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**New Perspectives on Innovative Entrepreneurship and Path
Dependence – A Regional Approach¹**

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New Perspectives on Innovative Entrepreneurship and Path Dependence – A Regional Approach

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Abstract This paper uses path dependence as an interpretive lens to examine the relationship between innovative entrepreneurship and regional development. A literature review of path dependence explains why that concept is relevant for this paper. The paper reaches four conclusions about the relationship. First, in the study of innovative entrepreneurship in a regional context, the technological, social and cognitive dimensions should be taken into consideration. Second, the effect of the different types of innovative entrepreneurship on path dependence depends on specific, regional situations. Third, the dominant regional network forms an institutional foundation that may either hinder or support innovative entrepreneurship. Fourth, innovative entrepreneurs who introduce new knowledge from outside the region are more likely to alter the regional path.

Key words: Entrepreneurship, Innovative Entrepreneurship, Regional Development, Path Dependence, Network-based Approach

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Introduction

Regional development researchers have long focused on the differences in economic development among regions. In general, the literature has two explanations for such development. The first explanation draws on impressive stories of innovative entrepreneurs whose activities change the course of the regional economic development. Such innovative entrepreneurs are often described as 'big men' who challenge uncertainty and conventional knowledge (Knight, 1921; Schienstock, 1975; Schon, 1963; Shane, 1994). Prominent examples in which entrepreneurs have provided the impetus for change are heavily industrialized regions that have become high-tech growth poles through radical, innovative activities (Hodson, 2008; Knapp, 1998; Lundquist and Winther, 2006).

The second explanation suggests that past activities influence present development (Berndt, 1998; Hudson, 2005; Trachte and Ross, 1985). According to the literature, because of negative constraints from the past, regional development occurs along established regional trajectories that ultimately result in lock-ins. Such regions are caught in destructive path dependence processes with limited possibilities for breaking free from these constraints. A characteristic of this type of regional development is the absence of innovative entrepreneurs.

The innovative entrepreneur explanation derives from an actor-based understanding of regional development in which the emphasis is on the actions of innovative entrepreneurs. They advance the development. The path dependence explanation takes a structural perspective. Here,

the emphasis is on how the existing structures (e.g., institutions) influence the entrepreneurs' actions. The regional structures advance the entrepreneurs' initiatives.

This paper argues that these two apparently opposing explanations are related and should be integrated as one approach that can provide a better understanding of regional development processes. The paper presents four conclusions on innovative entrepreneurship and regional development that support this argument.

The paper responds to recent calls to link entrepreneurial activities and localities 'in order to reach a better understanding of the everydayness of entrepreneurship' (Trettin and Welter, 2011, p.575). Researchers are critical of the fact that the socio-spatial context of entrepreneurship is still missing in most of the entrepreneurship debate (Malecki, 1997; Steyaert and Katz, 2004; Trettin and Welter, 2011). By integrating the two explanations, this paper contributes to the literature and research on entrepreneurship and regional development in three ways.

First, the paper takes a more actor-centred perspective on regional development than is typical in the regional development literature. Second, the discussion veers from the big man theory of entrepreneurship towards a network-oriented understanding of entrepreneurship. The claim is that innovations are seldom the achievement of one individual but rather of a group of individuals (Graf, 2011). In this respect, the paper follows Steyaert and Katz's (2004) recommendation to shift the perspective from the 'elistic entrepreneurs' to entrepreneurship as a collective, network-based activity (see also Schienstock, 2007). While the importance of global networks for knowledge access is undeniable, research has shown that most contacts are local, especially for innovative entrepreneurial activities where knowledge flows between talented individuals are important factors (Nijkamp, 2003; O'Donnell et al., 2001; Smith et al., 2005). Third, the paper addresses different types of innovative entrepreneurship. Bathelt and Glückler (2003) propose that entrepreneurship, as a collective activity that should be examined in a particular temporal and spatial context, is based in propositions about regional path dependence. In the literature, innovative entrepreneurs are, however, treated as a rather homogenous group. The paper claims there are different types of innovative entrepreneurs who are highly dependent on specific regional paths.

The theoretical framework of this paper rests on the assumption that even such disruptive activities as revolutions or innovations are never really 'discontinuous' because of the informal constraints in societies (North, 1990). Thus, entrepreneurs, individually or in groups, can create new regional paths although those paths, to some extent, depend on existing patterns and behaviours in the region.

Studies of innovation systems (IS) emphasize the systemic nature of innovation (Fagerberg, 2006). In this understanding, innovations are not developed in isolation but are rather the result of an interactive process. Therefore, innovations are subject to institutions, such as laws, rules, norms and routines (Edquist, 2006; Lundvall 1985; 1988; 1992; Nooteboom, 2000; Nelson, 1993). At the same time, the IS literature focuses on location-specific factors that highlight the importance of local conditions for the innovation process. For example, the IS literature stresses the importance of path dependence in economic geography studies (Cooke et al., 1998; Doloreux and Parto, 2005; Edquist 1997; Martin and Sunley, 2006; Niosi et al., 1993). Despite its popularity, several shortcomings of the IS approach have been criticised, such as its lack of a general definition of system boundaries and the absence of individual actors (Balzat and Hanusch, 2004; Carlsson, 2007; Doloreux and Parto, 2005). While this paper acknowledges the IS concept of innovation, the focus is the role of entrepreneurs and their interactions in the innovation process.

In this paper, entrepreneurship refers to the identification of new business opportunities, the development of new products or services, and the commercialization of those products or

services (Shane, 2003) through inter-corporate networks in the innovation process. The definition is not limited to the founding of new businesses.

The paper is structured as follows. The next section describes how the concept of path dependence is used in the regional development literature. This section proposes an enlargement of the concept in order to use it in the analysis of the relationship between innovative entrepreneurship and regional development. The entrepreneurial regional path is described in the following section. Then four conclusions are drawn about innovative entrepreneurship in a regional context. The final section discusses implications of the study.

Literature review of the path dependence concept

Researchers in many different disciplines have used the concept (see Martin and Sunley, 2006, for an in-depth analysis), but there is no clear and common definition of it in the literature. It is necessary, then, to examine the suitability of using the concept in this paper as an interpretive lens to examine the relationship between entrepreneurship and regional development.

