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Book

Beyond smart specialisation: introducing complex innovation system thinking and the will factor in regional innovation policies

Beyond Smart Specialisation: Introducing Complex Innovation System Thinking and the Will Factor in Regional Innovation Policies

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Introduction

Regions are attributed an important role in innovation policy and since at least the launch of the current funding period of the European structural and investment funds (ESIF), European regions face the challenge to conceive Research and Innovation Strategies for Smart Specialisation (RIS3). Departing from this new innovation policy paradigm, this paper addresses specific challenges for regional innovation policy making, aiming at delivering indications for supporting the related processes. It addresses questions like : How can innovation policy on the regional level define its position in the new strategy-building context? Which factors may be decisive to contribute to efficient policy-making? How can policy making be supported by new concepts and approaches in innovation research?

We can speak here of novel approaches in innovation policy and adapt findings from innovation research, especially when it comes to the issue of creativity. Following Sternberg (2008), creative achievements need to fulfil the requirements of (i) novelty, and (ii) relevance to be successfully implemented. Héraud/ Muller (2016) add a further aspect: willingness, understood as "willingness to change the world", in our context as capacity and motivation to enforce participative processes, to take risks for selecting and standing for (defending) specific specialisations, but also to observe and assess their evolution and decide about their further development.

The paper is structured in three sections. Section one sets the frame and context of our arguments and focuses on smart specialisation in European regions. It focuses on the process of identifying and selecting distinct fields of specialisation. The second part has a specific focus on regional innovation policy making and its rationales in the smart specialisation context. The third section addresses the "will factor" as crucial element for successful policies. The concluding remarks aim at synthesising the presented ideas and at producing findings of relevance for regional innovation research and policies.

1 Smart specialisation as rationale for innovation policy in European regions

Innovation policies have different traditions and histories in European regions: While focusing on (public) research in some regions or technology development in others, they have a rather application-oriented business perspective in further ones. In order to promote innovation activities in their territories, regions spend EU Structural Funds along with national and regional funds to contribute to an innovation-friendly context, to support specific research and technology fields, entrepreneurial and collaborative activities, and further measures for initiating and strengthening innovation activities. Since research and innovation strategies for smart specialisation (RIS3) were defined as ex-ante conditionality for European Cohesion Policy in the current 2014-2020 funding period (European Commission 2014), European regions passed through a process of identifying and defining their specific fields of specialisation, according to a pre-defined methodology and process.[1] The basic underlying concept was developed by academics at the end of the 2000s (Foray/ David/ Hall 2009) and was then integrated into the

[1] Support was provided by the Smart Specialisation Platform at http://s3platform.jrc.ec.europa.eu/. See also European Commission (2012).

European Commission's rationale of regional policy and its contribution towards implementing the Europe 2020 strategy (European Commission 2010). In a vertical intervention logic, it addresses the identification of most promising activities for competitiveness (technologies, fields, sub-systems) within a region, which may complement horizontal measures favouring the general framework conditions and capabilities for innovation.

The "inventors" of this concept suggested to identify a territory's strong scientific-technological fields in the course of an 'entrepreneurial process of discovery', understood as "...a learning process to discover the research and innovation domains in which a region can hope to excel" (Foray/ David/ Hall 2009: 2ff.).

The expression entrepreneurial discovery process was borrowed by Foray from Kirzner (1997). Quoting Schumpeter about an evolutionary approach is a conditioned reflex for most innovation researchers, but the Hayek-Kirzner evolutionary approach is in a way more system-oriented than the Schumpeterian model - and particularly relevant in our case. The entrepreneur explores the market and reveals it, builds innovation by interacting with the market, all in a very "serendipitous" way.

Contrary to policy plans or foresight activities guided by individual experts, this discovery process involves "entrepreneurial actors" to be at the core in order to resort to localised information, tacit knowledge and social capital. The process of entrepreneurial discovery receives a core position in this overall context because it does not solely focus on scientific and technological knowledge, but combines it with market-related knowledge, i.e. concerning development and growth potentials, competition and necessary additional knowledge and competencies to initiate and develop the activity in question.

