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Danny MacKinnon, Stuart Dawley, Andy Pike & Andrew Cumbers

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abstract

A burgeoning strand of evolutionary economic geography (EEG) research is addressing questions of regional path creation, based on the idea that place-specific legacies and conditions play a critical role in supporting the emergence of new economic activities. Yet there has been little effort thus far to take stock of this emerging body of research. In response, the aims of this article are to offer a fresh synthesis of recent work and to develop a broader theoretical framework to inform future research. First, it presents a critical appraisal of the state of the art in path creation research. In an effort to address identified gaps in EEG research, this incorporates insights from sociological perspectives, the global production networks approach, and transition studies. Second, the article's development of a systematic theoretical framework is based on the identification of key dimensions of path creation and their constitutive interrelations. This contribution is underpinned by a geographical political economy (GPE) approach that provides the ontological basis for the integration of the five key dimensions of path creation within an overarching framework and the positioning of regional processes in relation to the broader dynamics of uneven development. Informed by GPE, the argument is that knowledgeable actors, operating within multiscale institutional environments, create paths through the strategic coupling of regional and extraregional assets to mechanisms of path creation and associated markets. To inform further research, the article outlines four concrete propositions regarding the operation of path creation processes in different types of regions and explores these through case studies of Berlin and Pittsburgh.

Danny MacKinnon
Centre for Urban and
Regional Development
Studies (CURDS)
Newcastle University
Newcastle Upon Tyne
NE1 7RU
UK
Danny.Mackinnon@ncl.ac.
uk

Stuart Dawley
Centre for Urban and
Regional Development
Studies (CURDS)
Newcastle University
Newcastle Upon Tyne
NE1 7RU
UK
Stuart.Dawley@ncl.ac.uk

Andy Pike
Centre for Urban and
Regional Development
Studies (CURDS)
Newcastle University
Newcastle Upon Tyne
NE1 7RU
UK
Andy.Pike@ncl.ac.uk

Andrew Cumbers
Adam Smith Business School
University of Glasgow
Glasgow G12 8QQ
UK
Andrew.Cumbers@glasgow.
ac.uk

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The development of evolutionary economic geography (EEG) has inspired a new wave of research on processes of urban and regional adaptation and change since the mid-2000s (Martin and Sunley 2006; Isaksen 2015). In recent years, work on path creation and regional branching has gathered momentum (see, e.g., Neffke, Henning, and Boschma 2011; Dawley 2014; Binz, Truffer, and Coenen 2016). Here, path creation refers to the emergence and growth of new industries and economic activities in regions, reflecting the broader evolutionary interest in the generation of novelty (Morgan 2017). Building on a longer strand of sociological research (Garud and Karnøe 2001), the idea that place-specific legacies and conditions play a critical role in fostering new path creation is a founding assumption of recent work (Isaksen 2015). Yet, despite the identification of path creation as “one of the most intriguing and challenging issues in our field” by Neffke, Henning, and Boschma (2011, 241), there has been little effort thus far to take stock of this flourishing strand of EEG research (cf. Boschma 2017). By contrast, the related concept of path dependence has been subjected to extensive theoretical and empirical scrutiny (Hassink 2005; Martin and Sunley 2006; Martin 2010).

In response, the aims of this article are to offer a fresh synthesis of recent work and to develop a theoretical framework to inform further research on urban and regional (hereafter regional) path creation. To accomplish this, the article undertakes two closely related tasks. First, it presents a critical appraisal of the state of the art in path creation research. Here, the discussion covers not only EEG research on path creation and regional branching but also related literatures on sociological approaches, global production networks (GPNs), and transitions research. This is designed to address identified gaps in the EEG literature concerning the social and economic agency that underpins path creation, the role of institutions, and the contribution of extraregional linkages (Boschma 2017).

Second, the article develops a systematic theoretical framework for investigating regional path creation, based on the identification of its key dimensions and their constitutive interrelations (see Figure 1). This framework is underpinned by an evolutionary geographical political economy (GPE) approach (MacKinnon et al. 2009; Pike et al. 2016), emphasizing the interplay of causal relations, processes, mechanisms, and actors through time and across

space (Martin and Sunley 2015). GPE provides the ontological basis for the integration of the principal dimensions of path creation within a comprehensive and holistic framework and for the positioning of regional processes within the broader dynamics of uneven development (MacKinnon et al. 2009; Sheppard 2011). The article adopts an open and pluralistic version of GPE that evolves in line with its main object of analysis, the capitalist economy, and that is itself extended and renewed by engaging other approaches (in this case, sociological perspectives, GPN research, and transition studies) (see Hudson 2006). In the context of path creation, the adoption of a GPE perspective focuses attention on diverse forms of social and economic agency, and the struggles of actors to initiate and reproduce regional paths in the context of broader, spatially uneven processes of production, consumption, circulation, and regulation. This perspective is designed to provide a systematic framework for further empirical research addressing critical unresolved questions about agency, institutions, and wider social and political processes (Boschma 2017).

Informed also by the review of EEG research and related literatures, the framework stresses the interactions between five key dimensions of path creation: regional and extraregional assets; economic, social, and institutional actors; mechanisms of path creation; market construction; and institutional environments. Agency is linked to key mechanisms of path creation through the concept of strategic coupling, adapted from GPN research (Coe and Yeung 2015). This concept underpins the article's argument that it is knowledgeable actors, operating within multiscale institutional environments, who create paths through the strategic coupling of regional and extraregional assets to mechanisms of path creation and associated markets. This general argument supports the identification of four concrete propositions regarding the forms of agency and mechanisms that operate in different types of region.

The remainder of the article is structured into five sections. The next section assesses current research on path creation and branching in EEG, leading to the identification of certain gaps and limitations. In order to address these gaps, the article proceeds to review sociological concepts, GPNs, and transitions studies. This is followed by the elaboration of the theoretical framework. A brief illustration of the framework is subsequently provided through case studies of Berlin and Pittsburgh. A final section concludes the article.

Path Creation and Regional Branching

Martin and Sunley (2006) provide an important point of departure for our rethinking of path creation through their identification of particular mechanisms or *drivers* of change. They highlight five regional *de-locking* scenarios: indigenous path creation, based on the exploitation of new technological paradigms; heterogeneity among agents, technologies, institutions, and social networks that foster variety and innovation; trans-plantation through the importation and diffusion of new technologies, firms, or industries; diversification into related industrial sectors; and the upgrading of a region's industrial base. While originally conceived in the context of de-locking from established paths, following the mechanisms as they unfold directs attention to the new paths generated, reflecting the idea of *path as process* (Martin and Sunley 2006). Accordingly, the operation of such mechanisms plays a key role in the transition between what Martin (2010) terms a *preformation* phase dominated by preexisting economic and technological conditions, and a path creation phase involving the growth of new industries.