Perhaps the most well known references to path dependence are found in the research by W. B. Arthur, P. A. David and D. C. North. In economics, Arthur (1989; 1994) and David (1985) have used path dependence to explain technological adaptation processes and industry evolution. In this literature, path-dependent processes are characterized by the quasi-irreversibility of investments, economies of scale, and technical interrelatedness or the need for system compatibility. Because of historical accidents, sub-optimal technologies dominate even if superior technology emerges because of these three characteristics (David, 1985). Due to increasing inflexibility, an industry tends to become more and more locked into one technology (Arthur, 1989).

These characteristics may also be discussed at the regional level. Due to limitations in absorptive capacities (Cohen and Levinthal, 1990), regional knowledge accumulation may lead to path-dependent specialization in a region. Among other factors, new technology can make such specializations obsolete. A region may face the challenge of being locked into a technological setting that is no longer useful. Therefore, this review of the literature also addresses path dependence and regional development.

Table 1 lists the eight most-cited articles that deal with path dependence in a regional context. These eight articles were selected from a list of articles with the following words in their title or listed as key words: path dependency, path dependence, regional, region, and economics. Those articles were read to see if they described path dependence. Often path dependence appears in an article title or as a key word without further analysis of the concept. Authors with multiple articles on the topic are only listed once because their descriptions of path dependence did not vary among their publications.

Insert Table 1 about here

Despite its popular use, there is no common definition of path dependence across different disciplines or even within disciplines. It is often not clear what the path is, why some historical events related to the path are more important than others, or to what extent these events can influence present decisions. Most researchers provide little additional conceptualization of path dependence in their publications. For their research questions, this approach may be adequate. However, without an agreed-on definition of the concept, it is challenging to accumulate knowledge about the concept. In this paper, path dependence must be clearly conceptualized in order to identify the regional path and to discuss its relationship to innovative entrepreneurship.

The eight articles in Table 1 almost exclusively address the technological dimension of path dependence. Within the regional development literature, most articles that discuss the concept deal with the technological development of a single technology or a single industry—either in a specific region or in several regions (Martin and Sunley, 2006). These articles are therefore technologically process-oriented rather than actor-oriented. They describe the evolutionary path of the technology, but the actors (e.g., innovative entrepreneurs) and their roles are often not discussed. Of these authors, only Hassink (2005) takes a more comprehensive approach. He addresses the institutional, although not the actor, context

The narrow, technological perspective on entrepreneurial activities in the framework of path dependence is too limiting. The study of entrepreneurs requires a much broader cultural perspective (Aldrich and Zimmer, 1986; Granovetter, 1985) that looks at the biases acquired from their experiences and prior knowledge (Shane, 2000) that a narrow, technological perspective cannot address. The comments on the articles listed in Table 1 show that path dependence is often held responsible for technological lock-ins that eventually cause stagnation and decline. This is a negative perception of path dependence that inhibits innovation. The path must be broken.

The many actors in a region may perceive path dependence differently. For example, in certain industries, path dependence is a pre-requisite for the accumulation of relevant knowledge and experience. Actors outside these industries, however, may perceive such a development along defined trajectories as rather restricted. The literature acknowledges that novelties have historical antecedents. In early research, Schumpeter (1934) suggested that entrepreneurs reconstitute existing resources to create new ones. But entrepreneurs are not passive observers who follow the flow of events. Instead, they are embedded in social structures that are jointly created (Granovetter, 1985), and they use prior knowledge to intentionally create new, although related, paths (Garud and Karnøe, 2001).

This idea reflects Colombelli and von Tunzelman's (2011) recent claim that innovation is a dynamic process characterized by persistence and path dependence. In fact, evidence suggests that prior related knowledge increases the likelihood of initiating successful economic activities in a related field (Boschma and Frenken, 2011; Boschma and Iammarino, 2009; Frenken et al., 2007). Existing industries can attract and anchor new, emerging industries in a region (De Propriis and Crevoisier, 2011). The implication from this line of thinking is that one should avoid prematurely labeling path dependence as either positive or negative. The evaluation depends upon the observers, the stakeholders and the specific situation. Until evidence to the contrary is presented, path dependence should be perceived neutrally.

The entrepreneurial regional path

The regional development literature rarely addresses actors. Linking entrepreneurship with regional development through the interpretive lens of path dependence is a way to include actors in the discussion. Entrepreneurs are economic actors who are an important source of job creation and economic growth (Audretsch and Keilbach, 2004; Birch, 1979). As agents of change, entrepreneurs' actions may disturb obsolete economic and institutional structures. In this respect, innovative entrepreneurs are especially important.

Although entrepreneurs have often been described as champions, this big man theory does not seem to correspond with recent discussions about innovation processes (Schienstock, 2007). Most innovations are now described as processes involving a large network of different actors (Freeman, 2001; Johannisson, 2003). Rost (2011) notes there are two views in the literature on how networks enhance innovation. Coleman (1988) suggests that actors in closed networks are more likely to share information, while Burt (1992) suggests that networks with structural holes provide access to non-redundant knowledge. Despite this ongoing debate about the nature of

networks, the value of networks as integral parts of entrepreneurial success is widely acknowledged (Elfring and Hulsink, 2003). If knowledge and experience from different fields are combined as one innovation, it is difficult for an entrepreneur, acting alone, to initiate a new development path.

What, then, is the nature of the regional path and how can entrepreneurs influence that path? In discussions on path dependence, the path is often described as a linear trajectory with certain alterations (Martin and Sunley, 2006). Because researchers can identify paths only in retrospect, they include only the events they think have altered the path. Figure 1(a) illustrates the linear relationship between events that occur in a certain sequence and a certain time horizon. There is a time delay between the entrepreneurial activity and the alteration in the regional path.

It can be difficult to identify a particular path-altering event. The process can obscure the activity, especially when *small* historical accidents alter the path. In addition, a combination of several activities may affect the path alteration. As Johannisson (2003) explains in his claim that entrepreneurship is a collective phenomenon, paths develop in broad contexts and not just from isolated events.