The smart specialisation concept attributes public policy a threefold role: (1) to support entrepreneurial discovery, including suitable conditions for the process to take place or incentives for regional actors (entrepreneurs, research institutes, universities) to participate in the process of discovering regional fields of specialization, (2) to assess and evaluate the outcomes of the process and conceive strategic conclusions, and (3) to strengthen emerging trends including identifying complementary fields of investment in order to best possibly promote the specialization fields (education, access to external expertise, R&D support in the pre-competitive phase, etc.). This includes the role of risk-taking for selecting fields of specialisation, of initiating and mediating the process of identifying and selecting suitable fields and of pushing the subsequent implementation and assessment process (Foray/ David/ Hall 2009: 4, Foray/ David/ Hall 2011: 10ff., Foray/ Goenaga 2013: 3).

2 Introducing complex innovation systems in smart specialisation processes

As Foray (2014: 493ff.) shows, the challenging task of identifying priorities and thus fields of specialisation is not primarily a policy process; there are various examples of spontaneous processes of entrepreneurial discovery processes in absence of policies. However, since this is not the usual case, policy is asked to launch and accompany the process of selecting and supporting fields of specialisation in their territories, with the final aim to concentrate territorially available resources and competencies in fields that develop into promising structures for regional transformation.

In order to be able to go beyond what has been displayed so far, we propose to introduce one further dimension in the line of reasoning, i.e. to integrate the "systemic complexity" of innovation systems. This seems coherent with Foray/ Rainoldi (2013: 2) asserting that "However, it [smart specialisation] cannot incorporate all the complexity of regional development issues nor become an illusory all-in-one solution to fostering regional growth."

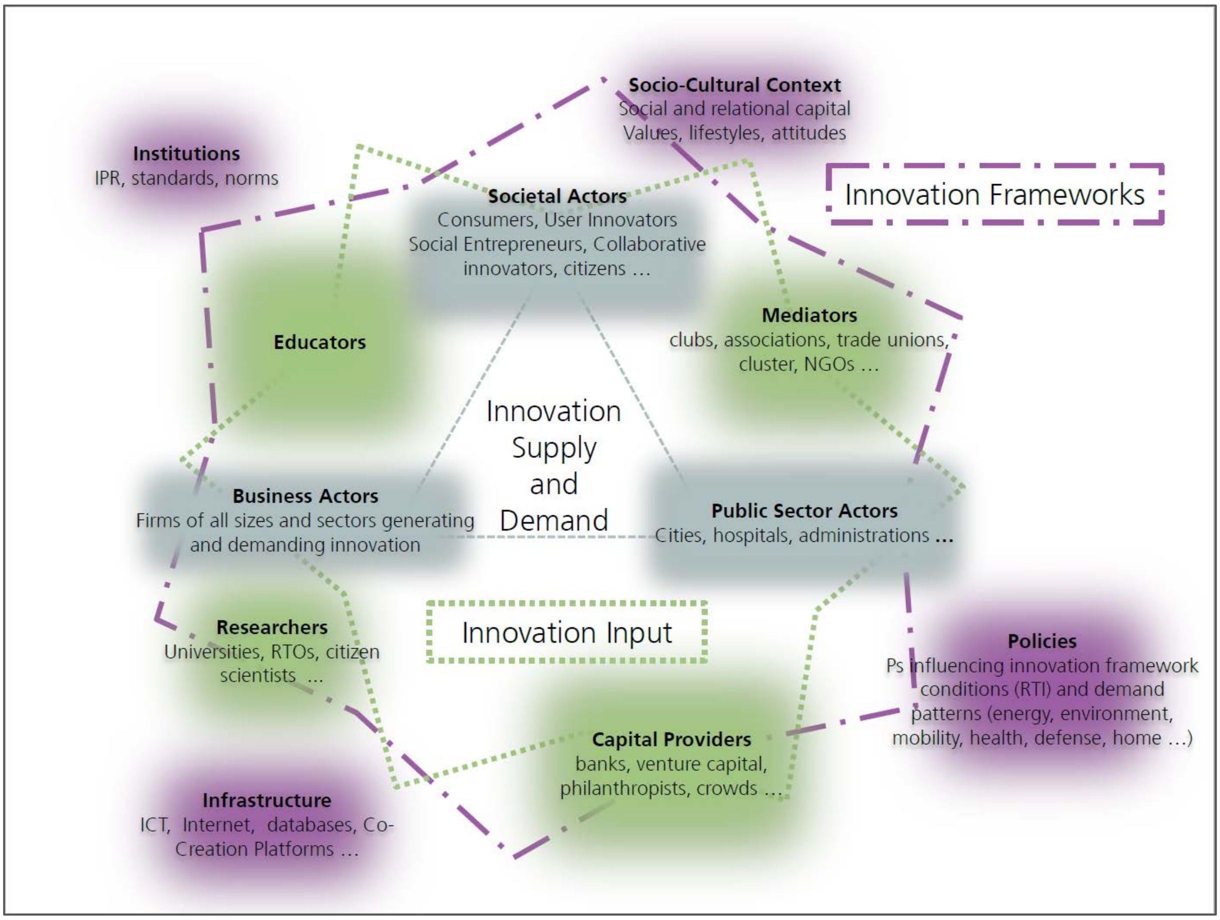
The systems perspective has been discussed in innovation research since the 1980s, for instance in the frame of conceptual or comparative analyses written and / or edited by scientists like Richard Nelson, Christopher Freeman, Bengt-Åke Lundvall and many others. Their work was referring to innovation and innovation systems on the national level, leading to further develop this approach on the level of technological (e.g. Dosi 1988), sectoral (e.g. Malerba 2002) and regional (e.g. Cooke 1998, 2004) innovation systems. All these analyses have in common to be rooted in the evolutionary economics framework that refers to the pioneer works of Joseph Schumpeter, his concept of "creative destruction" and the resulting reflections on innovation types and business cycles.