Recent EEG research has concentrated on regional diversification or branching into new and related industries (see Boschma 2017), with Boschma and Frenken (2011) identifying four submechanisms of regional branching: entrepreneurial activities such as spin-offs and start-ups, firm diversification, labor mobility between firms and sectors, and social networking between agents. Regional branching is underpinned by the concept of related variety, defined in terms of regions possessing a number of complementary sectors with overlapping knowledge bases (Frenken, Van Oort, and Verburg 2007; Grillitsch, Asheim, and Tripl 2018). As such, regional branching involves firms moving into new industries that are related to existing economic activities in a region, building on regional capabilities and assets (Neffke, Henning, and Boschma 2011; Boschma 2017). This finding of related diversification has been replicated by a number of studies (see Essletzbichler 2015). By contrast, unrelated diversification is less common, although it can enable countries and regions to move into more technologically advanced industries, often through transplantation from outside (Zhu, He, and Zhou 2017).

4 In general, the EEG literature has tended to conceive of regional branching as a largely endogenous process of firms moving into related industries within the same region (Tripl, Grillitsch, and Isaksen 2017), although some recent studies have incorporated extraregional linkages and actors (Binz, Truffer, and Coenen 2016; Zhu, He, and Zhou 2017). While nonfirm actors, such as universities, research institutes, and government bodies, often play a key role in supporting regional diversification (Tanner 2014), they have received only limited attention (Boschma 2017). In addition, the processes through which branching actually occur remain underspecified, particularly in terms of the forms of social agency that shape them (Cooke 2012). Moreover, work on path creation and branching remains divorced from GPE understandings of broader processes of capital accumulation, state regulation, and uneven development (Martin and Sunley 2015).

Enriching Path Creation Research: Insights from beyond EEG

In order to address the limitations of extant EEG research, this section engages with three neighboring literatures on sociological approaches to path creation, GPNs, and transitions research (Table 1). This necessarily brief engagement is focused on the specific themes of agency and institutions, strategic coupling to extraregional actors, and the relationships between emerging technological niches and sociotechnical regimes with the aim of enriching EEG understandings of path creation.

Sociological Perspectives on Path Creation

Path creation research has drawn on Garud and Karnø's (2001) sociological approach, which conceives of agency as distributed across a range of economic and social actors. Originating in *mindful deviation* by knowledgeable agents, an emergent path has to overcome various path-dependent barriers before it can reach critical mass and achieve the momentum to become a new technological pathway (Simmie 2012). Path creation occurs through a process of *bricolage* involving a multiplicity of actors who enable the alignment of heterogeneous actors, institutions, and networks (Garud and Karnø 2001; Boschma et al. 2017; Carvalho and Vale 2018). In conjunction with economic understandings of path dependence, this sociological approach informs Simmie's (2012) hybrid socioeconomic theory of path creation as a series of stages of mindful deviation; incremental innovation; the overcoming of path-dependent barriers; and, finally, the diffusion of new technologies.

The sociological approach emphasizes the role of institutions in path creation, referring to formal and informal rules, conventions, and practices (Gertler 2010).

While institutions are generally regarded as sources of stability and order, path creation often involves institutional adaptation and change (Martin 2010). This focuses attention on the activities of institutional entrepreneurs, referring to “actors (organizations and/or individuals) who, first of all, have an interest to change particular institutional arrangements and who, second, mobilize resources, competences, and power to create new institutions or to transform existing ones” (Sotarauta and Pulkkinen 2011, 98).

Global Production Networks and Strategic Coupling

In response to the neglect of extraregional linkages in path creation research, recent contributions highlight how such linkages supply complementary assets, such as knowledge, technology, and investment, that are not available locally (Binz, Truffer, and Coenen 2016; Trippl, Grillitsch, and Isaksen 2017). They take a variety of different forms, including foreign direct investment (FDI), labor mobility, knowledge flows, joint research and development (R&D) projects, and exogenous policy influences (Dawley et al. 2015; Binz, Truffer, and Coenen 2016; Trippl, Grillitsch, and Isaksen 2017). Here, we concentrate on FDI and GPNs, reflecting the relative neglect of this type of extraregional linkage in the EEG literature. In addition, the GPN concept of strategic coupling informs the theoretical framework developed in the next section of the article.

The GPN approach is concerned with the changing organizational dynamics of globalization and their implications for regional development (see Coe and Yeung 2015; Table 1). It incorporates a strong GPE orientation, emphasizing, in its latest GPN 2.0 iteration, the relationships between the competitive dynamics of capitalism, firm-specific strategies, and regional development outcomes (Coe and Yeung 2015). While GPN research has not been explicitly concerned with the emergence of new industries and networks, recent contributions have introduced a stronger evolutionary dimension (see MacKinnon 2012; Coe and Yeung 2015). At the same time, recent EEG research indicates that links to GPN actors, such as transnational corporations (TNCs), often play an important role in fostering regional path creation, particularly in the context of *latecomer* countries and regions that lack the indigenous assets to compete with more advanced regions (Zhu, He, and Zhou 2017).

From a GPN perspective, strategic coupling processes between regional assets and GPN actors foster path creation (Table 1), resonating with the traditional regional development concern with FDI and *transplantation*. Strategic coupling involves regional actors and institutions harnessing and molding regional assets to ensure that they fit the needs of lead firms in GPNs (Coe and Yeung 2015). This process results in the creation of value through the economic returns generated by the production of commodities for sale, raising the question of value capture in terms of which actors and places in the network are able to appropriate and retain value. Value capture is closely bound up with relations of ownership and control (Coe and Yeung 2015; Werner 2018). To foster regional path creation, the process of strategic coupling must encompass multiple instances of coupling between individual GPN actors and regional assets.

