

# Path Dependency and Path Creation: Continuity vs. Fundamental Change in National Economies

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## Abstract

*Path dependency theory explains organizational, institutional, and political change processes mainly from a techno-economic view. The main argument here is that historic events in the past determine future paths. However, these developments often are inefficient. On this basis, it is hard to explain how completely new paths evolve. Therefore, this article focuses on the creation of new and more preferable paths in the future. It adds the key role of agency to the concept of path dependency to enhance the understanding of path creation.*

**Keywords:** path dependency, path creation, technological paradigm, communities of practice, niche concept

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## Introduction

The current debate on technological development and socio-economic change is characterized by an obvious contradiction. Some scholars argue that the economy in industrialized countries is undergoing a fundamental and very rapid transformation towards a knowledge-based economy, sometimes also referred to as the third industrial revolution (Castells, 2000). To explain the rapid and fundamental transformation process, scholars often refer to the dictating influence of certain mega-trends (e.g. Naisbitt, 1982). These include the globalizing markets, the pervasive informatization of the economy and the widespread diffusion of modern ICT, cultural changes and new demand patterns, or the scientific-technological revolution, to mention just a few. These trends are assumed to be so powerful that they can enforce a systemic transformation process in all advanced

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economies, also drastically reducing the possibility of alternative national responses (Regini, 1999). Consequently scholars assume some kind of convergence in the development of industrialized economies.

There is, on the other hand, a growing interest in the aspect of continuity in economic development. The dominant message coming from research on national business systems (Whitley, 1992) and on varieties of capitalism (Hall & Soskice, 2001), for example, is that economic change is slow and gradual, if it occurs at all. This is because nation-states tend to retain patterns of institutional continuity and national distinctiveness, in which techno-economic processes are embedded, even under conditions of external shock to their political and economic environment (Tainio & Lilja, 2003, p.69).

Evolutionary economics refer to the concept of path dependency to explain why technological change shows great regularities and develops within certain boundaries (Nelson & Winter, 1977).<sup>1</sup> The central argument of this paper is that path dependency is a key concept in analyzing technological change, but as it mainly deals with incremental innovations, it does not provide an explanation of how breakthrough innovations and technological regime shifts occur. To study the dynamics of the transformation of socio-economic structures, organizational forms, institutional settings and cultural patterns which take place in periods of mismatch, triggered by new technologies (Dolata, 2007; Dosi, 1988), the focus should be on emerging new paths and path creation processes.

### Technical Regimes and Path Dependency

The concept of path dependency suggests that technological change is widely pre-structured (Dosi, 1992). The fact that path dependency does not separate technological innovations from past developments but assumes some kind of continuity in the process of technological change is seen as the strength of the concept. It defines certain boundaries for technological progress and indicates directions in which progress is possible and desirable. The main argument of the path dependency concept is that technological innovations and their knowledge base are closely linked with earlier developments. New innovations line up with earlier technological change; they have historical antecedents of progress (David, 1985, p.332). And today's knowledge base and technological advantages lay the foundations for succeeding rounds of technological development in the future (Foray, 1997, p.65).

The concept of 'increasing returns' (Arthur, 1994, p.1996) adds to the argument that technological change is self-reinforcing; as a technology has been accepted and incorporated in the technological system by a critical mass of applicants, it becomes a general standard. This accelerates its diffusion still more, even if it is not the best possible solution. This phenomenon has been called 'network externalities of technologies'. They occur when a technology is spreading and the network of its users is growing; the broad diffusion makes a technology more attractive to possible users (Kemp, 2002, p.104). Under the conditions of increasing returns, the circumstances of the first successful application are of major significance.

Both concepts, path dependency and increasing returns, assume some kind of channelled technological change or "positive lock-in effect", which means that the options for technological development are continuously reduced within the change process due to the cumulative nature of knowledge creation. Through concrete technology projects and selective processes of technology closure, functioning production patterns and use practices stabilize, new technological development paths solidify and 'effects of irreversibility' become stronger (David, 2000; Dolata, 2007, p.5).

What is termed the 'Arthur model' considers cognitive aspects as the most important factors in path dependent development processes. It assumes that the beliefs and imagination of engineers cause technology to proceed in a certain development path. Some scholars have criticized that the model has a technological overtone. Others insist, however, that the concept also has a social dimension of technological development (Kemp, 2002), because the idea of a channelled technological change leaves limited space for social choice. Path dependency embodies strong prescriptions about which direction technical change should be pursued and which should be neglected, but it does not determine technological change.