As such, the evolutionary economic paradigm constitutes the framework in which system models of innovation are rooted. They consider innovations as activities that go beyond the boundaries of individual firms, including relationships to other economic actors, surrounding institutions and the general framework in which innovation takes place. Referring to innovation systems' complexity, Katz (2006: 893, based on Kline and Rosenberg 1986) describes innovation systems as being "... composed of individuals and organizations that directly and indirectly invest time and energy in the production of scientific and technical knowledge. This knowledge flows and recombines in complex ways". He derives the propensity for scaling properties – understood as power law correlation between variables - as common feature of all complex systems (Katz 2006: 894/895).[2]

Following this line of reasoning, various innovation system analyses (on the conceptual and the empirical level related to national and regional economies) have been conducted in the past decades. Attempting to consider and incorporate new developments in the innovation phenomena, a revision of the innovation system framework was published by Warnke et al. (2016). This revised concept refers to a broader range of actors, institutions and innovation modes and distinguishes three types of innovation contributions: (1) innovation supply and demand, (2) innovation influx, and (3) innovation framework. Contrary to former analytical approaches, this new framework aims to emphasise the increasing blurring and "fluidity" between actors and functions, leading to consider that a specific innovation actor is not restricted to a specific function in the innovation process. The new model is not only based on a broad understanding of innovation in the sense of "..."novel solutions" that are successfully embedded into society be it new technologies, products, social practices, processes and concepts" (Warnke et al. 2016: 32), but also considers multiple roles and functions of different actor groups (see Figure 1).

2 „Intuitively we know that innovation processes and the systems in which they are embedded must be complex and adaptive. If we assume they are complex then we expect them to exhibit scaling properties." (Katz 2006: 897).

Figure 1: A new analytical framework of an innovation system



Source: Warnke et al. (2016: 33).

Evolutionary economics and complex system research have some common elements. They abstract from basic principles on which "traditional" (neoclassical) economic theory is based, and they tend to rather have a bottom-up (and interactive) character. Basic principle of complex systems research and modelling is to consider so-called building blocks at low system levels that produce effects through interactions. Translated to innovation system research, this would mean to include various different types of actors and to consider multiple interactions among them. Due to the non-linearity of interactions, the abstraction from rational behaviours and complete information as well as from the equilibrium assumption, the results of these interactions are not straightforward; they present so-called emergent phenomena:

Foster (2004: 5ff.) brings forward the argument that there is no unique definition of complex systems in the various fields of domain, and pleads for classifying those systems according to their order of complexity. He distinguishes between (1) first order complex systems in chemistry, describing energy inflow and impact on elements; (2) second order complex systems that are capable to absorb information and to transform it into knowledge which leads to control the acquisition of energy (e.g. biological systems: genetic encoding of knowledge, selected through experience; in parallel: non-genetic knowledge acquisition through experience); (3) third order complex systems that interact with their environments on the base of images or representations of the world, thus on mental models. Systems of this kind include feedback processes with reality; system adaptation to the environment is not a mere process of selection anymore, but includes creative processes; and (4) forth order complex systems based on the interaction of mental models, leading to commitments for future activities and for cooperation.