Strategic coupling is best viewed as an evolutionary process, focusing attention on future rounds of *decoupling* and *recoupling* (MacKinnon 2012). Decoupling involves disinvestment, the exit of foreign firms, and the loss of foreign markets, while recoupling, by contrast, is based on the attraction of repeat investment. The further reproduction over time of a regional path based on investment from GPN actors will require multiple recouplings through further rounds of investment (see MacKinnon 2012). Moreover, the adoption of a GPE perspective emphasizes the need to position such

Table 1

Enriching Path Creation Research: A Summary of the Three Stands of Non-EEG Literature

	Sociological and Institutional Perspectives	Global Production Networks	Transitions Research
Disciplinary background	Management, economic sociology, innovation studies	Economic geography	Innovation and technology studies, evolutionary economics, management
Intellectual influences	Institutional theory, regional innovation systems, heterodox economics	Relational economic geography, international political economy, innovation studies	Evolutionary theory, institutional theory, science and technology studies, sociology
Orienting concepts	Mindful deviation, bricolage, institutional entrepreneurship	Value creation, enhancement, and capture; strategic coupling, decoupling, and recoupling	Technological niches, sociotechnical regimes, landscapes, legitimation, and anchoring
Objects of enquiry	Emergence of new technological paths, institutional environments, institutional change	Organizational and technological dynamics of globalization, GPNs, and regional economic development	Path-breaking forms of technological change, relations between emerging niches and incumbent regimes, legitimation of niches
Key insights for path creation	Distributed agency, ability of knowledgeable actors to break with existing pathways and technological paradigms, path creation requires institutional change	Regional development depends on the strategic coupling of regional assets to global production networks, regional development based on value capture from GPNs, strategic coupling as an evolutionary process	New technologies emerge in protected niches; tensions with regimes and incumbent interests; importance of legitimation processes, particularly through the articulation of narratives

Source: Authors.

recoupling and path renewal within a broader landscape of uneven development, meaning that it may be paralleled by the destruction of established paths in other regions as processes of intercorporate competition create *winner*s and *loser*s (Werner 2018).

Transitions Research

Work on sustainability transitions is primarily concerned with the sociotechnical dimensions of disruptive processes of technological change and innovation, focusing on the emergence of new technologies that struggle against incumbent actors and regimes (Raven et al. 2016; Boschma et al. 2017; Table 1). Here, transition studies serves to emphasize the radical novelty of path-breaking forms of change in contrast to the preoccupation with continuity and path dependence in the EEG literature (Martin 2010; Zhu, He, and Zhou 2017). Geographers have made some important recent contributions to transition studies, adding a missing spatial dimension in terms of the crucial role played by key *transition spaces*, the operation of multiscale processes, and the spatial politics of transition (Truffer and Coenen 2012; Murphy 2015). Here, our concern is not with the contribution of geography to transition studies, but the reverse, in terms of what transition studies can offer to geography, focusing specifically on regional path creation. Accordingly, our principal interest is in the social and political processes through which actors seek to empower and legitimate emerging industries and technologies (Geels and Verhees 2011; Smith and Raven 2012), focusing attention on the multilevel perspective's (MLP) key concepts of technological niches and socio-technical regimes (Geels 2004).

Niches are defined as protected spaces for the emergence of radical novelty in the form of innovative ideas and technologies. Transitions research focuses on technological niches such as R&D laboratories, demonstration projects, and subsidized market niches. Niches are distinct from sociotechnical regimes, which are complexes of established institutions, knowledge, practices, and infrastructures (Boschma et al. 2017). Regimes are situated within a wider sociotechnical landscape or selection environment. The initial protection of niches is seen as essential, since otherwise potentially path-breaking and path-forging niche innovations will fail to compete within selection environments dominated by prevailing sociotechnical regimes and incumbent interests (Smith and Raven 2012; Boschma et al. 2017). While niches should not be equated with the local or regional scale of organization and “often consist of globally inter-connected activities” (Boschma et al. 2017, 36), they may also be rooted in key regional transition spaces (Truffer and Coenen 2012).

The relations between niches and regimes can be understood in terms of the overlapping processes of legitimation and anchoring. As the transitions literature stresses, the process of legitimation is a necessary one for innovations to overcome their *liability of newness*, which leads to them being perceived as “strange, weird or unfamiliar” (Geels and Verhees 2011, 911). It has cognitive, normative, and regulatory aspects, referring to knowledge and understanding, conformity with societal values, and compliance with rules, respectively (Markard, Wirth, and Truffer 2016). One key aspect of legitimation is through the development of narratives by what Raven et al. (2016) term *technology advocates*, referring to the key actors that promote emerging technologies such as entrepreneurs, technology developers, lobby groups, policy makers, politicians, and potential users. These actors deploy narratives to empower niche innovations by imbuing them with meaning and garnering wider legitimacy and support while also seeking to counter the *antinarratives* of opponents (Smith and Raven 2012; Smith et al. 2014). Second, anchoring refers to the processes by which a novelty—for example, a

new technology, concept, or practice—becomes aligned with a regime (Elzen, Van Mierlo, and Leeuwis 2012). Anchoring can be seen as an outcome of legitimation, representing a key step toward the absorption of an innovation within the regime, which may enable it to foster transition (Murphy 2015).

Summary

This section has engaged critically with related literatures in order to enhance EEG research on path creation. First, sociological perspectives provide a broader sense of agency beyond the firm, particularly through the concepts of mindful deviation and institutional entrepreneurship. Second, the GPN approach emphasizes processes of strategic coupling between regional assets and extraregional actors within a framework of interregional competition. Third, research on niches and sociotechnical regimes highlights path-breaking forms of innovation and path creation that have been underplayed in EEG and focuses attention on the legitimation and anchoring of emerging paths.

8 Developing a Systematic Theoretical Framework

This section elaborates a systematic theoretical framework designed to bring key dimensions of path creation research together (Martin and Sunley 2015). From a GPE perspective, path creation must be related to the wider dynamics of capital accumulation, involving processes of production, circulation, consumption, and regulation that coevolve through time and across space (Harvey 1982). More specifically, the broader processes that underpin regional path creation include technological innovation; the attraction of investment from financial institutions and venture capitalists; the recruitment, control, and social reproduction of labor; market construction; the operation of infrastructure networks; and the state regulation of economies (Harvey 1982; Hudson 2005; Sheppard 2011). While value is rooted in regional and extraregional assets, such assets must be harnessed and valorized by economic actors working in the context of these broader processes. Established patterns of uneven development mean that opportunities for path creation vary between regions, reflecting their positions within wider spatial divisions of labor (Massey 1995). Accordingly, regions have different endowments of resources, such as skills, investment capital, research facilities, and supporting institutions, which are, in part, inherited from previous rounds of development (Grillitsch and Sotarauta 2018). While GPE provides an integrated understanding of the broader processes and relations that shape path creation, the following discussion of the individual dimensions in our framework is closely informed by the four strands of literature reviewed in the previous section.