Furthermore, technical change is closely linked to organizational innovations. While the traditional argument is that technology determines organizational structures, more recently technology is seen as rather flexible, which implies that technology can be embedded within organizational structures (Brousseau & Rallet, 1998). But actually technical and organizational change mutually influence each other; this suggests – instead of focusing on technological change only – analysis of paths of techno-organizational development, which can best be researched on the level of industrial sectors.<sup>2</sup> And some authors stress the importance of 'institutional embeddedness' of techno-organizational change (Granovetter, 1985). There is plenty of evidence that these changes are influenced by national institutional settings. While the cumulative nature of techno-organizational development narrows down the range of potential choices, national paths increase differentiation and diversification as offshoots from the main development path (Dosi, 1982).

A well-established national techno-organizational path, this can be concluded, tends to form a synergistic combination with an economy's institutional structure. The prevailing norms, values and policies are continuously reinforced by the positive experience and feedback from the evolutionary phase of techno-organizational and institutional development, which suggests adding a cultural dimension to path dependency (Hämäläinen, 2003). Together these factors provide a sound basis for long-term economic growth (Freeman & Perez, 1988). Consequently, path dependency represents a multidimensional phenomenon which involves a specific group of actors, organizational formations, technical systems and their knowledge bases, as well as an institutional and cultural setting. The originally technical concept of path dependency is extended to a comprehensive concept of national development and growth paths.<sup>3</sup>

While path dependency is often seen as an important key to economic growth, it always carries the risk of an inefficient lock-in (Grabher, 1993). Economic decision-makers, due to resource absorption, vested interests or cognitive rigidity, are likely to stick to the existing development path and the learning mechanisms involved, although this may result in a loss of competitiveness and retarding economic growth.

Especially those countries which, in periods of techno-organizational paradigm shift, concentrate on the exploitation of the existing development path are likely to fall behind, as they are missing out in taking advantage of the growth enhancing innovation potential of the emerging new paradigm. The core problem is to overcome the inertia of the institutional and cultural framework.

Whereas incremental techno-organizational innovations can be accommodated easily by the existing institutional setting, this is not the case with fundamental changes based on a new knowledge paradigm, which by definition involve an element of destruction (Schumpeter, 1934). This means that in a period of a paradigm shift, the cultural and institutional setting can no longer function as a filter between external pressures and techno-organizational responses; instead, it becomes increasingly fragile itself. We can conclude that, aiming at understanding fundamental techno-organizational changes, we have to give more attention to problems of unlocking, emerging new paths, and path creation (Fuchs & Shapiro, 2005; Garud & Karnøe, 2000; Schienstock, 2004).

### **Evolving New Paths and Path Creation**

In general we can distinguish between two different approaches to explain the development of new techno-organizational paths. The first approach is based on the assumption that new paths have their origins in the existing techno-organizational system and that they are triggered by small events. The second approach interprets path creation as the transformation of a new techno-organizational paradigm into new national trajectories. The concept assumes that new paths are hardly linked with the existing techno-organizational system; they are based on a fundamentally new scientific knowledge base. In the first case, we can speak about path development within the process of path dependency; in the second case, a more fundamental break with the traditional path is assumed.

### **Path Change Out of Path Dependency**

Representatives of the path dependency approach reject the critique that the concept mainly focuses on incremental innovations but cannot deal with and explain breakthrough innovations and fundamental techno-organizational regime changes. They argue that small events can have dramatic consequences and can shift the process of techno-organizational development in a new direction; they can unleash new innovation dynamics that eventually result in fundamental techno-organizational changes and produce major economic discontinuities. New technological paths are often triggered "by temporally events, including happenings dominated by chance rather than by systemic forces" (David, 1985, p.332). Contingent events can set into motion event chains that have deterministic properties. But because these small events or insignificant accidents are hardly observable, the development of a new path takes place behind the back of social actors.