Insert Figure 1 about here

In this paper, a path is defined as a collection of events that concentrate along certain directions. See Figure 1(b) that illustrates how paths are not formed simply by a few, isolated events but by multiple events. All events are included because their interactions affect other events. A single event is important only as it creates opportunities for subsequent events. The adoption of this more complex view of path formation means less attention is paid to a few entrepreneurial success stories. In this view of path formation, one entrepreneurial activity can stimulate similar entrepreneurial activities. For example, Holbrook et al. (2000) uses the failure of the Shockley Semiconductor Laboratory to show that even entrepreneurial failures can create new opportunities.

Events in this context refer to entrepreneurial activities such as the commercialization of new business opportunities. Each entrepreneurial activity has the potential to create such opportunities for others. Schumpeter (1934) used the term ‘swarming’ to describe this imitative behaviour of firms when they rush to join new growth areas. Swarm behaviour is often localized because knowledge spillovers tend to remain local (Audretsch and Feldman, 1996), entrepreneurs rarely relocate when starting a new firm (Buensdorf and Fornahl, 2009; Cooper and Folta, 2000), and entrepreneurs act as local role models for other entrepreneurs (Aldrich, 1999; Arenius and Minniti, 2005; Henrekson and Stenkula, 2007).

Entrepreneurial activities may alter the regional (i.e., local) path. But how do we define a regional path? While the region is not an actor itself, and is unable to initiate actions, it houses the actors—the entrepreneurs, the politicians and others—who can initiate the actions that create the regional path. As a simple example, consider a single-industry region in which entrepreneurial activities are concentrated around this industry. The path of this industry, created by those activities, is the regional path.

Single-industry regions are less common today because many regions have multiple industries that are or are not related. The larger the region, the more industries. In such a complex environment, the path of the dominant industry can suppress lesser business activities. Yet even in multi-industry regions, *small* events can alter the path development. The question then is: How do we define a regional path when a region has multiple industries with different development

paths? One possibility is accept idea that there many paths. In this paper, however, path development is defined as a single regional path because it is not possible to add paths.

Another definition links the regional path to the technology trajectories of the regional industries. The regional development path depends not only on the paths of the different industries but also on the interactions between them and the regional actors. Some activities, which are more important than others, are likely also more related to the regional path. The introduction of a new, related technology can lead to the emergence of a new regional industry; this industry is therefore less related to the current regional economic profile.

Entrepreneurs, however, who imitate the successful entrepreneurial activities of other regional entrepreneurs are closely related. Path dependence becomes a selection process achieved through the specialization of knowledge accumulation. The entrepreneurial activities create a regional path that is linked to the region's industries. Yet this technological dimension is insufficient as an explanation of how and why regional paths change.

This discussion of the entrepreneurial regional path leads to three ideas. First, the regional development literature should address entrepreneurs as the agents of regional change. Second, entrepreneurial activities are the combined actions of several actors. Third, the linkage of entrepreneurs to regional development offers new insights on regional development.

The next section of the paper presents four conclusions about the linkage between entrepreneurial activities and regional development using the interpretive lens of path dependence. These four conclusions are based on the ideas listed in the preceding paragraph.

Innovative entrepreneurship as a regional process

Much research has been conducted on the technological relatedness of innovative entrepreneurial activities (Gathmann and Schoenberg, 2010; Ingram and Neumann, 2006; Poletaev and Robinson, 2008; Shane, 2000; Wood and Pearson, 2009;). Entrepreneurs tend to use their existing competences because their prior technological knowledge increases their ability to acquire new, related technological knowledge (Cohen and Levinthal, 1990). Similarly, Bessant (1992) shows that most innovations result from borrowings and not from inventions. Other empirical studies reveal that entrepreneurs' prior knowledge, if it is technologically-related, improves performance in the new venture (Boschma and Frenken, 2011; Klepper, 2010).

However, the research approach that has only a technological dimension provides an insufficient explanation of regional development. Therefore, Zahra (2007) claims a contextualization of the entrepreneurial phenomenon is needed that acknowledges the dynamics of the research context and eliminates major gaps in the reader's understanding. As shown in Table 1, most research has focused on the technological dimension that is closely linked to the development of a technology. Thus, other, interrelated dimensions of path dependence should be identified in order to present a complete view of the entrepreneurial process.

The research approach that has a cognitive dimension explains how we know the world using mental models based on human experience and behaviour. Cognitive approaches to entrepreneurship emerged in the early 1990s as a result of the criticism of personal trait research and its modest results (Gartner, 1988, 1989; Hatten, 1997; Katz and Shepherd, 2007). Instead of focusing on personal traits that distinguish entrepreneurs from non-entrepreneurs, the cognitive approach suggests that entrepreneurial behaviour should be regarded as a consequence of person-situation interactions and not as a mere outcome of personal traits.

In his description of the development of the disk drive industry, Christensen (1977) discusses cognitive path dependence. He concludes that the large disk drive companies failed, not because they lacked the knowledge to produce smaller disk drive units, but because they could not see the benefit in producing smaller units. The large companies simply could not imagine

there was a market for smaller units. According to Christensen, this story reflects the mental impact technology may have. Because the large disk drive companies had worked so long in this one technological setting, they may have lost their ability to recognize new opportunities.

The third research approach has a social dimension that refers to a region's culture. As one example of this approach, Saxenian (1996) describes differences in regional cultures in a comparative analysis of two American business communities: Silicon Valley in California and Route 128 in Massachusetts. In Silicon Valley, risk-taking was accepted and even glorified. Along Route 128, stability and company loyalty were more highly valued. Similarly, Davidsson (1995) reveals how the cultural differences among regions in Sweden affect entrepreneurship. Feldman (2001) describes the development of an entrepreneurial culture in the US Capitol region. Yet, although there is a great deal of regional variation in cultures and attitudes, more research is needed in this field (Lundström and Stevenson, 2005; Verheul et al., 2002).

Different regional attitudes towards entrepreneurship have some effect on the course of the regional path. Figure 1(b) depicts the formation of a new path when followers swarm around a new business opportunity. Such entrepreneurial swarming is more likely if the social and cognitive dimensions are in line with such opportunities. Cognitive and social differences between regions suggest that path dependence should not be limited to a technological dimension in discussions of entrepreneurship in a regional context. The phenomenon is too complex to be captured by a single dimension. Interaction among the three dimensions is necessary. Therefore:

Conclusion 1: In the study of innovative entrepreneurship in a regional context, the technological, cognitive and social dimensions should be considered.