As indicated earlier, the integrative framework developed below is based on the intersection of five key elements: regional and extraregional assets; economic, social, and institutional actors; mechanisms of path creation; market construction; and institutional environments (Figure 1). Path creation depends on the articulation of these five elements in a region at a particular point in time, stimulating a distinct trajectory of growth. The boundaries of regions are viewed as open and porous in our framework. While each of the individual elements has regional and extraregional components, assets and actors are the most regionally embedded. By contrast, mechanisms, markets, and institutional environments are largely extraregional in operation, reflecting the positionality of regions within broader spatial divisions of labor (Massey 1995).

The elements of the framework interact in three main ways to foster regional path creation. First, operating in the context of particular institutional environments, key actors seek to identify, harness, and valorize regional and extraregional assets. Second, path

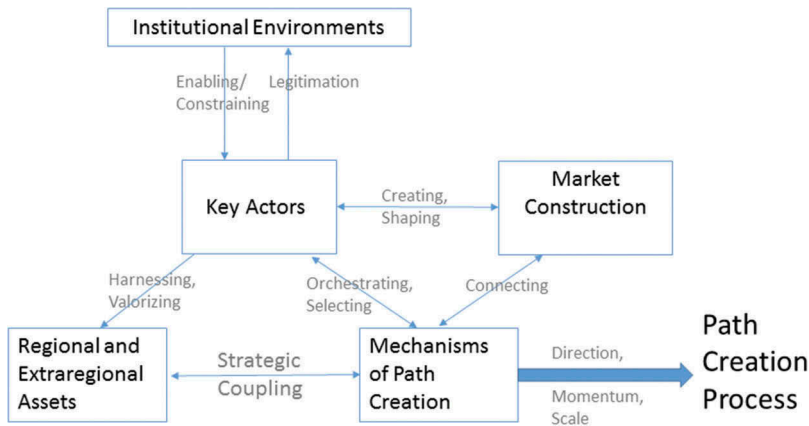


Figure 1. Integrative framework.
Source: Author.

creation depends on such actors matching or strategically coupling these assets to generative mechanisms of path creation such as diversification, indigenous path creation, and transplantation, and associated markets. Third, it is this process of matching or strategic coupling between regional and extraregional assets and mechanisms that provides the critical mass and forward momentum to propel the growth of a path, crucially reinforced by the operation of agglomeration economies (Martin and Sunley 2006).

The above formulation is underpinned by the concept of strategic coupling, adapted from the GPN approach (Coe and Yeung 2015). While GPN research views strategic coupling as occurring solely between such assets and GPN actors, here this relationship is redefined to refer to the dynamic processes by which regional actors seek to harness and match regional and extraregional assets to multiple mechanisms of path creation, principally, diversification, transplantation, and indigenous creation. This broadens the concept of strategic coupling beyond GPNs and transplantation, based on the understanding that path creation depends on the matching of regional assets to a number of mechanisms that connect different actors, including local small and medium enterprises (SMEs) and institutions that may not be active within GPNs, to broader processes of uneven economic development.

The positioning of regions within wider political and economic relations highlights what might be termed the *dark side* of path creation (Phelps, Aienza, and Arias 2018; Werner 2018). There are three principal dimensions of this. First, new paths may generate new forms of inequality and exploitation through, for instance, the growth of low-value and precarious employment, uneven resource allocation, and the exclusion and displacement of some groups (Coe and Hess 2011; Kelly 2013). The second dimension concerns the relationships between different regional paths, invoking the notion of path interdependence, referring to “situations where the path-dependent trajectories of particular local industries are to some degree mutually reinforcing” (Martin and Sunley 2006, 413). Of particular interest here are the relationships between successive regional industrial paths. In some cases, these are positive with existing assets and capabilities providing a basis for diversification into related technologies (Simmie et al. 2008). In other cases, however, negative forms of path interdependence may be apparent whereby the creation of new paths cannot fully compensate for the destruction of established ones, resulting in unemployment and poverty for *left behind* people and places (Rodríguez-

Pose 2018). Third, the extraregional dynamics of path interdependence also need to be taken into account, particularly in terms of how competition between regions may support or undermine path creation opportunities in a particular region (cf. Massey 1995). These may operate through the constraining effects of established concentrations of economic activity in advanced regions on path creation in less favored regions, or, more positively, by a kind of spread effect through the dispersal of certain functions from advanced regions to emerging ones (Zhu, He, and Zhou 2017).

Regional and Extraregional Assets

10 Based on Maskell and Malmberg (1999), the following types of regional assets are identified: natural assets (covering resources); infrastructural and material assets; industrial assets (covering technology and firm competencies); human assets in the shape of labor skills, costs, and knowledge; and institutional endowments of rules, routines, and norms. Such assets should be seen as products of the broader regional environment, which are utilized by firms and nonfirm actors for specific purposes. They tend to reflect previous forms of regional economic development, representing an important element of the *preformation* phase of path creation (Martin 2010). As Maskell and Malmberg (1999) argue, however, regional assets are not merely a passive reflection of the past. Instead, they are actively “modified or reconstructed by the deliberate and purposeful action of individuals and groups within or outside the area” (Maskell and Malmberg 1999, 10).

While regional assets are often seen as primarily endogenous, path creation may involve the forging of linkages to exogenous assets and resources through wider extraregional networks, particularly in its early stages (Binz, Truffer, and Coenen 2016). Industrial and human assets, such as technology, knowledge, and skills, may actually be imported from outside a region by regional actors and gradually transformed into endogenous resources through ongoing processes of knowledge absorption (Binz, Truffer, and Coenen 2016). Linkages to extraregional assets can often play a particularly important role for peripheral and latecomer regions, potentially enabling them to jump ahead by creating more technologically advanced growth paths (Zhu, He, and Zhou 2017).