The argument that small events can trigger fundamental changes implies that the development of a new path and path dependency are closely linked. An emerging new

path cannot be understood without referring to path dependency which "structures" new developments (Van Looy, Debackere & Bouwen, 2000, p.333). One can criticize, however, that the model of path dependency represents a world which is governed by insignificant events and not by social actors. Without social actors, structures and social relationships, events are essentially arbitrary. Referring to Giddens' (1979 & 1984) structuration theory, we can argue that all structures including technical ones are constructed by social actors; they cannot be explained to be results of accidentally occurring small events.<sup>4</sup> Therefore, the development of new paths cannot be understood without referring to the concept of agency, a term, which is used to characterize the ability to introduce new elements into existing structures (DiMaggio, 1988).

### **The Communities of Practice Concept and the Niche Concept**

More recently the important role of communities of practice in innovation processes has been discussed (van Looy, Debackere & Bouwen, 2000). The concept argues that technological innovations are embedded in social activities, which take place in specific socio-cultural settings. A community of practice can be defined as a sustained and cohesive group of people with a common purpose, identity for members, and a common environment using shared knowledge, language, interactions, protocols, beliefs, and other factors (Gertler, 2005).

A major assumption of the community concept is that one cannot separate learning and techno-organizational innovations from work. Instead, learning occurs and innovations are developed mainly through conversations and interactions between people within the work process (Brown & Duguid, 1991). "Working, learning and innovation are not distinct; they are rather closely bound up with each other in a local practice and in the culture of that practice" (Gherardi & Nicolini, 2000, p.42). But communities of practice do not have a constant, formally acknowledged number of members. Instead, communities constantly adapt and change membership; they often transcend organizational and sometimes even national borders. Because of their fluid membership and trans-organizational linkages, communities of practice can become important sides of innovation and important routes for technology transfer (Brown & Duguid, 2000).

Kemp (2002, p.106) also sees a strong connection between path dependency and the development of a new path arguing that new technological regimes "build on what is available and are shaped by this." The author mentions niches as an important aspect in the process of technological regime shift.<sup>5</sup> There are basically two niches: technological niches and market niches. Technological niches often emerge around highly standardized products or they occur in the presence of a more complex technology. For example, the recombination of various elements of a complex technology may lead to a radical technological shift.

However, the existence of a technical niche is not a guarantee that a new technology will diffuse widely. Therefore, besides a technological niche, the existence of a market niche is important for a shift in the technological regime. For a new technology to develop it is important that there is an economic application. Without a market for use, companies' interest in the development of a new technology will be marginal.

But the existence of these niches does not automatically lead to the development of breakthrough innovations; consequently the author stresses the important role of social actors: "... new technologies need a champion and the champion needs a market" (2002, p.107).

Although the concept of small events provides some insights into the process of technological change, it is not capable to explain how we can break away from path dependency (Greener, 2005). It is important to understand technological structures as produced by social actors. But the concept of communities of practice, which aims at explaining the social shaping of technology, focuses mainly on the reproduction of technological structures including incremental changes caused by learning in working and not so much on major techno-organizational changes that initiate a new development path. The fact that communities of practice go beyond organizational boundaries and develop into trans-organizational and even transnational<sup>6</sup> networks, which enables the diffusion of new knowledge, may explain to some degree how breakthrough innovations can develop. Also the niche concept provides some hints about how the creation of a new techno-organizational path is influenced by the dominant technological paradigm. The main argument here is that social actors start to extend their search processes for new techno-organizational solutions, if their search in the neighbourhood of the existing techno-organizational structures has been unsuccessful.

### **New Technological Paradigms and Path Creation**

By distinguishing between technological paradigms and technological trajectories, Dosi (1988) claims to account for both continuous and systemic, or regime, change. Continuous incremental changes are related to learning processes along with a technological trajectory as the dynamic aspect of a technological paradigm, while discontinuities in technological development and breakthrough innovations are associated with the emergence of a new techno-organizational paradigm.

Dosi's (1988) distinction between learning in an existing trajectory and applying a new paradigm suggests that being locked in a specific technological path is not irreversible. But the process of path creation cannot be explained by referring to single factors or simple models. The transformation of a new knowledge paradigm into a national growth path is a highly complex process involving external and internal factors. The difficulties associated with systemic transformation are quite obvious, when we consider that a fundamentally new path requires the development and co-ordination of a vast array of complementary tangible and intangible elements.

To analyse path creation processes, five building blocks that interact in the process of path creation can be distinguished (Schienstock, 2004):<sup>7</sup>

- A 'window of new opportunities' associated with a new techno-organizational paradigm,
- the prospects of new businesses and new markets,
- pressures coming from external socio-economic factors,
- key change events,
- and the human will to change things.

