

Bateira, Jorge

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## Conceptual foundations of innovation systems

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# Working Paper Series

## Conceptual foundations of innovation systems

Jorge Bateira

Manchester Business School Working Paper No 588

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The University of Manchester  
Booth Street West  
Manchester M15 6PB

+44(0)161 306 1320  
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## **Author(s) and affiliation**

Jorge Bateira  
Manchester Institute of Innovation Research (MloIR)  
The University of Manchester  
Harold Hankins Building  
Booth Street West  
Manchester  
M13 9QH  
Tel: +44 161 275 7368  
Fax: +44 161 275 7361

## **Abstract**

“Production” and “transfer” of knowledge, and the role of institutions, are two major conceptual tenets of Innovation Systems (IS) literature, which flourished in the evolutionary stream of economics since the eighties of last century. Building on results of different disciplines, the paper critically discusses ‘knowledge’ and ‘institution’ concepts used in that literature and presents alternative meanings supported by emergentist ontology of persons, social and cultural phenomena. The paper discusses how such conceptual framework matters for the analysis of innovation processes and what are its policy implications.

## **Keywords**

Innovation systems, knowledge, institutions, evolutionary economics

## **JEL Classification**

O31; D80, B52

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# Conceptual foundations of innovation systems

Jorge Bateira

Manchester Institute of Innovation Research (MioIR)  
The University of Manchester  
Harold Hankins Building, Booth Street West  
Manchester M13 9QH, UK

Tel: +44 161 275 7368; Fax: +44 161 275 7361

[Jorge.Bateira@postgrad.manchester.ac.uk](mailto:Jorge.Bateira@postgrad.manchester.ac.uk)

## Abstract

“Production” and “transfer” of knowledge, and the role of institutions, are two major conceptual tenets of Innovation Systems (IS) literature, which flourished in the evolutionary stream of economics since the eighties of last century. Building on results of different disciplines, the paper critically discusses ‘knowledge’ and ‘institution’ concepts used in that literature and presents alternative meanings supported by emergentist ontology of persons, social and cultural phenomena. The paper discusses how such conceptual framework matters for the analysis of innovation processes and what are its policy implications.

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## 1. Introduction

Following Nelson and Winter's (1982) evolutionary critique of neoclassical view of technical change and economic growth, there emerged a strand of economics reclaiming an evolutionary orientation (Cantner and Hanusch, 2002). Assuming this affiliation, by the mid-1980s first appeared the concept of National Innovation Systems (NIS) in relation to industrial policy debates, which gained prominence in the beginning of 1990s with the works of Lündvall (1992), Nelson (1993) and Freeman (1995), which developed into a varied literature exploring different approaches (Balzat and Hanusch, 2004; Sharif, 2006). The concept also became readily connected with different theoretical approaches to, and policy concerns with, territorial development, which ultimately gave rise to the concept of Regional Innovation Systems (RIS) (Braczyk *et al.*, 1998).<sup>1</sup>

In the present paper I address methodological issues that are common to different strands of "Innovation Systems" literature. As Balzat and Hanusch (2004: 206) have acknowledged, the linkage of those concepts to economics' evolutionary school requires more research "if the theoretical foundation of the notion of innovation systems is to be taken seriously." The paper takes this challenge and critically discusses three major tenets of the Innovation Systems (IS) literature: the concepts of *knowledge*, *social system* and *institution*. For that, I adopt a point of departure that is radically different from mainstream economics and also diverges in important aspects from the most salient 'brands' of evolutionary economics. In brief, I assume: a 'process' rather than 'substance' metaphysics; a multi-layered ontology, rather than physicalism or dualism; an interactivist-constructivist

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<sup>1</sup> This paper is focused on the National and Regional strands of IS literature. Other strands (technological, sectoral) are left aside in the discussion although much of what is said also applies to them. Further, the term 'region' is used in a broad sense, which includes territories that do not have political powers but whose socio-economic structure, and cultural and civic dynamics could make them evolve into that stage. For the remaining territories at a sub-national level I use the term 'local'.

epistemology, rather than a ‘mirror’ epistemology, which on the overall constitute the foundations of what I have called elsewhere a ‘Naturalist’ approach to human and socio-cultural phenomena (Bateira, 2006a).<sup>2</sup>