Actors

An important analytical distinction is drawn between agency as the underlying capacity to act or intervene and the actors who exercise this agency in specific temporal and spatial contexts, although these dimensions are empirically intertwined (Emirbayer and Mische 1998). From a sociological perspective, agency is conceptualized as “a temporally embedded process of social engagement, informed by the past (in its habitual aspect), but also orientated towards the future (as a capacity to imagine alternative possibilities) and toward the present (as a capacity to contextualise past habits and future projects within the contingencies of the moment)” (Emirbayer and Mische 1998, 963). These three constitutive elements of agency are termed *iteration*, *projectivity*, and *practical evaluation*, corresponding to its different temporal orientations. As such, path creation implicates all three moments of time as actors mobilize the past to generate new options and initiatives for the future, based on the evaluation of alternative possibilities and involving discussion and dialogue with others (Garud, Kumaraswamy, and Karnøe 2010). In addition to this constitutive temporality (Steen 2016), the conception of agency developed here is simultaneously spatial, emphasizing how actors are both positioned within the wider geographies of capitalism and embedded in specific regional contexts (Coe and Jordhus-Lier 2011).

Grillitsch and Sotarauta (2018) identify three main forms of agency that shape regional growth paths. First is innovative entrepreneurship, which has attracted most attention in the EEG literature. This focuses on firm and entrepreneurs and corresponds most closely to the classic Schumpeterian conception (Boschma 2017). Such entrepreneurship encourages *mindful deviation* from existing paths and the creation of new ones (Garud and Karnøe 2001), based on the identification of future opportunities and the presence of individuals that seek to exploit these opportunities, requiring new forms of market and technological knowledge (Grillitsch and Sotarauta 2018).

Second, institutional entrepreneurship involves challenges to existing rules and norms, and attempts to institutionalize alternative rules and practices (Grillitsch and Sotarauta 2018). In general, the process of institutional change is best understood as one of gradual transformation rather than abrupt dislocation, as institutional entrepreneurs adapt and recombine existing institutional arrangements and mold them into new configurations in support of particular path creation agendas (Strambach 2010; Sotarauta and Pulkkinen 2011). This raises questions of power and interest in terms of the ability of such institutional entrepreneurs to mobilize tangible and intangible resources to reinforce the path, construct rationales for its promotion, modify or create institutions, and overcome opposition from incumbent interests (Sotarauta and Pulkkinen 2011). Operating within broader institutional environments, innovative and institutional entrepreneurs play a critical role in harnessing and valorizing regional assets within our framework (Figure 1).

Third, place leadership requires what can be termed *path advocates*—based on the notion of technology advocates (Raven et al. 2016)—to build leadership capacity by influencing other actors across organizational divides (Grillitsch and Sotarauta 2018). This is a form of *place-renewing leadership*, defined as “public-private strategic leadership that empowers institutional or social forms of decision-making to absorb and adjust (pro-actively and reactively) to path-breaking economic change” (Bailey et al. 2010, 462). Such leadership involves the development of collective visions or expectations to attract and enroll other interests and actors. This echoes transitions research on the legitimation and empowerment of paths, particularly in terms of the capacity of path advocates to anchor the path by linking it to the broader conventions, rules, and networks that structure the existing sociotechnical regime or to broader discourse coalitions and political formations that are seeking to reform the established regime (Geels and Verhees 2011; Smith and Raven 2012).

Mechanisms of Path Creation

The concern with mechanisms of path creation is a distinctive feature of the GPE framework advanced in this article, advancing beyond agency-based sociological understandings (Garud and Karnøe 2001; Simmie 2012). Research suggests that diversification, transplantation, and indigenous creation are the most prevalent of Martin and Sunley’s (2006) mechanisms (Simmie et al. 2008; Dawley 2014). In practice, such path creation mechanisms are likely to operate in an open and contingent manner. Rather than regarding them as ontologically *pure* and separate entities, they should be viewed in relational terms as fuzzy, partial, and overlapping. For instance, while the notion of indigenous path creation emphasizes processes of new firm formation, spin-off, and local knowledge generation, it may also rely on certain extraregional assets such as knowledge and financial investment (Binz, Truffer, and Coenen 2016).

From a GPE perspective, the language of mechanisms of path creation may seem overly abstract and potentially reductionist, invoking a naturalized conception of mechanisms operating in a disembodied fashion. In response, the approach adopted here is highly sensitive to agency and context, emphasizing how the operation of key mechanisms is shaped and mediated by innovative and institutional entrepreneurs who ultimately put the creation into path creation. Such actors do the work of coupling regional and extraregional assets to mechanisms of path creation, ensuring that the selection and regional orchestration of these mechanisms is a product of conscious agency (Figure 1). The coupling process reflects a recognition by key actors that regional assets are not in themselves a sufficient basis for regional development (see Coe and Yeung 2015) but must be matched to the needs of SMEs and indigenous start-ups as well as TNCs. It is structured by unequal power relations, with powerful actors often orchestrating and controlling the selection of particular path creation mechanisms and their coupling with identified assets (MacKinnon, 2012). This can lead to the marginalization or suppression of other regional interests, such as through cases of coupling to lower value forms of transplantation, which involve the exploitation of labor and the diversion of resources away from local entrepreneurship (see Kelly 2013).

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Mechanisms play a crucial role in the transition from the preformation phase to path creation proper and subsequent path development (see Martin 2010) by fostering self-reinforcing growth. This involves the generation of agglomeration effects through external economies and increasing returns (Martin and Sunley 2006). In this sense, mechanisms play a crucial role in generating and reproducing regional paths by connecting them to wider processes of uneven economic development. Once a path has gained momentum and critical mass, its further reproduction is dependent on periodic recoupling between regional assets and mechanisms. Alternatively, if key actors are unable to effect such recoupling, initial path creation may mutate into path decay and dissolution through forms of decoupling linked to wider processes of economic restructuring and technological change (MacKinnon 2012; Werner 2018).

Market Construction

Market construction represents the fourth key element of our framework, involving a related set of connections between regional assets and wider economic processes. Its status as a key constituent element of our framework reflects the market imperative (Coe and Yeung 2015) of regional path creation; in a capitalist economy, path creation is dependent on the generation and circulation of value through the sale of commodities in markets (Harvey 1982). While the path creation mechanisms discussed above play a key role in creating and reproducing a regional path by generating economic momentum and direction, their operation is underpinned by this additional set of connections to markets (Figure 1).

The construction of markets is the focus of the recent marketization literature in economic geography (Berndt and Boeckler 2012). From this perspective, informed by actor-network theory, markets are performative in the sense that they are actively constructed by economic actors, rules, calculating devices, and forms of scientific knowledge (Berndt and Boeckler 2012). Here, we follow Christophers (2014) in adopting a weaker version of marketization, which he argues is not only compatible with a GPE approach but actually needs to be integrated with theories of accumulation to provide a fuller and more dynamic understanding of markets. This weaker version of marketization contends that markets are (re)constructed out of existing relations rather than created afresh, emphasizing that this process is shaped by unequal power relations and struggles between actors (Christophers 2014). The approach taken here is

principally concerned with how “economic agents create and shape . . . market structures” through their “actor-specific practices” (Coe and Yeung 2015, 96).