The existence of a window of new opportunities opened up by an emerging new techno-organizational paradigm is definitely a key factor that can stimulate a process of creating a new national path. However, new technical and/or organizational opportunities do not trigger major transformation processes automatically; economic actors are unlikely to engage in the creation, diffusion and utilization of fundamentally new knowledge without prospects for new businesses. Still, as the process of path creation entails high technical and market uncertainties, it does not generally get started without external socio-economic pressures coming particularly from the ongoing globalization process. This process triggers growing innovation competition. Radical, growth-enhancing innovations, however, become increasingly difficult to make along a traditional growth path. Additional pressures often come from key change events, such as an economic crisis or a political turmoil.

It is quite obvious, however, that the development of a new national path cannot be explained by referring to objective factors only; one also has to emphasize the importance of the human will in the path creation process (Bassani & Dosi, 2000). The path creation perspective differs from the path dependency perspective in the way in which economic actors are perceived. Rather than treating them as more or less passive observers within a stream of events, they are seen as knowledgeable agents with a capacity to reflect and act in ways other than those prescribed by social rules and taken-for-granted technical artefacts (Garud & Karnøe, 2000). Path creation is seen as a process of mindful deviation; it implies de-embedding from the structures that embed economic actors. But besides its dynamic, path creation cannot be understood as a straightforward development process; instead, it involves extended, unclear and tentative search and selection processes.

The successful creation of a new path depends on the engagement of various groups of social pioneers. Scientists and engineers with an understanding of the characteristics of the new paradigm are among those groups that can guide social and institutional creativity in a viable direction (Perez, 1997). The process of path creation also depends on the engagement of visionary policy-makers who can introduce anticipatory institutional change, particularly in the science and education system. But, of course, risk-taking entrepreneurs who trigger off a shift in common sense about the efficiency principles in an economy are necessary for the new paradigm to make its way into business reality (Perez, 1997). Schumpeter (1947), when writing on the process of creative destruction, saw the will of the entrepreneur as decisive for the creation of a new development path. Garud and Karnøe (2000) also stress the importance of entrepreneurship in the processes of path creation. Path creation, as the two authors argue, "provides a way of understanding how entrepreneurs escape 'lock-in'" (p.238).

Open economies give also external actors the opportunity to influence and shape the processes of path creation (Wicken, 2005, p.5). But the so-called 'big man theory' (Schienstock, 1975) that links the creation of a new path with specific characteristics of exceptional personalities hardly reflects the real world. Entrepreneurship is increasingly seen as a collective phenomenon. Due to the complexity of the process of fundamental techno-organizational change, path creation can better be understood as a collective and even inter-organizational undertaking, in which organizational capabilities and relational aspects are more important than individual competencies and personal

characteristics (Dyer & Singh, 1998). Empirical research supports the conclusion that entrepreneurship is a collective activity, particularly for the foundation of new industries or organizational populations, teams of individuals are critical (Schoonhoven & Romanelli, 2001).

Teams of social pioneers and innovative networks can initiate path creation activities and they can be trailblazers for the creation, diffusion and application of new techno-organizational knowledge developed within the new paradigm. But the creation and successful establishment of a new path is dependent on a successful deliberate path dependency process (Wicken, 2005, p.1). Only if the knowledge, experiences and practices developed by these social pioneers diffuse throughout the major parts of the economy and the innovation system, the process of path creation is successful. Such a collective learning process depends upon the establishment of a new institutional infrastructure that strengthens the diffusion capacity of an economy (den Hertog & Bilderbeek, 2000). Through unleashing a multitude of organizational and institutional innovations, the new diffusion capacity can contribute to the 'homing' of a growing number of economic actors onto the evolving growth path. Without the support of new knowledge diffusing institutions, the path creation process may lose momentum and its economic impact may become less significant.

The development of a new path does not occur as a sudden break from the old one. On the one hand, the development of a new techno-organizational paradigm and its transformation into a new national path takes time – and the creation of a new path, in its earlier stage, remains often more or less unrecognized; it cannot challenge the traditional paths in any way. On the other hand, old sectors, although they are likely to shrink, reducing also the influence of traditional paths in the economy, will hardly disappear in a short period of time. Instead, they will continue to develop; but they may integrate some knowledge, technologies, organization forms and institutional structures from the emerging new path.