Certainly, mainstream economics goes beyond neo-classical economics taking account of the absorption of ‘game theory’ concepts and the integration of a New-Institutionalist strand. However, New Institutional thinking is basically static; it is an economics of resource allocation, and therefore it is inadequate to capture the dynamics of the economy where human creativity is the fundamental source of novelty (Metcalf and Ramlogan, 2005). On the other hand, the use of rational choice theory to explain human behaviour, and the simplistic understanding of institutions as a set of “coordination rules”, makes the New-Institutionalist wing of mainstream economics an inadequate framework for the study of social phenomena, particularly the study of socio-economic development (Archer, 2000; Chang, 2005; Hodgson, 1999). Instead, I will argue that evolutionary economics needs to assume the specifics of socio-cultural reality, and to ground the understanding of its dynamics in consistent articulations with the contemporary results of human, social and natural sciences. This new approach leads to better insights, both at a theoretical and policy level, than either mainstream ‘endogenous growth’ theories—sometimes well accepted in some evolutionary quarters (Cf. Balzat and Hanusch, 2004)—or the Schumpeterian stream that outstands in this literature (Edquist, 1997).

The paper is organised as follows: the next section presents in broad lines current evolutionary economics’ understanding of knowledge in the IS

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<sup>2</sup> Here the term ‘Naturalist’ does not equal to ‘materialist’ or ‘physicalist’. It is used in the sense that the ontological diversity of reality is the actuality of an originary and unitary process labelled Nature. In a convergent sense, see the “unified ontology” proposed by Smith (1999: 96): “physical objects and events, mental activities, persons, societies, and cultural institutions all occur in this one world of nature.”



literature, which is followed by a critique from an Interactivist-Constructivist (I-C) perspective of human cognition that connects with the Pragmatism of Charles S. Peirce and the developmental psychology pioneered by Piaget and Vygotsky. In the third section I present an emergentist understanding of institutions in line with a emergentist ontology of socio-cultural phenomena that, I argue, should inform economics if we take it seriously as a field of social science. The fourth section explains why and how such a Naturalist approach makes a difference in policy issues. The paper concludes that societal development calls for a participatory multi-level style of policy-making, which is seen to evolve with the meta-institution state.

## **2. Knowledge and evolutionary economics**

The evolution of economic science is strongly tied to the different ways it has understood human beings and their relation to the world (Davis, 2003). This means that economics' conceptualisation of human knowledge, in the sense of more or less elaborated representations of reality, have been different in time and according schools of thought. Taking account that innovation studies in economics usually assume an evolutionary affiliation, in this paper I set aside the reduction of knowledge to a commodity (R&D "designs"), which is typically assumed by New-Growth Theories,<sup>3</sup> and concentrate my discussion on the way knowledge is currently treated in the IS literature, even if in some texts there are sympathetic connections (not to say overlaps) between both strands.

### **2.1 Algorithmic minds, codified knowledge**

Against the understanding of knowledge as a stock-like variable, Machlup (1984) argued for a distinction between information and knowledge, the latter being inherently subjective ("a state of mind"). Such distinction is

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<sup>3</sup> For a critique of NGT from different perspectives cf. (Fine, 2000), (Foss, 1998) and (Martin, 1999).

worth to be discussed taking account it became widely used in modern evolutionary economics. Another important source of reconsideration of knowledge in economics came from the seminal work of Nelson and Winter (1982), which exerted a strong influence by highlighting the importance of Michael Polanyi's (Polanyi, [1966] 1983) analysis of human knowledge. Building on that work, different streams of heterodox economists joined other social scientists to adopt the concept of 'tacit knowledge', although in most cases ignoring both the original formulations of Polanyi and his ontological and epistemological framework. In fact, Polanyi did not conceive of two types of knowledge, 'tacit vs. codified'; rather, he discussed *a unitary process of knowing* that always needs a "tacit dimension". Contrary to the diffused view that tacit knowledge is confined to practical skills, Polanyi argued that even scientific knowledge (including mathematics) is rooted in a process of tacit knowing, just as any other human activity. But the wrong interpretation took a life of its own and soon became entangled with computer-inspired concepts diffused by the influential work of Herbert Simon (Newell and Simon, 1972), thus becoming economics' reading of cognitivism.

Also connecting with (Nelson and Winter, 1982), NIS literature presents a new conceptual framework for the study of capitalism dynamics by putting national sources of scientific and technological knowledge, and the broad "institutional set up", at the core of economic growth processes. The NIS literature argues that there are national specificities regarding structure and functioning of markets, firms' technological capabilities, institutions, and mechanisms for selecting and diffusing innovations. In the words of Gregerson and Johnson (1997: 482):

The idea that lies at the centre of the concept of innovation systems is that the overall innovation performance of an economy depends not only on how specific organizations like firms and research institutes

perform, but also on how they interact with each other and with the government sector in knowledge production and distribution.