From a regional path creation perspective, our interest is in the creation of markets for regionally based firms rather than the construction of markets per se. Typically, the generation of scale effects and the achievement of critical mass to support a regional path requires expansion into national and international markets. From a regional perspective, market construction also entails place marketing to promote regions in national and international markets (Harvey 1989). The process of market creation tends to be particularly visible for new technologies and products, with states often playing an important role in creating niche markets through a range of price supports, regulations, and procurement policies (Essletzbichler 2012). Contrary to the MLP conception of innovation originating in niches outside established regimes, this suggests that regime actors can actually play a crucial role in the creation of protective spaces for potentially path-creating innovations (Smith and Raven 2012).

Institutional Environments

The fifth element in the theoretical framework concerns the role of institutional environments, referring to the sets of rules and norms that inform the behavior and strategies of actors (Gertler 2010). Institutional environments can be distinguished from institutional arrangements, which refer to specific organizational forms (Martin 2000). In our framework, actors are embedded within multiscale institutional environments that enable and constrain their actions and strategies (Martin 2010; Figure 1). In this context, states play a central role as differentiated ensembles of institutions, meaning that particular policies and initiatives may be subject to political contestation between different branches of the state (Jessop 2007). At the same time, regional growth strategies and initiatives often face pressures to comply with broader industry standards and investment rules (Christopherson 2002). This conception of institutional environments has some affinities with the MLP concept of sociotechnical regimes (Geels 2004). Our preference for the term *institutional environments*, however, reflects a conventional economic geography understanding of institutions as inherently multiscale, reflecting the interplay of local, regional, and national rules and norms (Gertler 2010), and addressing concerns about the rather aspatial conception of regimes within the MLP approach (Coenen, Benneworth, and Truffer 2012).

Nonetheless, our understanding of institutional environments is informed by the notions of legitimation and anchoring that link niche and regime actors (Smith and Raven 2012; Murphy 2015). Here, the legitimation of an emerging path requires a critical mass of actors who can form *packs* of entrepreneurs, working through industry associations and other collective agencies (Bergek, Jacobsson, and Sandén 2008). Such path advocates engage in various forms of institutional entrepreneurship to legitimate and empower the emergent regional path by developing supportive linkages with the broader institutional environment (Smith and Raven 2012). This can generate conflict, particularly in transitions contexts where incumbent regime actors may resist change (Bork et al. 2015). As such, legitimation generally involves the development of broader sociopolitical narratives or frames, based on the assertion of positive future effects and benefits, claims to its competitiveness within existing institutional environments, or arguments for institutional reform to support it (Smith and Raven 2012). Framing struggles may erupt between the emerging narratives of path advocates and the often dominant *antinarratives* of established economic and political elites (Geels and Verhees 2011; Bork et al. 2015).

Legitimation also operates through path advocates' visible activities such as competitions, technology assessments, product testing, and lobbying (Bork et al. 2015). From an MLP perspective, such activities take place in the overlapping area between niches and regimes, or emerging regional paths and institutional environments in this article's terminology. They operate through hybrid forums such as pilot projects, research programs, and meetings between participating organizations (Elzen, Van Mierlo, and Leeuwis 2012). In addition, while laws and regulations to support or restrict innovations can only be introduced by state actors with regulatory authority, path advocates attempt to influence this through lobbying (Elzen, Van Mierlo, and Leeuwis 2012). These lobbying activities are often focused on the introduction of policies to create market niches to shield the emerging path from competition from incumbent technologies (Bergek, Jacobsson, and Sandén 2008). As a result, innovations can be aligned with established rules, actors, and practices, serving to anchor regional paths with key technological, network, and organizational aspects of the institutional environment (Murphy 2015).

14 Creating New Paths: An Illustrative Grounding of the Framework

This section provides a brief exemplification of the above framework through the identification of four theoretical propositions that are applied to two case studies drawn from the literature. These relate to the nature of path creation in different types of regions, based on a simplified distinction between large metropolitan regions (LMRs) and specialized industrial regions (SIRs) (see Iammarino, Rodríguez-Pose, and Storper 2018). First, in terms of the forms of the agency involved, emerging paths will tend to be more business led in LMRs, with state institutions playing a greater role in SIRs (Dawley 2014; Isaksen 2015). While all three forms of agency identified by Grillitsch and Sotarauta (2018) may operate in each type of region, innovative entrepreneurship will be more prominent in metropolitan regions. Second, there will be a greater emphasis on indigenous creation and branching in LMRs, and, conversely, an orientation toward transplantation and unrelated diversification in SIRs (Isaksen 2015). Third, legitimation will be easier to achieve for incipient paths in LMRs than those in SIRs since paths in the former type of region will demonstrate a closer fit with institutional environments, based on existing social networks and institutions. Fourth, path interdependence will often assume more negative forms in SIRs defined by the decline of previously dominant manufacturing paths, relative to the positive dynamics of branching in LMRs (Simmie et al. 2008).

The two case studies of Berlin and Pittsburgh provide a preliminary exploration of the four propositions outlined earlier, acting as exemplars of LMRs and SIRs, respectively (Table 2). These city-regions are designed to illustrate the key dimensions and relations of our theoretical framework, particularly through the interaction between their unique assets, actors, and institutions, and broader mechanisms of path creation. They have been selected to reflect the wider context for path creation in North America and Western Europe in terms of the underlying shift from manufacturing to services over recent decades (Bryson 2016). Each region experienced deindustrialization as a major structural break in the 1980s and 1990s. This reflected the collapse of the steel industry in Pittsburgh, leading to the loss of 44 percent of the city's manufacturing jobs between 1979 and 1988 (Giarratani and Houston 1989). Following the overthrow of the socialist system and the rapid shift to a capitalist economy from 1990, Berlin lost 200,000 industrial jobs between 1990 and 1996 (Krätke 1999). These structural shifts

