# Introduction: On the coevolution of innovation and public policy

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Why a special issue on the coevolution of innovation and public policy? Innovation and public policy are much researched subjects and evolutionary theories have offered a very helpful explanatory framework for these topics in many scientific disciplines (Sanderson, 1990). Naturally, societies benefit from innovation as a way of generating growth. However, to enable or even steer innovation through public policy is not a simple, straightforward task. Misguided policies can waste considerable resources, including tax money, without gaining any traction. Questions about policy and innovation do not only have practical relevance, they also tap into important theoretical and methodological debates. This is particular the case in evolutionary and complexity economics. Perhaps somewhat hidden from the common foci in the scholarly debates of public administration and public policy, there is a lively debate within economics about the nature of economic systems and how this should be researched. The debate pitches neoclassical or traditional approaches against so-called heterodox economics. Our community should pay ample attention to that debate because it is one where the case for complex systems and evolutionary approaches develops quickly and profoundly.

An economic angle may seem at odds with the focus on public policy, but bear with us for a minute. Of course, economics is a social science because it focuses on the behavior of people from a scarcity perspective. Social scientists from e.g. public administration or public management may have a different approach to human behavior than economists do. But these differences aside, the common theme is behavior and its mechanisms in a dynamic society, and that is where economics and the social sciences can inform each other. Indeed, society itself can benefit from understanding the coevolutionary relation between innovation and public policy because such understanding will enhance innovative capacity, which in turn enhances the welfare distribution in society. This special issue deals with questions such as how public policies can facilitate innovation in order to change that welfare distribution, and how the evolutionary economics perspective can inform public policies by looking at complementary mechanisms that facilitate innovation. The perspective selected for this special issue will be of importance for anyone interested in public policies that promote innovation.

## Innovation and economics

The theme for this special issue has a long intellectual history. In economics, innovation, or 'creative destruction', as it was first coined by Joseph Schumpeter in 1942, refers to the "[...] process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one." (Schumpeter, 1942: 83) This innovation process replaces long-standing arrangements by new ones, whilst freeing resources to

be relocated and deployed elsewhere to seek profit. Although people may lose their jobs and companies may disappear, society will benefit from the innovations as it will be able to become more productive, thus raising welfare. That is, it is in the nature of capitalism that economic markets evolve naturally (conf. "spontaneous order" by Hayek). The idea that innovation spurs economic growth by reshaping knowledge and technology is a step away from neoclassical economics that focus on productive factor accumulation (capital and labor) for economic growth. Innovation then has impact on the macroeconomic performance as factor markets will function differently, but also impact long term growth. "At the microeconomic level, restructuring is characterized by countless decisions to create and destroy production arrangements. These decisions are often complex, involving multiple parties as well as strategic and technological considerations." (Cabellero, no year: p. 1) The analysis of decision making doesn't focus on the individuals and firms but especially on the institutional context of research, governments and society. Arguably product or process innovations take place at any moment in time, which means that a continuous restructuring of the economy would occur if no institutional barriers would be put into place. However, there are many such barriers to change, e.g. technological, economical, institutional, political, as well as with regard to specific policies such as labor safety or consumer protection. In evolutionary terminology, which relates strongly to the complexity sciences, one could speak of selection mechanisms that select certain innovations from the space of possibilities (variety) while non-selecting or stopping others.

Innovation then is propelling change in a context where certain elements are selected from a variety of options that are enabling or constraining the future space of possibilities. This is essentially an evolutionary process. From an evolutionary (economics) perspective "[...] it is argued that selection mechanisms bring to the fore techniques, organizational routines and products that are best adapted to their respective environmental contexts" (Foster & Metcalfe, 2001: 1). The introduction of this evolutionary perspective can be attributed to the works of Boulding's (1981) book *Evolutionary Economics* and to Nelson & Winter's seminal book *An Evolutionary Theory of Economic Change* (1982). The evolutionary perspective puts much more emphasis on processes, changes and structural transformations (Hodgson, 2002: xix). Persistent questions cover how selection principles operate in economic contexts and how the variety upon which selection works comes into being (Foster & Metcalfe, 2001; Dopfer, 2005). The evolutionary metaphor, once carefully reconstructed, provides the basis for the study of economic change and process (Potts, 2000: 183).

