market and preparing the respective paths for competition are critical aspects of regional development strategies. Explicitly supporting desirable paths by increasing their competitive position may be achieved through the use of nonneutral support schemes. At certain stages of development, a neutral relationship with other linked paths may be most beneficial. This could help to broaden the industrial base and enhance the future diversification potential and resilience of specialized regions. Policy instruments to neutralize interpath relationships could include the provision of additional resources, supporting linked paths in accessing resources and markets outside the region, or demand-side interventions through public procurement or the stimulation of private demand by offering subsidies and tax incentives. Overall, it is clear that there is not one strategic option for a whole region but that a combination of measures must be implemented, which should also be adaptive to changes in interpath relationships.

The aim of this article has been to broaden the debate over interpath dynamics in regional contexts. We have done so by contributing a framework that may be the basis for further research. Different types of regions have different rationales and capacities for fashioning interpath relationships. More in-depth studies of how place-specific characteristics influence the options available for actors to promote interpath relationships may be a subject of further research. Empirical research on the emergence of multiple paths within a region, ideally comparing dynamics across different types of regions and industries, would undoubtedly produce important insights to complement, refine, and improve the framework, and would help to enhance understanding of how policy actors and the state influence interpath dynamics.

In our framework, the nature and strength of interpath linkages depends on how emerging paths relate to local and regional assets and markets. Yet, we appreciate that the distinction made in [Table 1](#) is often not easily drawn. Moreover, the regional asset base and markets, as well as the relationships between emerging paths themselves, are subject to change over time, as it has been shown for the case of alternative transport fuels in “Shaping Interpath Relations: The Role of Agency,” where, in the course of time, supportive competitive, and neutral relationships have been observed. It follows that regional path development and strategic choices for path relationships are not only place sensitive but also time sensitive, which would warrant closer examination, especially as part of empirical work.

We have alluded to the opportunity of linked paths that draw on assets from different local and nonlocal sources but have not in full considered the influence of multiscalar influences and nonlocal actors on the interactions and interdependencies between multiple emerging paths in regions. The case of the gaming industry in Scania has shown how regional asset creation may be pushed by coalitions of local and national actors, bypassing regional policy makers. More research is required to better understand the roles played by extraregional actors (such as national or supranational policy actors, intermediaries, and support organizations operating at higher spatial scales, powerful multinational companies, and so on) in regional interpath development. In addition, the reliance on spatially sticky and regionally available assets and regional markets varies markedly between different industrial paths (Binz and Truffer 2017). While we considered the possibility to unlink regional paths by accessing distant markets or sourcing assets from abroad, more research is needed to unravel how and why industries differ in their capacity to employ such neutralization strategies.

48 Our framework also gives limited consideration on how sociocultural factors, local and regional institutional arrangements, and environmental factors impact the scope for strategic action of actors. Gaining a better understanding of the ways in which those factors influence agentic processes and interpath dynamics is a key challenge for future research.

Finally, our framework focuses on linkages resulting from the common reliance on scarce assets and/or markets. Interpath dynamics may, however, also be the result of input–output relationships, indirect interdependencies, or externalities (Martin and Sunley 2006). Moreover, actors may simultaneously engage in different business areas (that is, they may belong to and operate in several paths), which might considerably affect their goals and strategic orientation when undertaking agency. Future studies could open up to incorporate such wider sources of interdependencies and examine how they influence new path development. A broadening of the framework, including not only regional interpath dynamics between emerging industries—which was in focus in this article—but also interregional interpath linkages, as well as relations between mature paths or between mature and emerging paths, would bring important insights into how regional structural change processes unfold and would allow for drawing more comprehensive policy implications.

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