Table 2

Comparative Dimensions of Path Creation in Berlin and Pittsburgh

	Berlin	Pittsburgh
Main regional and extraregional assets	<p><i>Infrastructural assets:</i> profusion of cultural facilities; cheap premises</p> <p><i>Human assets:</i> diverse workforce and youthful in-migration</p> <p><i>Institutional assets:</i> voids in planning and regulation; low cost of living</p>	<p><i>Human assets:</i> major research universities</p> <p><i>Industrial assets:</i> corporate headquarters</p> <p><i>Institutional assets:</i> philanthropic foundations</p> <p><i>Infrastructural assets:</i> redundant manufacturing sites and facilities</p>
Key actors	<p><i>Innovative entrepreneurship:</i> culturepreneurs</p> <p><i>Institutional entrepreneurship:</i> the local state and political leaders as path advocates</p>	<p><i>Institutional and innovative entrepreneurship:</i> local state and local businessleaders exercising <i>place leadership</i></p>
Mechanisms of path creation	<p><i>Indigenous path creation</i></p> <p><i>Transplantation</i></p>	<p><i>Related diversification</i></p> <p><i>Indigenous path creation</i></p> <p><i>Transplantation</i></p>
Market formation	<p>New international place marketing institutions and strategies created to promote the <i>creative city</i></p>	<p><i>Eds and meds serving/creating national, regional, and international technological markets</i></p> <p>Active place marketing</p>
Institutional environment	<p>National context: reunification and coordinated market economy</p> <p>Powers and autonomy: capital city status and autonomous city state</p> <p><i>Legitimation of path:</i> framing strategies of <i>alternative Berlin</i>, place marketing, democratic city politics</p>	<p>National context: liberal market economy, federal retrenchment</p> <p>Powers and autonomy: decentralisation</p> <p><i>Legitimation of path:</i> public-private partnership adopting postindustrial strategy</p>

Source: Authors' research.

created new political and economic conditions for path creation, particularly in the Berlin case (Grabher and Stark 1997).

Despite such challenging structural conditions, each region has created a new postindustrial path since the early 1990s. Berlin has become a leading international exemplar of a creative city, based on the rapid and sustained growth of a creative and cultural industries path comprised of media, creative arts and entertainment, information and communication technologies (ICTs), education and research, and tourism (Berlin Senate 2017). Pittsburgh has gained international renown as a postindustrial *turnaround* city, reflecting its development of a high-technology path based on advanced manufacturing, health care and life sciences, energy, financial, and business services and ICTs (Jacobs 2000; *The Economist* 2009). At the same time, the cases also point to the *dark side* of path creation (Phelps, Atienza, and Arias 2018) as reflected in social inequality, unemployment and insecure employment, and social and racial tensions (Kunzman 2011; Rhodes-Conway et al. 2016).

16 Cultural and media-related activities grew rapidly in Berlin in the 1990s, reflecting a rich combination of assets (Table 2). While this abundance of assets is broadly characteristic of large metropolitan regions, it also reflects the unique political and institutional environment of Berlin. In particular, one of the legacies of division is a profusion of cultural assets, which was driven by the geopolitical rivalry and showcasing between the former eastern and western sections. In addition, the postreunification restructuring of Berlin's infrastructure and property market created an array of infrastructural assets in the form of cheap, often temporary, premises for creative workers (Novy and Colomb 2013). These low-cost sites and premises acted as niches for the growth of creative activities, offering a degree of protection from market forces and formal property regulations (Colomb 2012b). Moreover, Berlin's relatively low cost of living and alternative cultural scene encouraged high levels of youthful in-migration, strengthening its human assets by enlarging an already diverse labor pool. The initial phases of indigenous path creation thrived in the regulatory voids of the postreunification institutional environment, fostering alternative and experimental spaces (Colomb 2012b).

The presence of major research universities, corporate headquarters and philanthropic foundations provided an important set of human, industrial, and institutional assets for Pittsburgh (Table 2; Neumann 2016). These represented richer indigenous assets than found in many SIRs, reflecting an important element of path interdependence between successive paths. In common with many SIRs, industrial closure meant that there was an abundance of redundant manufacturing sites and facilities available for redevelopment.

Turning to questions of agency, the early phases of path creation in Berlin were largely driven by a group of *culturepreneurs* who developed a critical mass of start-ups in the creative industries (Lange et al. 2008). Subsequently, the Berlin state (*Land*) acted as a key institutional entrepreneur and path advocate by branding Berlin as a creative city through the *Be Berlin* campaign (Colomb 2012a). The Berlin Senate's first Creative Economy Report in 2005 represented a key moment in the legitimation of the path, serving to emphasize the scale and significance of its economic contribution. The creative branding approach was immortalized when the Mayor, Klaus Wowereit, described the city as *poor but sexy*, serving to "enhance Berlin's image as a hip, tolerant, cultural city" (*Der Spiegel* in Lange et al. 2008 536).

Path creation in Pittsburgh has been based on the growth of high-tech industries linked to the city-region's universities and hospitals (*eds and meds*) (Jacobs 2000; *The Economist* 2009). The key actors in this process have been institutional entrepreneurs from the local state, particularly the mayor and city council, and local business leaders

(innovative entrepreneurs). They exercised place leadership through a vision of high-tech growth and postindustrial renaissance that largely ignored the region's declining industrial path and made little attempt to stem the tide of steel closures, triggering opposition from labor interests and religious leaders (Neumann 2016). The cases provide support for our first proposition outlined above with innovative entrepreneurs acting as key instigators of path creation in Berlin, while institutional entrepreneurs played a leading role in Pittsburgh, although the differences are in part ones of emphasis and timing as the two groups ultimately worked together in each case.

There is considerable overlap between the mechanisms of path creation in each case. An underlying dynamic of indigenous path creation in Berlin was channelled through start-ups, freelancing, labor mobility, and social networking (Lange and Schüssler 2018). The path creation process has subsequently been catalyzed by the transplantation of skilled migrants along with a growing level of investment from TNCs such as Google, Microsoft, and General Electric. Pittsburgh's focus on *eds and meds* represented a form of related regional diversification based on recognized institutional and industrial assets, principally the University of Pittsburgh and Carnegie Mellon University, which developed strengths in computer science and robotics and biotechnology, respectively (Detrick 1999). Here, university research facilities and laboratories acted as niches that helped to incubate high-tech businesses (Greenblatt 2014). Such diversification was combined with elements of indigenous creation through support for entrepreneurship and transplantation involving the attraction of new businesses and middle-class residents (Neumann 2016). In general, the cases provide only limited support for our second proposition: indigenous creation provided the key dynamic in the metropolitan capital region of Berlin as expected, but it played a more prominent role in Pittsburgh, alongside related diversification, than would be envisaged in an SIR context, reflecting the region's rich industrial history.