In this definition there are two important concepts that I will discuss below: the nature of human knowledge, and the systemness of innovation processes. I begin with the first. Some authors have explicitly acknowledged that the IS approach draws on evolutionary economics (Cooke et al., 1998; McKelvey, 1998; Saviotti, 1997). Differently from neo-classical economics, the following three assumptions are usually assumed in the literature: (1) the heterogeneity of agents in cognitive and behavioural terms; (2) the dynamic nature of economic systems, thus involving open-ended processes and uncertainty, but also path dependency; (3) a broad analogy with biological evolution, which usually means a population approach based on the Darwinian triplet “variation-inheritance-selection”.<sup>4</sup>

Within the IS literature it is common to invoke biological evolution as a source of inspiration, and at the same time also stress that there is no mechanical transfer of concepts into economic analysis.<sup>5</sup> In doing so IS literature attempts to preserve the specifics of socio-economic reality, which is a valuable aim. The problem is that, by lack of inter-disciplinary discussion and methodological reflection, it has fallen into the opposite extreme and created a sharp divide between its theories and the results of other sciences, which is manifestly evident in what concerns the understanding of knowledge. See for instance the following statement (Saviotti, 1997: 192):

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<sup>4</sup> For a comprehensive discussion of the biological metaphor cf. (Hodgson, 1993). Here I need to acknowledge that while Hodgson now goes beyond metaphor and argues for a broad ontological analogy, a few authors in the evolutionary camp disagree with his stance and prefer the analogy with self-organising physic-chemical systems (Cf. Foster, 1997, 2005). See below my attempt to overcome this opposition.

<sup>5</sup> (Cf. Saviotti, 1997: 183): “Biology can be a very powerful source of inspiration for evolutionary economics, but in the sense of allowing us to formulate new questions and problems and not in providing biological answers to economic problems.”

Innovation systems are very knowledge intensive. (...) These different types of knowledge are often created and transmitted by different types of institutions, but they have to be combined into the production of final outputs.

It is important to observe that expressions such as “types of knowledge”, “knowledge combination”, “flows of knowledge” and similar ones, all point to the reification assumption: knowledge is a ‘thing’ that can be accumulated and transferred. In a similar vein, McKelvey (1998: 203) states: “In order to avoid confusion, we can distinguish between ‘information’ which exists independent of receiver/transmitter and ‘knowledge’, that is, information which has been translated so that humans understand it.” Like many authors, McKelvey accepts that knowledge is subjective (“an interpretive structure”) although, with recourse to linguistic codes, we may convert it into “information”. Thus, it is easily assumed that linguistic communication transmits “codified knowledge”.<sup>6</sup>

The above-mentioned understanding of knowledge and information is framed within the cognitivist psychology of Herbert Simon dating back to the fifties of twentieth century. The fact is that current neurobiological research (Cacioppo *et al.*, 2000; Damasio, 1999; Freeman, 1999) does *not* support the idea that cognition (and the whole mind) is the outcome of neural symbolic computations running upon information ‘collected’ by human senses;<sup>7</sup> rather, as discussed below, it is *a constructive process that emerges* in the person from its interactions with the world (Bickhard, 2000). Traditionally, cognitivist psychology draws on first-wave Artificial Intelligence (AI), labelled *symbolic computation*, which in the last decades

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<sup>6</sup> Besides the distinction between information and knowledge, these authors usually refer to “tacit knowledge”, a residual type of knowledge that cannot be codified. In fact, they blindly follow the misreading of Polanyi ([1966] 1983) made by Nelson and Winter (1982). On this point cf. (Bateira, 2006a).

<sup>7</sup> Usually this literature is not aware that the term ‘information’ is problematic; it is used with different meanings in different sciences and paradigms. For a discussion that connects with the approach here argued, see (Brier, 2006) .

has been subject to the critique of AI *connectionism* (Cilliers, 1998). Evolutionary economists' uncritical adoption of the computer metaphor leads much frequently to the use of expressions such as "knowledge accumulation" or "retrieval of knowledge" in memory, the latter viewed as a container in the brain. Because metaphors and analogies are crucial for our social life, which includes science (Lakoff and Johnson, 1999; Lopez, 2003), we should care about their adequacy and implications. Actually, the computer metaphor underlies the flawed understanding of knowledge, which is mostly based on *three problematic assumptions*: knowledge processes are of algorithmic nature (mind as 'software' running on the brain, the 'hardware');<sup>8</sup> most knowledge can be made explicit by linguistic codification and made public as information; non-codifiable, tacit knowledge appears combined with explicit knowledge in variable degrees.<sup>9</sup> As I discuss in the next section, the problem is that none of this is acceptable in light of converging scientific research in the last two decades.<sup>10</sup>

## **2.2 Personal knowledge and culture**

At the outset it is necessary to stress that human beings are deeply rooted in the evolutionary process of Nature, not only by their biology but also by their minds (Donald, 2001). Taking account of this integration, we should

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<sup>8</sup> See, for instance Hodgson (2004: 423; emphasis mine): "To think and act in social and natural environments, some initial guidances and predispositions are necessary to identify key stimuli and trigger appropriate responses. Once the limited interconnectedness of a rule-system is in place, further habits and rules can be compounded onto this structure."