As a consequence, the increasing degree of complexity is strongly shaped by knowledge and connectivity, and natural selection is mediated by experience and imagination (of possible future processes): thus, the evolution of socio-economic systems is less the result of "Darwinian" selection, but, to an increasing extent, the result of novelty and selection of ideas. This view is congruent with evolutionary economics and innovation research: innovation yields novelties from which the successful ones are selected and contribute to forward system evolution. This, in turn, inevitably leads to evolutionary processes of the system – or evolution based on creative destruction, as Schumpeter termed it.

3 The will factor as an emergent property of smart specialisation strategies and entrepreneurial discovery processes

In this section, we argue that (regional) innovation systems should be seen as complex systems since they are based on complex behavioural patterns. The crucial issue to be addressed is the following: If innovation systems are complex systems, what are the mechanisms that explain the mobilization and alignment of resources in an innovative direction? Even more important, when it comes to smart specialization: should it be expected that the will factor required for entrepreneurial discovery processes is an emergent property from a complex (regional) innovation systems view?

At least two aspects play a crucial role in this context: First of all, the underlying assumptions of (neo-)classical economics are replaced by characteristics like humans' opportunistic behaviours, uncertain context conditions such as complex and unstable production environments, evolving structures, learning processes and so forth (see for instance Simon 1957). Scholars in evolutionary economics assume that complex economic processes characterized by variety, technology development, firm evolution, etc. are embedded in and interrelated with dynamic and uncertain contexts (cf. Boschma and Frenken, 2011).

The second aspect to be considered refers to individual (innovation-related) actors and their 'views of the world'. It cannot be assumed that the totality of 'elements' in a system (here: innovative actors) behave in the same way, thus acting as a kind of 'uniform crowd', but that every individual has rather built up his/her individual model of the surrounding world. In short: human beings perceive the world in a specific way and create individual mental models of their surrounding which, in turn, strongly guide their behaviour (e.g. Johnson-Laird 1983). It can be assumed that members of the same system have converging views of the world (again compared with members of other systems, cf. for instance Stamboulis 2008).

Nevertheless, as soon as we talk about smart specialization we must consider changing systemic conditions in the meaning of a realignment of goals, resources, actions, etc. The case of ants, which is quite often quoted as an illustration for better understanding why and how complex systems matter in economics (cf. Kirmann 2010) provides a good example in this respect. Ants are considered by researchers in system theory as individuals that are able to reach goals thanks to their impressive capacities to solve mathematical problems such to find an optimal route to a food source as a group. Nevertheless, it appears at first glance quite surprising that there are always some ants that do not follow this route and that seem to choose non-optimal routes. In fact, as soon as the “main and optimal” route can no more be followed due to the apparition of an obstacle, "new paths" resulting from the exploration by "scouts" or "deviant ants" are quite rapidly adopted by the whole group.

In the case of human individuals acting inside (regional) innovation systems, the equivalent of this kind of biologically induced atypical of deviant behaviour can be designed as "will factor" (in the meaning of Héraud/Muller 2016). In other words, individuals conceive their actions not only on the base of knowledge and learning processes, coupled with optimisation mechanisms in order to achieve best possible solutions. Following Foster (2004: 14), those processes are strongly influenced by emotional drivers such as satisfaction and excitement: "It is variety, creativity and learning that we enjoy (disequilibrium adjustment in the standard story) not an optimized steady state."

There are parallels to smart specialisation and particularly the entrepreneurial discovery process. Its precise meaning is the following: the entrepreneurial discovery process "is basically economic experimentation with new ideas", the latter coming to a great extent from scientific discoveries or technological inventions, but it is linked to the more general notion of "entrepreneurial knowledge", i.e. knowledge about market growth potential, potential competitors, and the whole set of inputs and services required for launching a new activity.

Turning to decision criteria for making selections based on various options, Sarasvathy’s (2001: 251) contrasting view on causation and effectuation seems helpful. Causation processes help to choose between means to achieve a given effect, whereas effectuation processes help to choose between possible effects that can be created with given means. Therefore, in the first case, a relative novelty is expected in terms of technical or organizational ideas, but in the second case, the stress on novelty is more important since it aims at future goals. Another aspect mentioned by the author is the type of outcome: market share in existing markets (through competitive strategies) in the case of causation; new markets (created through alliances and other corporative strategies) in the case of effectuation. The degree of novelty is obviously higher in the second case.