The continuously developing set of institutional arrangements and technological innovations implies that the economy is not necessarily in stasis, but is 'out of equilibrium'. That is, the economy might show every-changing novel behavior that does not appear in a steady state. The lack of stasis is due to constant disruptions coming from agents adjusting to new situations. This presents a classical theme in the complexity sciences; i.e. agents reacting to changes caused by other agents. It is ever more complex as the agents are uncertain how other actors perceive the same situation and how they might react. "Agents therefore inhabit a world that they must cognitively interpret—one that is complicated by the presence and actions of other agents and that is ever changing." (Arthur, Durlauf & Lane, 1997: 5)

In this complexity perspective structure matters because all economic action involves recurring interactions among agents. Such interactions define systems that conversely constrain and facilitate the interactions, as per Holland's thesis (1995). These multilevel interactions mean

that the traditional neoclassical perspective of methodological individualism doesn't hold anymore. The fact that these actions and interactions perform at different levels means that the reciprocal causation operates between the different levels of organization; in other words: the fundamental principle of organization is the idea that units at one level combine to produce units at the next higher level (Arthur, Durlauf & Lane, 1997: 5-6) Thus it is of interest to research how an economy emerges, grows and changes structurally over time represented by ideas about innovation, economic development, structural change, and to focus on the role of history, institutions, and governance in the economy.

All in all, evolutionary and complexity economics offer a different way of understanding innovation and public policy in the economy. It questions traditional assumptions, in particular the ceteris paribus clause. Time is an important driving factor, which implies that structures may constantly (re)form and that equilibria are temporal at best. Traditional equilibrium analyses are no longer sufficient. The complexity and evolutionary perspective "[...] gives us a world closer to that of political economy than to neoclassical theory, a world that is organic, evolutionary, and historically contingent." (Arthur, 2013: 1)

**This issue**

The article by J.W. Stoelhorst demonstrates that the evolutionary perspective, which combines the starting point of competition with the ideas of cooperative arrangements, offers explanatory value for economic progress. He builds his argument on the so-called naturalistic approach, which considers the various forms of human cooperation as products of gene-culture co-evolutionary processes and multi-level selection. It explains why human nature has evolved into being better than rational in collective action problems. Moving away from the decentralized exchange and rational self-interested choice, humans solve the collective action problems through establishing functional groups like households and firms. It creates and economic landscape of multi-level competition; within and between these functional groups. Here, organizations dominate markets; in contrast to economic theory's traditional emphasis on markets over organizations. This means that a different perspective on designing institutions that improve our welfare is needed.

Jason Potts, in the second article, focuses on that need, though from a different angle. His argument starts with the presentation of two more or less opposing views of science, economics and policy: an equilibrium approach and a complexity approach that focuses on rules. This means that there is an equilibrium-type of economics – focused on forces to move resources – and a complexity approach, that is focused on rules structuring knowledge. Consequently, (economic) policies are either focusing on reallocating resources or on redesigning rules for collective action. He demonstrates how the innovation problem from the allocation perspective implies top-down policies reallocating resources towards innovation in order to maximize some social welfare function. However, from the complexity perspective the innovation problem is a collective action problem that can be resolved with effective rules to enable agents to cooperate to pool resources and information. These emergent coordinating rules form a solution to the innovation problem: they are, in effect, policy.

The third article by Koen Frenken also argues that current innovation policies are based on two dominant frames; i.e. on market failure or systems failure. Frenken deems these two frames of reference as too narrow and too limited in the light of contemporary societal challenges. Innovation is strongly path-dependent, i.e. concerns strongly related activities instead of novel and unrelated activities. However, any economy will benefit more from a mixture of related and unrelated innovations, and requires innovation policies that facilitate both. This means that generic innovation policies can be relied upon to stimulate generic diversification, while at the same time stimulating unrelated diversification through more specific policies aimed at organizing the process of demand articulation. This would lead to clear translations of societal challenges into concrete objectives in order to build temporary innovation systems that can develop solutions bottom-up. In order to realize such innovation policies much can be learned by incorporating other disciplines, e.g. political sciences or institutional sociology.

Peter Marks and Lasse Gerrits in the fourth article take a retrospective approach and argue that policies should be understood and evaluated in terms of the coevolution between social practice and (technological) innovation. They apply this perspective to the Dutch high-speed railway case, which features a mixture of successful and less or even unsuccessful innovations in the three decades of development. Lack of success can be explained in terms of misfits between innovations and social practices.. That is, the case demonstrates that different underlying coevolving technologies as well as social practice need to be in sync in the multilevel high-speed railway innovation to reach the desired policy goals. This complexity informed socio-technological innovation perspective contrasts with traditional policy evaluations that are geared to finding the one variable that supposedly controls for all the policy problems encountered.

Together, the articles in this special present a refreshing, alternative and complexity-informed look at innovation and innovation policy. We hope that this inspires scholars in public administration and public policy, as well as practitioners eager to find the keys to successful innovation policy.

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