<sup>9</sup> This third assumption is not always evident in the literature but it has been increasingly recognised by leading authors in order to address the critique of dichotomous thinking. Cf. (Lündvall, 2004).

<sup>10</sup> Here it is relevant to note that Richard Nelson is now distant from cognitivist psychology. See for instance the following statement (Nelson, 2000: 142): "evolutionary economic theories (at least our kind) seem to be merging with the more recent articulations in cognitive science, and with developments in evolutionary epistemology, regarding the nature of 'human knowing' and 'learning'. I am struck, for example, by the consonance of my views on these matters with those of Merlin Donald in his *Origins of Modern Mind* (1991)." Cf. also (Nelson and Winter, 2002).

see human cognition as an evolved capability of mind that operates in intimate relation with the overall dimensions of person, which beyond the body (*not only the brain*) includes the natural and social environment (Cacioppo *et al.*, 2000; Christensen and Hooker, 1999). Humans are not born with ‘predetermined structures’ in higher cerebral centres that ‘encode’ neural signals coming from the periphery (Dupré, 1999); neither do we ‘encode’ our thinking into linguistic communication (Bickhard, 1987). Each human being develops in interaction with the world, and the meanings he constructs along life come from a complex process involving neural networking, hormones, emotions, imagination, and socialisation. In brief, knowledge belongs to the continuous flow of a personal experience (Bickhard, 2004b; Martin, 2003); it is an emergent, *personal sense-making process*. Therefore, rather than “encoded knowledge”, *language is a materially supported system of signs* (a historically evolved symbolic tool) we learn to use in order to manage our relations to the world. Certainly, we engage in communications and this is the most important way we learn to live in the world. But, through an act of communication I do not ‘send’ information; I use linguistic signs, which enter a semiotic process within which they become *interpreted* by persons who have lived personal experiences similar to mine, including the learning of the same language, thereby internally relating to those signs the same *public meanings*.<sup>11</sup> The latter emerge in a stable community, through interactions along time, upon different meanings internally constructed by each person. How can we understand this process?

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<sup>11</sup> On this I am not far from the formulation of Metcalfe and Ramlogan (2006: 11) : “knowledge is always hidden it is always private and discussion of its tacit or codified nature is simply misplaced. However for knowledge to lead to social and economic action it must to a considerable degree be shared across individuals; there must be understanding in common so that the same questions or instructions elicit sufficiently similar responses for co-operation to take place whether in the production system or more generally.”

I have summarised elsewhere with some detail what I see as the best, currently available understanding of knowledge, the Interactivist-Constructivist (I-C) approach (Bateira, 2006a). In brief terms, cognitive functions of human beings have a regulatory process that provides normativity to the mental representations of the world (Christensen and Bickhard, 2002). This means that through positive and negative feedback/feedforward mechanisms, individuals ‘register’ internal differences about their performance in interactions with the environment, which progressively enable the emergence of *cognitive first-order invariants* about what really works. Therefore, “the appropriate criterion for what is fundamentally *real* [for the individual] will then be what is *invariant* across all [his/her] points of view. Thus we regard three-dimensional physical objects as real” (Hooker, 1995: 75; emphasis mine). This process corresponds to the emergence of *personal* knowledge about the world, which is (internally) constructed in interaction with the latter. At the same time, through long-term interactions, human communities settle what cognitive invariants are needed to live together, which gives rise to *second-level invariants*, that is, invariants of persons’ cognitive invariants. In this way there emerges a new kind of reality whose elementary elements are ‘public meanings’, that is, *meanings taken in a first person plural perspective beyond and above personal meanings*. Actually, the emergence of such second-order patterns, and their networks/systems, amounts to what is usually labelled *culture* (Adams and Markus, 2001), a process that is different but parallels and intertwines with the emergence of *social systems* (Archer, 1988).