The selection criteria are based on expected returns in causation processes, and more on affordable loss or acceptable risk in effectuation processes. Concerning the will factor, it can be broadly defined as a set of effectuation processes that require a very strong commitment of the leaders. Concerning causation, we talk about the predictable aspects of an uncertain future while we talk about controllable aspects of an unpredictable future with respect to effectuation. In other words: predictability is about knowledge; control rather expresses the willingness and the entrepreneurial spirit.

Table 1 presents an overview of regional policies in the traditional sense and on innovation policies incorporating entrepreneurial discovery. It becomes clear that “traditional policies" are oriented towards efficient procedures targeting pre-defined goals while entrepreneurial discovery is rather linked to insecurity, experimentation and creativity. In this case, the goals are open. In order to proceed on this latter path, policies need a strong degree of willingness and assertiveness to “leave established paths”.

Table 1: Traditional regional policies (based on optimization rationality) vs. entrepreneurial discovery (based on will factor)

Traditional regional policies*:* *Exploitation, relevance, causation*	**Entrepreneurial discovery***:* *Exploration, novelty, effectuation*
Realization	Imagination
Implementation	Design
Efficiency	Curiosity
Planning	Serendipity
Procedural selection	Experimental variation

In this respect, the will factor plays an evident role in such a territorial strategy of smart specialisation. If properly understood, regional smart specialisation exercises are not bureaucratic top-down analyses defining a priori opportunities and relative strengths, but interactive processes with local entrepreneurs and further stakeholders. The entrepreneurial discovery process means more than the selection of existing well-known technological or sectoral opportunities. It is an evolutionary mechanism with experiences spread across time like in the effectuation theory. Therefore, decision-making needs the willingness of individual actors, instead of bureaucratic and causal selection processes.

Table 2 gives insight into the three core dimensions of the will factor that could be expected as an emergent property of complex innovation systems corresponding to the rationale of smart specialisation strategies. According to our hypotheses, these three dimensions could be the following: at first desire and determination, then decision-making and finally competencies and skills.

Table 2: Main characteristics of the will factor as an emergent property of systems following the smart specialisation logic

Core dimensions affecting the will factor:	**Smart Specialization Strategies**
(1) Desire & determination	Pushing forward new ways of territorial development Avoiding lock-in situations and/or declining trends at regional level Reshuffling the cards in allowing new combinations of resources
(2) Decision making	Entrepreneurial discovery process (in the meaning of Foray *et al.)* Evolutionary selection between techno-scientific and sector-related fields
(3) Competencies & skills	Convincing the (mostly) regional actors to adopt new forms of cooperation Creating confidence and policy support in the process of emergence of (mostly unexpected) ideas

Conclusion

The objective of this paper was to revisit the notion of regional systems of innovation in order to propose a new approach of public policies that could be highly relevant by integrating a real dimension of collective creativity. The entrepreneurial discovery concept of smart specialization strategy (S3) is in line with this project, as far as it is interpreted in the meaning of Dominique Foray and his colleagues, not understood in a bureaucratic way. The bureaucratic top down interpretation consists of selecting the priorities for public actions on the basis of strengths, weaknesses and opportunities of the territory as they can be "observed" by experts that are external to the process of innovation. Such a procedure supposes the existence of a regional system that can be piloted from the outside (an open system in the sense of the theory of systems). The corresponding policy is the "causal" expression of a project logically constructed from the assigned objectives. To the contrary, a creative policy supposes the adoption of an "effectual" philosophy in the sense of Sarasvathy (2001).

A smart (creative) way to design a regional innovation policy would consist of considering the complex local system in constant evolution and in interaction with the external environment. The complexity of the regional system is mainly defined by the constant interaction of micro subsystems like innovating firms and networks with the macro (regional) level. Each micro actor has its own representation of the system it belongs to. In order to efficiently manage the global system, it is necessary to take into account those micro representations. The governance structure must be aware of the fact that the elements of the system are not behaving like ants or programmable logic controllers: they are strategic actors who act and interact on the basis of their representations of the global system and its governance. We must even go a little further into this logical consideration: micro actors must be associated with the governance since individual entrepreneurs - innovators in the sense of Schumpeter - carry the future of the system. The vision of decentralised actors is a significant part of the definition of the territory's future.

In the framework of such dynamic complex systems of innovation, the concept of "entrepreneurial discovery" applied to public policy means to let micro actors develop their visions and experiment products and processes on local and external markets, and then to select the projects that look particularly relevant to support. In this respect, our conclusion is that economics of innovation is not only economics of knowledge. Involving and supporting entrepreneurship is as important as stimulating knowledge creation and diffusion.

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