A product, service or technology can be new to a region even if it has been previously introduced to the global market. Thus, entrepreneurs' activities can either be radical or related. Radical activities are activities initiated outside the established regional trajectories by the so-called Schumpeterian entrepreneur (Schumpeter, 1934). Related activities reflect established regional trajectories and are initiated by the so-called Kirznerian entrepreneur (Kirzner, 1973). As Shane (2003, p.21) explains, Schumpeterian entrepreneurs are 'innovative and break away from existing knowledge', while Kirznerian entrepreneurs are 'not very innovative and replicate existing knowledge'. It is not enough to begin just any innovative activity; the activity must initiate a new path outside established trajectories. Schumpeterian entrepreneurs form a new path while Kirznerian entrepreneurs follow a path. See Figure 1(b). Both types of entrepreneurs are needed for the regional path.

Because different types of innovative entrepreneurship exist in relation to the regional path, the concept of path dependence should be perceived in general as neutral. Whether path dependence initiates new regional development trajectories or leads to a decline of the regional economy depends on the entrepreneurship type and the specific situation. Furthermore, because different stakeholders may not perceive the same process in the same way, they relate differently to the path dependence process. A negative perception of path dependence is therefore unproductive and inappropriate.

Insert Table 2 about here

Table 2 shows how the same type of innovative entrepreneurship can lead to quite different regional development processes depending on the specific regional situation. If the region has mostly mature industries, related innovative entrepreneurship will not alter the path. If

the mature industries in a region stagnate or decline, the regional economy will also eventually stagnate or decline. In general, path dependence is linked to such lock-ins (Belussi and Sedita, 2009; Hassink, 2005; Shapira and Youtie, 2008). Under the same circumstances, radical innovative entrepreneurship will generate new products or technologies that may initiate new development trajectories. If successful, eventually the regional economy will renew. If the region has emerging industries, related innovative entrepreneurship is needed to support the new industry development. As a result, the regional path can alter.

Related innovative entrepreneurship may support the development of a dominant design and enable the commercialization of innovations. Under the same circumstances, radical innovative entrepreneurship may disturb the development of the new industry when it hinders the development of a dominant design. This can lead to a failure of the emerging industry such that the regional path cannot be altered. Aldrich and Fiol (1994) suggest, for example, that emerging industries should avoid competing designs in order to eliminate confusion and uncertainty for potential stakeholders. Thus, it is important to be aware of the specific regional situation and the different types of entrepreneurship. Therefore:

Conclusion 2: There are different types of innovative entrepreneurs. Their effect on the path dependence depends on the specific regional situations.

Entrepreneurial activities are found in some regions more often than in others. Andersson and Koster (2011) discuss the spatial-temporal persistence of entrepreneurship. As suggested above, this persistence is not merely the result of different economic profiles. Each region has different actors and different regional networks. Institutions, also referred to as the rules of the game (Boettke and Coyne, 2009; North, 1990), shape the interactions within networks and between actors. The analysis of entrepreneurship as a combined activity of several actors in a regional context, with its informal institutions (e.g., taboos, norms, traditions and codes of conduct) is of special interest. Different types of entrepreneurs may have different attitudes towards such formal and informal institutions.

Entrepreneurs who engage in related activities are inclined to conform to the established institutions. Entrepreneurs who engage in radical activities introduce either new or new combinations of knowledge/technology are inclined to depart from these institutions. The incompatibility of these activities with the existing institutional framework means the framework must eventually be altered as entrepreneurs swarm around the new business opportunity.

A single event, however, cannot cause a change in an existing institutional framework. Different actor groups and different networks exist in each region. Yet each region has certain local-territorial, informal institutions as a foundation (Davidsson, 1995; Lundström and Stevenson, 2005). An area with a traditional manufacturing industry, such as the metal or paper industry, for example, has a rather different institutional foundation than an old university or cathedral town. In various ways, different institutional foundations have different effects on entrepreneurial activities. Therefore:

Conclusion 3: Every region has an institutional foundation. Some institutional foundations hinder innovative entrepreneurship while others support innovative entrepreneurship.

The next issue concerns the circumstances in which the different innovative entrepreneurs emerge. One factor may be the new knowledge, whether tacit or explicit, introduced in the region. It is theorized that new knowledge enters the region in three different

ways: (1) migration of entrepreneurs and employees, (2) information exchange in global networks, or (3) regional research activities. These theories are explored next.

The entrepreneurship literature suggests that entrepreneurs' social networks are mainly local (Hess, 2004; Sorenson, 2003) and that knowledge spillovers are geographically bounded (Audretsch and Feldman, 1996). Despite this geographical limitation of knowledge, entrepreneurs are highly mobile individuals (Godley, 2007), and some research suggests that knowledge migration can overcome long geographical distances (Saxenian, 2006). Migrating entrepreneurs, who typically come from different institutional backgrounds and possess different spheres of knowledge, introduce new knowledge to new regions. Even if this knowledge is technological knowledge, it can change the cognitive or social perception of other entrepreneurs in the region. As Figure 1(b) illustrates, the activities of migrating entrepreneurs encourage others to follow them as new paths are formed.

There are three reasons that migrating entrepreneurs are more likely than local entrepreneurs to initiate radical innovative entrepreneurial activities. First, migrating entrepreneurs are not aware of the regional technological, cognitive and social paths. Second, because entrepreneurial networks are local, the knowledge exchange among innovative actors in a local network generally increases the region-specific knowledge stock (Bathelt et al, 2004; Graf, 2011; Storper and Venables, 2004). Specialized regions risk lock-ins where shifts to new development paths are impossible (Camagni, 1991; Malmberg and Maskell, 1997). Similarly, Birley (1985) confirms the importance of local networks where entrepreneurs found firms in similar industries. Migrating entrepreneurs, however, have access to larger, even more global, networks than local entrepreneurs. Third, migrating engineers possess new knowledge. They can become network gatekeepers who link the specific local knowledge to external knowledge (Graf, 2011). Moreover, global networks are a source of new knowledge. While local entrepreneurs can receive new knowledge through such global networks, they may be more restricted in its use because of their established regional practices and cultures. Therefore:

Conclusion 4: Innovative entrepreneurs who introduce new knowledge to a region are more likely to alter the regional path.