At this point I want to emphasise that my understanding of culture is much different from Karl Popper’s (1972) “objective knowledge”, which referred to language-based cultural artefacts such as books. By lack of a semiotic perspective, Popper failed to see that (*per se*) the material record of human

discourse only amounts to signs; it is not knowledge. Those signs stand for the socially regulated public meanings (*epistemic invariants*) that have emerged through communication since the emergence of human beings and their communities, and then reproduced in each new generation (Wight, 2004). Obviously, this gave rise to a formidable *accumulation of scaffolds* for human cognition thereby enabling literate individuals to access public meanings without a personal interaction. As a symbolic tool, written language has enormously reduced the costs of developing new knowledge, personal and public. Accordingly, the role of new ICT in contemporary societies should be understood in the following terms: *we need both face-to-face interactions for emotionally rich, embodied communications, which create bonds and public meanings, and hence give rise to social structures and cultural elaboration; at the same time, we cannot dispense with cultural objects that enormously scaffold cognitive processes, including memory, and support time/space large scale interactions.*<sup>12</sup>

To conclude: in order to enable a better grasp of what occurs in science and technological activities, I am suggesting that the IS literature should abandon the cognitivist paradigm, which lacks support from current research in neurosciences, developmental psychology, and embodied semantics. Instead, a Naturalist approach to human nature, which points to an emergentist connection between personal meanings, semiotic processes and public meanings/culture appears more apt to overcome opposing views in debates such as the role of geographical proximity in innovation processes (Rallet and Torre, 1999), or the role of institutions in economic development (Chang, 2005; Nelson, 2006). In the next section I use the

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<sup>12</sup> In this paper I adopt the semiotic scheme proposed by the founder of Pragmatism, Charles S. Peirce, for whom a text is a dynamic process of inter-relating entities: (1) linguistic signs materially inscribed; (2) first-order cognitive invariants, personal meanings; (3) second-order cognitive invariants, public meanings, which are re-presented by linguistic signs. Of course Peirce's semiotic entails a complex metaphysics that is not easy to follow. For a good introduction see (Short, 2004).



above-presented view of personal knowledge and culture to provide a new understanding of institutions.

### **3. Institutions, organisations and culture**

Interactions between firms (supplier-customer relations), and between firms and universities, are seen in the IS literature as crucial determinants of economic innovation (Lündvall, 1992; Nelson, 1993). Much recently, the analysis has been extended to the so-called “triple helix” model (university-industry-government) “to take into account the predominant role of government in structuring these relationships in some societies and its relative absence in others” (Etzkowitz and Leydesdorff, 2000: 78). Some already invoke the need of a double helix also including the triplet “university-*public*-government” to account for wide society concerns with the impact of innovations on the natural and social environment (Ibid, 79-80).

The literature typically emphasises the *systemness* of these interactions, and thus aims to analytically bound into a system the most important societal determinants of innovation, which has been attempted initially at the national level. However, Edquist (1997: 15) has also admitted that “we simply do not know in detail what all the determinants of innovation are”, and finally recognised that the ‘system’ concept is ambiguous taking account that “none of the major authors provide a sharp guide to what exactly should be included in a ‘[national] system of innovation’; they do not define the limits of the systems in an operational way” (p. 27). Addressing the RIS concept, Cooke (1998: 11) also recognises that “in the literature on innovation, the term ‘system’ is not analysed in great detail.” McKelvey (1998: 201; emphasis mine) attempted to give a definition: “systems of innovation are constituted by innovative activities. (...) Innovative activities are therefore *here defined as knowledge-seeking*

*activities* to develop novelty of economic value.”<sup>13</sup> Actually, the definition begs the question about the properties that make “knowledge-seeking activities” a system and, above all, it is representative of the way IS literature frequently takes for granted the meanings of terms such as ‘knowledge’ or ‘system’.<sup>14</sup> My point is that there cannot be scientific progress in evolutionary economics research without facing head on the crucial question: what is a ‘system’ (of innovation)? Although there are authors that assume (explicitly or implicitly) *innovation systems are social systems*, most of them overlook a crucial aspect that underlies such claim: how *epistemic activities* that produce “flows of knowledge” (whatever this may be) could form *social systems*? As Lawson (1997) and others have argued, it seems that without a clear ontological stance about social and cultural realities we quickly run into conceptual confusion.

North’s (1990) concepts are frequently cited and seem dominant in evolutionary economics literature: firms, universities and public bodies are *organizations* constituted by formal ‘rules’; *institutions* are “rules of the [social] game”. Edquist (2001: 5) understands the latter as “common habits, routines, established practices, rules, or laws that regulate the relations and interactions between individuals, groups and organisations”. More than a decade ago Richard Nelson (1994) has taken distance to this eclectic view of institutions, which he saw “an extraordinary complex bag of things” (Ibid, 315). Although agreeing with this statement, I think that Nelson still

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<sup>13</sup> About a similar definition emphasising knowledge activities it is appropriate to quote Metcalfe and Ramlogan (2006: 7): “Niosi’s definition equates too easily the idea of innovation systems with the production of science and technological knowledge. The danger here lies in confusing invention systems with innovation systems and missing out the complementary economic processes required to turn invention into innovation.”