With reference to market construction, the operation of the mechanisms of indigenous path creation and transplantation in Berlin is linked to the increased visibility and prominence of the city in international markets (Table 2), including the attraction of international venture capital in recent years (Berlin Senate 2017). This reflects not only Berlin's place marketing activities but also the appeal of its alternative traditions and practices (Colomb 2012a). Thus, as indicated earlier, while firm formation and clustering may seem to be largely indigenous processes, they are often linked to national and international markets. In the case of Pittsburgh, the new high-tech path is oriented to regional, national, and international markets. In addition, efforts to attract new residents and firms have been channelled through a succession of place marketing initiatives emphasizing Pittsburgh's *liveability* and positive business climate (Neumann 2016).

The institutional environment of Berlin is shaped by its role as the capital of a reunified Germany, commonly identified as the archetype of a coordinated market economy (Hall and Soskice 2001; Table 2). Its status as an autonomous city state within a decentralized federal republic has given Berlin a range of powers and resources to promote path creation. The local state played an important role in reinforcing and legitimating the creative economy path, which offered a low-cost strategy for a highly indebted city that lacked resources for capital investment (Colomb 2012a). Furthermore, Berlin's open and democratic politics has allowed interest groups to preserve the alternative character of creative spaces, particularly through the use of referenda to block a series of state-led regeneration projects (e.g., MediaSpree and Templehof). In Pittsburgh, key institutional and innovative entrepreneurs sought to legitimate their postindustrial strategy within an

institutional environment structured by federal retrenchment, decentralization, and an emphasis on public–private partnership and business leadership (Neumann 2016). The development of Strategy 21 in 1985 represented a key moment in the legitimation process, based on the coordination of the efforts of the city, county, and universities to access dwindling state and federal resources to regenerate the regional economy (Neumann 2016).

18 In relation to our third proposition, the alternative ethos of Berlin’s creative economy was actually predicated on an underlying distance from established institutions and elites, but path advocates were able to mobilize an emerging set of alternative cultural norms and practices to anchor the path within the broader institutional environment (see Colomb 2012a). Yet Berlin’s creative path has a dark side, incorporating a significant volume of precarious employment and generating framing struggles between the creative economy narrative, as it has been adopted by local state actors, and protest movements against rising housing costs and gentrification (Colomb 2012b; Novy and Colomb 2013). By contrast, Pittsburgh’s high-tech postindustrial path has been instigated by traditional economic and political elites, becoming anchored with the extralocal institutional environment as a leading international exemplar of a turnaround city (*The Economist* 2009). At the same time, however, elements of a local framing struggle are apparent through tensions between the postindustrial narrative and recurring criticisms by trade unions and local campaigners and researchers of a dark side of entrenched social and racial disparities (Rhodes-Conway et al. 2016).

The cases largely support proposition four as new path creation has been unable to fully overcome the legacies of deindustrialization and path destruction in Pittsburgh (Neumann 2016). The partial nature of such path succession is common to many SIRs (Hudson 1994), compounded in this case by the severity of deindustrialization and limited welfare provision. While Berlin also experienced acute deindustrialization, it was more limited in duration, and its effects have subsequently been eclipsed by the growth of the creative path (Krätke 1999; Colomb 2012a). Reflecting the dynamism of this new path, the city’s growth rate exceeded the national average in 2014 for the first time since 1989 (Berlin Senate 2017).

Conclusions

This article was stimulated by the need to subject the rather undertheorized concept of path creation to the same level of theoretical scrutiny as path dependence has received in the EEG literature (Martin and Sunley 2006; Martin 2010). While hybrid theories of path creation provide “an empirically grounded basis for understanding new technological path creation” (Simmie 2012, 764), the article provides a more abstract GPE perspective that positions the efforts of actors to initiate and reproduce regional paths within a wider landscape of uneven development, interregional competition, and state regulation (Massey 1995). This GPE framework emphasizes five key dimensions of regional path creation and the constitutive relationships between them (Figure 1). As such, it provides an integrated account of the multiple actors, institutions, and mechanisms that shape regional path creation, avoiding a one-dimensional approach that would unduly privilege any single element (see Jessop, Brenner, and Jones 2008). The article’s understanding of these relationships is closely informed by the concept of strategic coupling, adopted from GPN research. This supports the argument that key actors, operating within institutional environments, create paths through the coupling of regional and

extraregional assets to mechanisms of path creation and associated markets. While the focus on actors, assets, and institutions reflects recent EEG research on path creation, the concern with mechanisms and markets is central to the distinctive contribution of this article, informed by GPE and the notion of de-locking mechanisms (Martin and Sunley 2006). The article has also sought to contribute to the advancement of GPE thinking in EEG (MacKinnon et al. 2009; Pike et al. 2016), adopting an open and pluralistic approach informed by sociological work and transition studies as well as GPN research. This has provided a stronger sense of agency, institutions, and the discursive and political processes through which paths are legitimated.

The theoretical framework outlined above is designed to focus attention on key unresolved questions concerning the role of different actors and institutions (Boschma 2017). In particular, it seeks to progress the qualitative research agenda on path creation to match the advances made by quantitative work on regional diversification. The four propositions identified above provide specific directions for further research. First, while agency is the subject of increased conceptual discussion, empirical assessments of how it actually fosters path creation remain rather scant, particularly in relation to institutional entrepreneurship and place leadership (Grillitsch and Sotarauta 2018). Second, future research should look beyond diversification to consider other causal mechanisms, particularly transplantation and indigenous path creation. Given that prevailing conceptions of path creation reflect a notion of innovative entrepreneurship drawn largely from the experience of metropolitan and advanced technology regions, there is a need for more research on industrial and peripheral regions to broaden our understanding. Third, a focus on the processes by which path advocates seek to legitimate and empower emerging paths promises to unlock the key social, political, and institutional dynamics of path creation. Finally, path interdependence represents another understudied dimension, not only in terms of the *horizontal* linkages between coexisting regional paths within a region (Martin and Sunley 2006) but also the *vertical* relations between successive paths. At least some of the research addressing these questions should be of an internationally comparative nature (MacKinnon et al. 2018), employing methods of incorporated comparison and deep contextualization to assess how similar processes and mechanisms of path creation operate across different national and regional contexts (see Pike et al. 2016).

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