Implications and discussion

The concept of path dependence is used in this paper as an interpretive lens to explore the link between innovative entrepreneurship and regional development. Path dependence contributes in four ways to this study of innovative entrepreneurship.

First, the evolutionary view entrepreneurship, in a departure from the big man theory, assumes that entrepreneurial activities are an accumulation of events involving cooperation, context and outcome. In this view, it is important to consider the different, interrelated dimensions of path dependence.

Second, different types of innovative entrepreneurship are proposed. Related innovative entrepreneurship activities are consistent with path dependence, while radical innovative entrepreneurship activities have the potential to alter that path. It is necessary to distinguish between non-innovative entrepreneurial activities and innovative entrepreneurial activities as well as to distinguish between different types of innovative entrepreneurship. Regional conditions are influential in the determination of which innovative entrepreneurs trigger which regional processes. Both types of innovative entrepreneurship are needed at different stages for regional development.

Third, different institutional foundations in regions have different effects on innovative entrepreneurship. An understanding of these effects helps us understand how regional networks and their informal institutions influence innovative entrepreneurship.

Fourth, innovative entrepreneurship is embedded in existing regional paths. Every region has unique developmental requirements. Entrepreneurs use prior knowledge and experiences to make decisions. These decisions depend, to different degrees, on the regional composition of this knowledge and the industrial structure. New knowledge can also help entrepreneurs use their prior knowledge in new business opportunities. Thus, the entrepreneur should not seek only novel products and processes. New, innovative paths can be found using a creative re-combination of existing regional resources. Moreover, entrepreneurs do not think in terms of related or radical innovative entrepreneurial activities. They initiate such activities when opportunities arise and generally are unconcerned about the effect their activities have on regional development processes. Nonetheless, their activities do influence others.

It is difficult for the researcher, after the fact, to identify the relevant entrepreneurial activities that contribute to the development of a region. Therefore, the researcher should focus on how different activities influence each other and which ones are more related to the regional path than others even though it may be challenging to identify the important ones. When a company fails, it is especially difficult to estimate the importance of their former activities. For example, the history of the failure of Shockley Semiconductor Laboratory was important to the development of the semiconductory industry in Silicon Valley (Holbrook et al., 2000). One company's failure can be a factor in another company's success. If Shockley had succeeded, the 'traitorous eight' who left the company might never have founded Fairchild Semiconductor. The lesson is that while it is impossible to predict which current activity is most significant for future regional development, it is useful to try to understand the different processes within a region.

References

- Aldrich, H.E. (1999) *Organizations evolving*, London: Sage.
- Aldrich, H.E. and Fiol, C.M. (1994) 'Fools rush in? The institutional context of industry creation', *Academy of Management Review*, Vol.19, No.4, pp.645-670.
- Aldrich, H.E. and Zimmer, C. (1986) 'Entrepreneurship through social networks', in Sexton, D. and Smilor, R. (Eds.), *The Art and Science of Entrepreneurship*, New York: Ballinger. pp.3-23.
- Andersson, M. and Koster, S. (2011) 'Sources of persistence in regional start-up rates – evidence from Sweden', *Journal of Economic Geography*, Vol.11, pp.179-201.
- Arenius, P. and Minniti, M. (2005) 'Perceptual Variables and Nascent Entrepreneurship', *Small Business Economics*, Vol. 24, No. 3, pp.233-247.
- Arthur, W.B. (1989) 'Competing Technologies, Increasing Returns, and Lock-in by Historical Events', *The Economic Journal*, Vol.99, No.394, pp.116-131.
- Arthur, W.B. (1994) *Increasing Returns and Path Dependence in the Economy*, University of Ann Arbor: Michigan Press.
- Audretsch, D. and Feldman, M. (1996) 'R&D Spillovers and the Geography of Innovation and Production', *American Economic Review*, Vol.86, No.3, pp.630-640.
- Audretsch, D. and Keilbach, M. (2004) 'Entrepreneurship Capital and Economic Performance', *Regional Studies*, Vol.38, No.8, pp.949-959.
- Balzat, M. and Hanusch, H. (2004) 'Recent trends in the research on national innovation systems', *Journal of Evolutionary Economics*, Vol. 14, No.2, pp. 197-210.
- Bathelt, H. and Glückler, J. (2003) 'Towards a relational economic geography', *Journal of Economic Geography*, Vol.3, No.2, pp.117-44.