<sup>14</sup> An exception is Cooke (1998: 11; emphasis mine) who gives an explicit ontological answer about the nature of IS, albeit ignoring its methodological implications: “Clearly, an innovation system is a social system, and innovations are the result of social interaction between economic actors. Furthermore, it is an open system in interaction with its environment.”

misses the core of the issue: language, conventions, norms, rules, patents, laws, etc. actually are *cultural entities* in the sense of networks/systems of public meanings, whatever the material support of the symbols to which they relate.<sup>15</sup> In brief, I claim that this literature largely misunderstands the nature of cultural and social realities. To substantiate such claim, I need to connect my views about human nature, knowledge and culture with my own understanding of institutions, which I attempt below.

Firstly, in order to prevent misunderstandings, I briefly present conceptual distinctions about social systems. Like other systems of Nature, social systems have properties of *organisation* and *complexity*, which they possess in varying degrees of scale and strength (Collier and Hooker, 1999).<sup>16</sup> Within social systems, organisations and societies belong to a special sub-set because, beyond self-organisation and complexity, they also exhibit properties typical of *autonomous* systems (Morel and Ramanujam, 1999). In fact, analogously to living systems, organisations and societies “exert a degree of influence on the conditions under which they exist” (Christensen and Bickhard, 2002: 17).<sup>17</sup> Assuming these analogies, but still keeping in mind the specifics of socio-cultural reality, in the following I concentrate my discussion on societal systems and their institutional elements.

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<sup>15</sup> Cf. (Groenewegen et al., 1999) who consider different “institutional layers” within innovation systems, the top of which is formed by cultural entities the authors label “informal institutions” in line with the dominant use in the literature.

<sup>16</sup> In my view, all social systems are (at least) self-organising complex systems independently of how much purposeful inter-actions they emerge upon.

<sup>17</sup> Christensen and Hooker (2000: 9) see autonomy as “the fundamental predicament of being alive”, and note that living entities “are dissipative because they are constituted by far-from-equilibrium thermodynamic processes” and “constantly seek out sources of ordered free energy with which to replenish dissipated cellular structures and sustain the capacity for the process that acquire these resources, and repair damage or avoid damage.”

The adaptability of a society depends on its internal structure, namely on the existence of sub-systems that serve important functions for the whole, and on the organization of their relations. In the exercise of their functions those sub-systems, similarly to other levels of reality, recur to an internal regulatory process built upon normative components of a cultural nature.<sup>18</sup> These sub-systems are what I label ‘institutions’. In fact, *institutions are (complex self-organising) socio-cultural systems* constituted by two kinds of interdependent entities: ‘social systems’ (networks, organisations) serving a particular function for society; a particular ‘cultural system’ playing a semiotic role that has normative force in regards to individuals’ participation in those social systems. In this view, institutions draw on society’s culture (a system of public meanings pervading society) in order to shape typical kinds of communication and define what is adequate/inadequate (good/bad) behaviour in a specific functional domain of social life. Thus, institutions such as state, marriage, science and economy are best seen as historical, *socio-cultural systems made of intertwinements between social systems and cultural entities* such as language, worldviews, ideologies, values, beliefs, theories, laws, etc. They emerge as a new level of reality upon individuals’ interactions and communications in particular settings and for specific purposes. Building on this analytical distinction, I argue that individuals’ *interactions* are responsible for the emergence of *social relations*, which self-organise into *social systems*. In the same process, their *communications* are responsible for the emergence of *public meanings* and their networking, and hence

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<sup>18</sup> As put forward by Bickhard (2004a: 130): “all of mind and mental and social phenomena are fundamentally normative, and they all emerge in a hierarchy with biological functional normativity at its base.” This point, among others, distinguishes my approach to societal systems from the one argued by Luhmann (1995), whose autopoietic operations underemphasize that the living system ‘guides’ and ‘constructs’ knowledge with recourse to a normative function to assess the outcomes of interactions with the environment.

responsible for the emergence of *cultural entities*, some of which (language, worldviews, ideologies, sciences) are complex self-organizing systems (Andersen, 2002). Whenever they are components of institutions, I will label these cultural entities as institutional norms, or simply ‘norms’ (Fig.1).