Consequently, it might be problematic to assume the existence of a coherent national development path, particularly in a period of a shift in the techno-organizational paradigm. Instead, it is probably more realistic to argue that a nation's economy includes a multitude of paths. The emerging path does not replace the old ones; it rather becomes a new 'layer' in the wider national economic and innovation system and thereby creates increased complexity and heterogeneity. These new 'layers', however, do not represent additional economic activities separated from the old 'layers'. The new path rather interacts with old paths, and this interaction creates dynamic processes that may both transform old paths and sectors as well as shape the new path (Wicken, 2005, p.2). By continuously re-bundling assets at hand and combining them with new assets from the outside, economic actors may create a configuration that generates growth, which combines novel industries with modernized old ones (Barthelt & Boggs, 2005). Of course, such a long-term development process may also result in the disappearance of older sectors and paths.

The main achievement of the new social groups involved in the creation of a new path is that they take the techno-organizational development out of the existing path-forming structures, organize collective activities to create a new path and defend it against opposition and resistance (Garud & Karnøe, 2000, p.235). But path creation

cannot be conceptualized as a rational decision-making process; it involves vested interests and power games. The path creation period is a period of trial-and-error experimentation and confrontation between the forces of change and those of persistence, but also between different groups of modernizers, because it is widely undetermined in which direction a new path develops. The development of a new path, therefore, has to be conceived of as a 'contested terrain' (Schienstock, 2004).

## Conclusion

Techno-economic change has been a key research topic in social sciences for a long time. More recently, evolutionary economics which uses the concept of path dependency has made a major theoretical contribution to the understanding of the subject. The concept of path dependency, initially introduced to analyse regularities of technological change, has been increasingly applied to research similar patterns in organizational, institutional, and political change processes. The common assumption is that history matters. But a comprehensive understanding of path dependency requires a concept, which understands a path as a multi-dimensional concept which integrates techno-economic as well as socio-technical aspects. Analysing the interdependency of the various dimensions of path dependent change processes can be seen as an important research focus in path analysis.

The phenomenon of an inefficient lock-in, which slows down growth and endangers competitiveness, raises the question of how to get out of path dependency and how to create a new growth path. However, up to now, the relationship between path dependency and the development of a new path is hardly understood. The argument that small events by triggering a chain of further events can have major consequences and can cause the development of a new path has been criticized for ignoring the key role of agency. Concepts such as communities of practice and the niche concept have introduced an actor perspective, but empirical research has not presented convincing evidence on how path creation takes place within path dependency so far.

The distinction between a new technological paradigm and national trajectories provides a useful approach to study both path creation and path dependency within an overall framework. It is important to mention that a new national growth path develops more or less independently from the existing technological regime through the transformation of a new paradigm into a national trajectory. Furthermore, the existing institutional setting does not channel a new growth path, but institutional renewal has to take place together with the creation of a new technological trajectory. Path creation, however, does not imply a total break with the existing growth path. Instead, the new path becomes a new layer in the wider national economy and innovation system; old and new path coexist side by side, mutually influencing each other. To better understand this dynamic interaction between processes of path creation and path dependency a lot more theoretical and empirical work is needed.

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## Notes

1. These important conceptual basics have come from historical studies of technological change by David (1985) and Arthur (1989).
2. Castells (2000), for example, suggests considering - parallel to the notion of technological paths - the existence of organizational paths.
3. Evolutionary economics analyse techno-economic processes primarily in relation to economic growth.
4. The structuration theory developed by Giddens applies to social phenomena; the author does not pay great attention to the role of technology (Wyatt 1998: 20).
5. The niche concept is closely related to the concept of localized learning (Malmberg & Maskell, 2002). The argument here is that companies searching for new solutions will search locally first. Their intimate knowledge of other local firms and their capabilities is built up through past interaction. This "local knowledge greatly improves their odds of finding the right 'match'."
6. Some scholars associate communities of practice with geographical closeness and face-to-face communication; but it is also possible to understand as a group of people working closely together on a common problem as a community, without been geographically related, as long as they have intensive virtual communication and knowledge exchange.
7. Bassani and Dosi (2000, p.62) mention the following factors: the emergence of a new technological paradigm, heterogeneity among actors, the co-evolutionary nature of many processes of socioeconomic adaptation, and the invasion of new organizational forms.

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