- Bathelt, H., Malmberg, A. and Maskell, P. (2004) 'Clusters and knowledge: Local buzz, global pipelines and the process of knowledge creation', *Progress in Human Geography*, Vol.28, No.1, pp.31-56.
- Belussi, F. and Sedita, S.R. (2009) 'Life Cycle vs. Multiple Path Dependency in Industrial Districts', *European Spatial Planning*, Vol.17, No.4, pp. 505-528.
- Berndt, C. (1998) 'Ruhr Firms between Dynamic Change and Structural Persistence – Globalization, the 'German Model' and Regional Place-Dependence', *Transactions of the Institute of British Geographers*, Vol. 23, No.3, pp. 331-352.
- Bessant, J. (1992) 'Big Bang or Continuous Evolution: Why Incremental Innovation is Gaining Attention in Successful Organizations', *Creativity and Innovation Management*, Vol.1, No.2, pp.59-62.
- Birch, D. (1979) *The Job Generation Process*, Cambridge, MA.: M.I.T. Program on Neighborhood and Regional Change.
- Birley, S. (1985) 'The role of networks in the entrepreneurial process', *Journal of Business Venturing*, Vol.1, No.1, pp.107-117.
- Boettke, P.J. and Coyne, C.J. (2009) 'Context Matters – Institutions and Entrepreneurship', *Foundations and Trends in Entrepreneurship*, Vol.5, pp.135-209.
- Boschma, R. and Frenken, K. (2011) 'Technological relatedness and regional branching', In: Bathelt, H., Feldman, M.P. and Kogler, D.F. (Eds.), *Dynamic Geographies of Knowledge Creation and Innovation*, (pp.64-81), London: Routledge.
- Boschma, R. and Iammarino, S. (2009) 'Related variety, trade linkages and regional growth in Italy', *Economic Geography*, Vol.85, No.3, pp.289-311.
- Buenstorf, G. and Fornahl, D. (2009) 'B2C-bubble to cluster: The dot-com boom, spin-off entrepreneurship, and regional agglomeration', *Journal of Evolutionary Economics*, Vol.19, No.3, pp. 349-378.
- Burt, R.S. (1992) *Structural Holes: The Social Structure of Competition*, Cambridge, MA.: Harvard Business School Press.
- Camagni, R. (1991) 'Local Milieu, uncertainty and innovation networks: towards a new dynamic theory of economic space', In: Camagni, R. (Ed.), *Innovation Networks: Spatial Perspectives*, (pp.121-142), London, New York: Belhaven Press.
- Carlsson, B. (2007) 'Innovation systems: a survey of the literature from a Schumpeterian perspective', In: Hanusch, H. and Pyka, A. (Eds.) *Elgar Companion to Neo-Schumpeterian Economics*, (pp. 257-271), Cheltenham: Edward Elgar Publishing.
- Christensen, C.M. (1997) *The innovator's dilemma: when new technologies cause great firms to fail*, Cambridge, MA.: Harvard Business Press.
- Cohen, W.M. and Levinthal, D.A. (1990) 'Absorptive Capacity: A New Perspective on Learning and Innovation', *Administrative Science Quarterly*, Vol.35, No.1, pp. 128-152.
- Coleman, J. (1988) 'Social capital in the creation of human capital', *American Journal of Sociology*, Vol. 84, Supplement, pp.95-120.
- Colombelli, A. and von Tunzelman, N. (2011) 'The persistence of innovation and path dependence', In: Antonelli, C. (Ed.), *Handbook on the Economic Complexity of Technological Change*, (pp. 105-119), Cheltenham: Edward Elgar Publishing.
- Cooke, P., Uranga, M.G. and Etxebarria, G. (1998) 'Regional systems of innovation: an evolutionary perspective', *Environment and Planning A*, Vol.30, No.9, pp. 1563-1584.
- Cooper, A.C. and Folta, T.B. (2000) 'Entrepreneurship and High-Technology Clusters', In: Sexton, D.L. and H. Landström (Eds.), *Handbook of Entrepreneurship*, (pp. 348-367), Malden, MA: Blackwell.

- David, P.A. (1985) 'Clio and the economics of QWERTY', *The American Economic Review*, Vol.75, No.2, pp.332-337.
- Davidsson, P. (1995) 'Culture, structure and regional levels of entrepreneurship', *Entrepreneurship and Regional Development*, Vol.7, No.1, pp.41-62.
- De Propriis, L. and Crevoisier, O. (2011) 'From regional anchors to anchoring', In: Cooke, P., Asheim, B., Boschma, R., Martin, R. Schwartz, D. and Tödtling, F. (Eds.), *Handbook of Regional Innovation and Growth*, (pp.167-177), Cheltenham: Edward Elgar Publishing.
- Doloreux, D. and Parto, S. (2005) 'Regional innovation systems: Current discourse and unresolved issues', *Technology in Society*, Vol. 27, No.2, pp. 133-153.
- Edquist, C. (1997) (Ed.) *Systems of Innovation: Technologies, Institutions and Organizations*, London: Frances Pinter.
- Edquist, C. (2006) 'System of Innovation. Perspectives and Challenges', In: Fagerberg, J., Mowery, D.C., and Nelson, R.R. (Eds.) *The Oxford Handbook of Innovation*, (pp. 181-208), Oxford: Oxford University Press.
- Elfring, T. and Hulsink, W. (2003) 'Networks in entrepreneurship: The case of high-technology firms', *Small Business Economics*, Vol.21, No.4, pp.409-422.
- Essletzbichler, J. and Winther, L. (1999) 'Regional Technological Change and Path Dependency in the Danish Food Processing Industry', *Geografiska Annaler: Series B*, Vol.81, No.3, pp.179-196.
- Fagerberg, J. (2006) 'Innovation: A Guide to the Literature', In: Fagerberg, J., Mowery, D.C. and Nelson, R.R. (Eds.), *The Oxford Handbook of Innovation*, (pp. 1-26), Oxford: Oxford University Press.
- Feldman, M.P. (2001) 'The Entrepreneurial Event Revisited: Firm Formation in a Regional Context', *Industrial and Corporate Change*, Vol.10, No.4, pp.861-891.
- Freeman, C. (2001) 'Networks of innovators: A synthesis of research issues', *Research Policy*, Vol.20, No.5, pp.499-514.
- Frenken, K., von Ort, F. and Verburg, T. (2007) 'Related variety, unrelated variety and regional economic growth', *Regional Studies*, Vol. 41, No.5, pp.685-697.
- Gartner, W.B. (1988) 'Who is an entrepreneur? Is the wrong question', *American Journal of Small Business*, Vol.12, No.4, pp.11-31.
- Gartner, W.B. (1989) 'Some suggestion for research on entrepreneurial traits and characteristics', *Entrepreneurship Theory & Practice*, Vol.14, No.1, pp.27-37.
- Garud, R. and Karnøe, P. (2001) 'Path Creation as a Process of Mindful Deviation', In: Garud, R. and Karnøe, P. (Eds.), *Path dependence and creation*, (pp.1-38), London: Lawrence Erlbaum Association.
- Gathmann, C. and Schoenberg, U. (2010) *How General is Human Capital? A task-based approach*, IZA Discussion Paper No.3067.
- Godley, A. (2007) 'Migration of Entrepreneurs', In: Casson, M., Yeung, B., Basu, A. and Wadeson, N. (Eds.), *The Oxford Handbook of Entrepreneurship*, (pp.601-610), Oxford: Oxford University Press.
- Graf, H. (2011) 'Gatekeepers in regional networks of innovators', *Cambridge Journal of Economics*, Vol.35, No.1, pp.173-198.
- Granovetter, M. (1985) 'Economic action and social structure: the problem of embeddedness', *American Journal of Sociology*, Vol.91, No.3, pp.481-450.
- Hassink, R. (2005) 'How to unlock regional economies from path dependency? From learning region to learning cluster', *European Planning Studies*, Vol.13, No.4, pp.521-535.
- Hatten, T.S. (1997) *Small Business: Entrepreneurship and Beyond*, Upper Saddle River, NJ: Prentice-Hall.