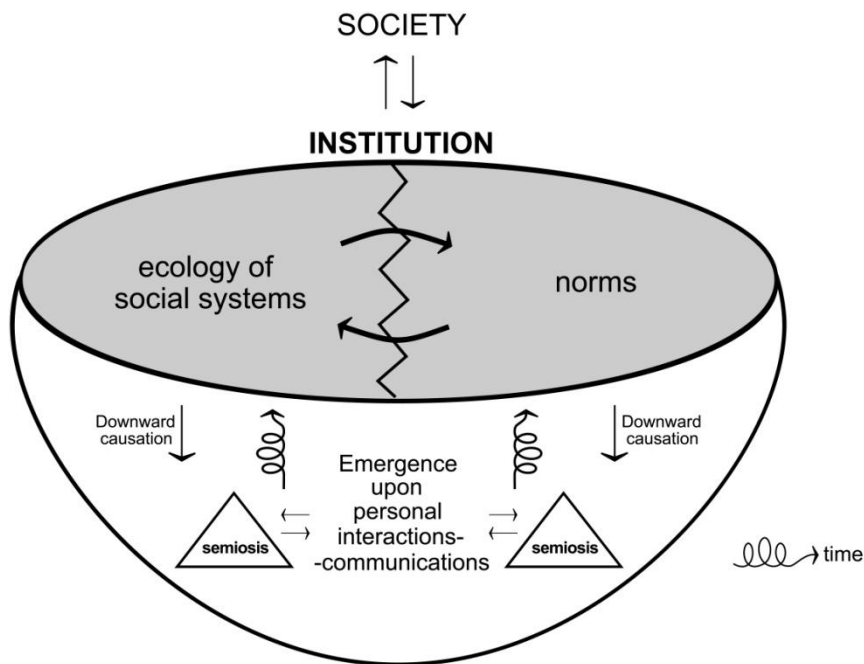


Fig. 1 - Institution as an emergent socio-cultural system

Therefore, *institutions are complex self-organising systems constituted by two sets of mutually determining and co-evolving entities: social systems and norms*. Unpacking this emergentist understanding of institutions, I further state: a) the social and the cultural components play distinct but interdependent roles because while the cultural provide meanings with normative force, the social provide a particular function for society; b) we need to consider three ontological levels (interactional-communicational, institutional, societal), each relatively autonomous to the others; c) because social structures are organised in interconnected layers, cultural entities are of different kinds and levels of abstraction, and because semiotic processes

cut across different spatio-temporal scales, *institutions are internally differentiated, highly complex systems*; d) the diversity of functions and structures of institutions, to which add different paces of change, are responsible for the existence of tensions and contradictions, both within and between institutions, and between each one and the whole societal system; e) interactions between society and the world are made through different institutions, the state and the economy having a prominent role.<sup>19</sup>

Assuming the above-presented view, it is clear for me that an important part of evolutionary economics literature needs a better theorising of institutions,<sup>20</sup> and the IS literature is a case in point because it claims a central role for institutions in innovation processes. The problem is that the IS literature (or most of it) uncritically treats institutions as “rules of the game” (North, 1990), which reveals a ‘rational choice’ understanding of social life going with an algorithmic view of human mind and the associated codificationist view of knowledge and language (Cf. Denzau and North, 1994).<sup>21</sup> Further, and consistently with a lack of ontological reflection, there are no clear distinctions in the literature between social and cultural realms, which stems from the absence of ontological reflection and the lack of a semiotic approach to epistemic processes. In brief, without clear choices at the ontological and epistemological level conceptual

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<sup>19</sup> The ‘economy’ is the institution that serves the function of provisioning society (Polanyi, 1957). Note that the process of economic globalisation may be seen as the initial stage in the emergence of a ‘world economy-institution’, which already points to the need of effective world-scale organizations and norms as part of such an “instituted process” (Nordhaug, 2003).

<sup>20</sup> Note the conspicuous absence of institutions in the survey of evolutionary economics presented by Cantner and Hanusch (2002), who mainly draw on the ‘post-Schumpeterian’ strand of evolutionary economics.

<sup>21</sup> Cf. Hodgson (2004) who also sees institutions as “systems of established and embedded social rules”, a definition that connects with an algorithmic understanding of mind.

confusion is to be expected in the IS literature, a situation that Edquist (2001: 5) explicitly acknowledges.<sup>22</sup>

The view of societies and institutions here argued leads to an understanding of innovation processes much different from what the IS literature usually presents. The point is that societies do not have a particular sub-system (an “institution” in the sense above given) to serve a function of innovation. What they do have is *a number of innovation-focused networks that connect different institutions and mobilise ‘local’ knowledge and personal skills* “around specific problem sequences” (Metcalfe *et al.*, 2005: 1301). These networks emerge upon interactions-communications between *individuals as members of organisations* such as firms, universities, development agencies and public administration that belong to different institutions (economy, science, education, state), which is an understanding that connects with the idea of a “distributed innovation system” as argued by (Coombs *et al.*, 2003) (Fig. 2).<sup>23</sup> Obviously, these networks build on the cultural components of the institutions involved. In this sense, they present national-specific patterns of innovation that may appear intertwined with regional ones.