- Henrekson, M. and Stenkula, M. (2007) *Entreprenörskap*, Stockholm: SNS Förlag.
- Hess, M. (2004) 'Spatial relationships? Towards a reconceptualization of embeddedness', *Progress in Human Geography*, Vol.28, No.2, pp.165-186.
- Hodson, M. (2008) 'Old industrial regions, technology and innovation: tension of obduracy and transformation', *Environment and Planning A*, Vol.40, No.5, pp.1057-1075.
- Holbrook, D., Cohen, W.M., Hounshell, D.A. and Klepper, S. (2000) 'The Nature, Sources, and Consequences of Firm Differences in the Early History of the Semiconductor Industry', *Strategic Management*, Vol.21, No.10/11, pp.1017-1041.
- Hudson, R. (2005) 'Rethinking change in old industrial regions: reflecting on the experiences of North East England', *Environment and Planning A*, Vol.37, No.4, pp. 581-596.
- Ingram, B.F. and Neumann, G.R. (2006) 'The returns to skill', *Labour Economics*, Vol.13, No.1, pp.35-59.
- Johannisson, B. (2003) 'Entrepreneurship as a collective phenomenon', In: Genescà, E., Urbano, D., Capelleras, J.L., Guallarte, C and Vergès, J. (Eds.), *Creación de Empresas / Entrepreneurship*, (pp.87-109), Universidad Autónoma de Barcelona: Barcelona.
- Katz, J.A. and Shepherd, D.A. (2007) *Cognitive Approaches to Entrepreneurship Research*, Wagon Lane: Emerald Group Publishing Limited.
- Kenney, M. and Burg, U. von (1999) 'Technology, Entrepreneurship and Path Dependence: Clustering in Silicon Valley and Route 128', *Industrial and Corporate Change*, Vol.8, No.1, pp. 67-103.
- Kirzner, I.M. (1973) *Competition and Entrepreneurship*, Chicago: University of Chicago Press.
- Klepper, S. (2010) 'The origin and growth of industry clusters: The making of Silicon Valley and Detroit', *Journal of Urban Economics*, Vol.67, No.1, pp.15-32.
- Knapp, W. (1998) 'The Rhine-Ruhr are in transformation: Towards a European metropolitan region', *European Planning Studies*, Vol.6, No.4, pp.379-393.
- Knight, F.H. (1921) *Risk, uncertainty and profit*, Chicago: University of Chicago Press.
- Lundquist, K.J. and Winther, L. (2006) 'The Interspace between Denmark and Sweden: The Industrial Dynamics of the Öresund Cross-border Region', *Danish Journal of Geography*, Vol.106, No.1, pp.115-129.
- Lundström, A. and Stevenson, L. (2005) *Entrepreneurship policy: theory and practice*; International Studies in Entrepreneurship, Vol.9. New York: Springer.
- Lundvall, B.A. (1985) *Product innovation and user-producer interaction*, Aalborg:Aalborg University Press.
- Lundvall, B.A. (1988) 'Innovation as an interactive process – from user-producer interaction to national systems of innovation', In: Dosi, G, Freeman, C, Nelson, C., Silverberg, R. and Soete, L. (Eds.) *Technology and economic theory*, (pp.349-369), London: Pinter.
- Lundvall, B.A. (1992) 'User-producer relationships, national systems of innovation and internationalization', In: Lundvall, B.A. (Ed.) *National Systems of Innovation : Towards a Theory of Innovation and Interactive Learning*, (pp. 45-67), London: Pinter.
- Malecki, E.J. (1997) *Technology and economic development: The dynamics of local, regional and national competitiveness*, Essex: Longman.
- Malmberg, A. and Maskell, P. (1997) 'Towards an explanation of regional specialization and industry agglomeration', *European Planning Studies*, Vol.5, No.1, pp.25-41.
- Martin, R. and Sunley, P. (2006) 'Path dependence and regional economic evolution', *Journal of Economic Geography*, Vol.6, No.4, pp.395-437.
- Meyer-Stam, J. (1998) 'Path Dependence in regional development: persistence and change in three industrial clusters in Santa Catarina, Brazil', *World Development*, Vol.26, No.8, pp.1495-1511.

- Nelson, R.R. (1993) (Ed.) *National innovation systems: A comparative analysis*. New York: Oxford University Press.
- Nijkamp, P. (2003) 'Entrepreneurship in a modern network economy', *Regional Studies*, Vol.37, No.4 pp.395–405.
- Niosi, J., Saviotti, P., Bellon, B. and Crow, M. (1993) 'National Systems of Innovation: In Search of a Workable Concept', *Technology in Society*, Vol.15, No.2, pp.207-227.
- Nooteboom, B. (2000) 'Institutions and Forms of Co-operation in Innovation Systems', *Organization Studies*, Vol.21, No.5, pp. 915-935.
- North, D.C. (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge: Cambridge University Press.
- O'Donnell, A., Gilmore, A., Cummins, D. and Carson, D. (2001) 'The network construct in entrepreneurship research: a review and critique', *Management Decision*, Vol.39, No.9, pp.749 – 760.
- Poletaev, M. and Robinson, C. (2008) 'Human Capital Specificity: Evidence from the Dictionary of Occupational Titles and Displaced Worker Surveys', *Journal of Labor Economics*, Vol.26, No.3, pp.387-420.
- Rost, K. (2011) 'The strength of strong ties in the creation of innovation', *Research Policy*, Vol.40, No.4, pp.588-604.
- Saxenian, A. (1996) *Regional advantage: culture and competition in Silicon Valley and Route 128*, Cambridge, MA.: Harvard University Press.
- Saxenian, A. (2006) *The New Argonauts: Regional Advantage in a Global Economy*, Cambridge, MA.: Harvard University Press.
- Schienstock, G. (1975) *Organisation innovativer Rollenkomplexe*, Meisenheim am Glan: Anton Hain.
- Schienstock, G. (2007) 'From Path Dependency to Path Creation: Finland on its Way to the Knowledge-based Economy', *Current Sociology*, Vol.55, No.1, pp.92-109.
- Schon, D.A. (1963) 'Champions for Radical New Investments', *Harvard Business Review*, Vol.41, No.2, pp.77-86.
- Schumpeter, J. A. (1934) *The theory of economic development*, Cambridge, MA.: Harvard University Press.
- Shane, S.A. (1994) 'Are Champions different from Non-Champions?', *Journal of Business Venturing*, Vol. 9, No.5, pp. 397-421.
- Shane, S.A. (2000) 'Prior Knowledge and the Discovery of Entrepreneurial Opportunities', *Organization Science*, Vol.11, No.4, pp.448-469.
- Shane, S.A. (2003) *A General Theory of Entrepreneurship: the individual-opportunity nexus*, Cheltenham: Edward Elgar Publishing.
- Shapira, P. and Youtie, J. (2008) 'Emergence of Nanodistricts in the United States: Path Dependency or New Opportunities', *Economic Development Quarterly*, Vol.22, No.3, pp. 187-199.
- Sorenson, O. (2003) 'Social networks and industrial geography', *The Journal of Evolutionary Economics*, Vol.13, No.5, pp.513-527.
- Steyaert, C. and Katz, J. (2004) 'Reclaiming the space of entrepreneurship in society: Geographical, discursive and social dimensions', *Entrepreneurship and Regional Development*, Vol. 16, No.3, pp. 179–96.
- Storper, M. and Venables, A.J. (2004) 'Buzz: face-to-face contact and the urban economy', *Journal of Economic Geography*, Vol.4, No.4, pp.351-370.

- Smith, H.L., Glasson, J. and Chadwick, A. (2005) 'The geography of talent: entrepreneurship and local economic development in Oxfordshire', *Entrepreneurship and Regional Development*, Vol.17, No.6, pp.449-478.
- Trachte, K. and Ross, R. (1985) 'The crisis of Detroit and the emergence of global capitalism', *International Journal of Urban and Regional Research*, Vol. 9, No.2, pp. 186-217.
- Trettin, L. and Welter, F. (2011) 'Challenges for spatially oriented entrepreneurship research', *Entrepreneurship and Regional Development*, Vol.23, Nos.7-8, pp.575-602.
- Verheul, I., Wennekers, S., Audretsch, D. and Thurik, R. (2002) 'An Eclectic Theory of Entrepreneurship: policies, institutions and culture', In: Audretsch, D., Thurik, R., Verheul, I. and Wennekers, S. (Eds.) *Entrepreneurship: Determinants and Policy in a European-US Comparison*, (pp.11-81), Dordrecht: Kluwer Academic Publishers.
- Wood, M.S. and Pearson, J.M. (2009) 'Taken on Faith? The Impact of Uncertainty, Knowledge Relatedness, and Richness of Information on Entrepreneurial Opportunity Exploitation', *Journal of Leadership & Organizational Studies*, Vol.16, No.2, pp.117-130.
- Zahra, S.A. (2007) 'Contextualizing theory building in entrepreneurship research', *Journal of Business Venturing*, Vol.22, No.3, pp.443-452.

Figure

Path dependence illustrated as

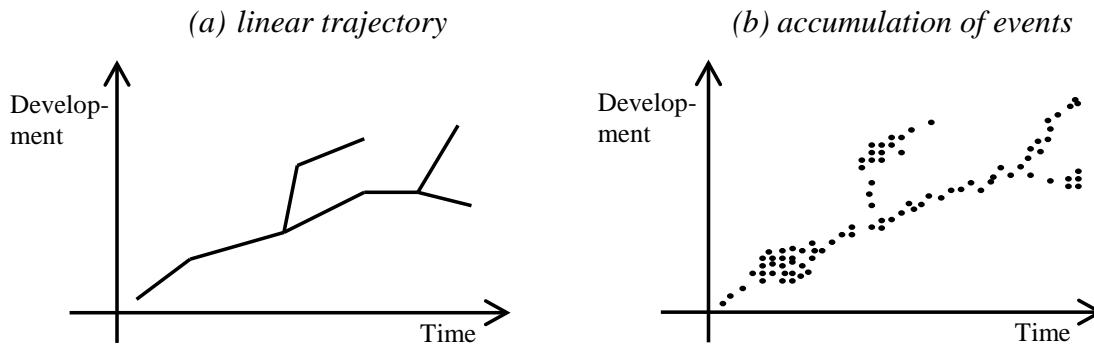


Figure 1 (a) and (b): Altered illustration of a technological path

Tables

Table 1: Definition of path dependence in selected regional development papers

Authors	Dimension	Definition of the concept	Type of paper
Belussi and Sedita (2009)	Technology	Path dependency can lead to 'lock-in' phenomena, where 'fixity' and 'ridification' are the characteristics of local economic development. P.507	Industrial district study
Shapira and Youtie (2008)	Technology	Regions maintain technological leadership through early entry and positional lock-in. p191	Industry case study
Schienstock (2007)	Technology	Technological choices made in the past influence subsequent choices. p. 93	National case study
Martin and Sunley (2006)	Technology	Inability to shake free of their own history. P. 399	Conceptualization
Hassink (2005)	Technology, Institution	The importance of history and institutional contexts for regional development as an explanation of the decline of industrial areas. P. 522	Regional case study
Essletzbichler and Winther (1999)	Technology	The dependence of technology on past and existing knowledge tends to move firms, regions and countries along relatively well-defined technological trajectories. P. 179	Industry case study
Kenney and Burg (1999)	Technology	Small events or historical accidents can be critical triggers that enable one region to become the centre of a particular type of economic activity. P.70	Regional cluster study
Meyer-Stam (1998)	Technology	It is an attempt to explain the rationality of behaviour that at first might appear irrational if	Regional cluster study

one assumes utility maximizing behaviour. P.
496

Table 2: Entrepreneurial types and the regional processes

Type of innovative entrepreneurship	Regional processes	
	<i>Mature industries</i>	<i>Emerging industries</i>
Related innovative entrepreneurship	Strengthening	Support
Radical innovative entrepreneurship	Renewal	Disturbance