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<sup>22</sup> Neo-Institutionalists such as (Mayhew, 1987) and (Bush, 1987) also do not make clear distinctions between personal and structural levels, and between cultural and social domains of reality. For a discussion of such distinctions, cf. (Bhaskar, [1979] 1989), (Lawson, 1997) and (Archer, 1988).

<sup>23</sup> Despite conceptual differences about knowledge and institutions, my formulation also bears a connection with the Triple Helix Model (Etzkowitz and Leydesdorff, 2000).

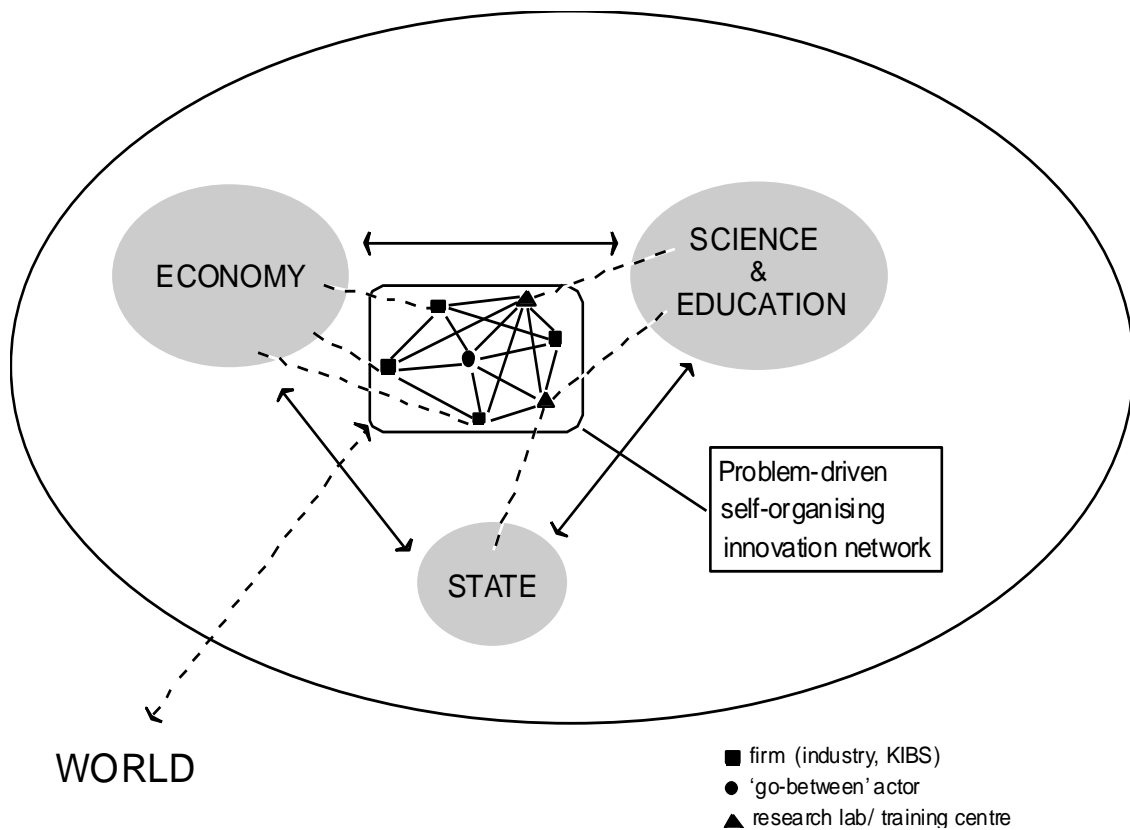


Fig. 2 – Innovation network as an institutional interface

Thus, as an institutional interface, innovation networks typically have a rather reduced number of participants, inevitable difficulties of communication, and circumscribed convergence of interests.<sup>24</sup> Due to important differences between the individuals involved, namely background training and organisational roles, plus the limited room for institutional enforcement in a context of cross-boundary work, innovation networks involve important risks for those who participate, which is why a “go-between” actor is frequently present to strength network governance (Nooteboom, 1999b). Nevertheless, *innovation networks are indeed social*

<sup>24</sup> Here I do not consider ‘informal’ networks, which of course are important sources of information and stay in the background of, and connect with, ‘formal’ networks. The latter have explicit innovation objectives shared by the participants. Cf. (Kingsley and Malecki, 2004) for a discussion of the importance of informal networks (local and non-local) for SMEs.



*systems* in the sense of a more or less complex and self-organised set of social relations seeking innovative solutions for specific problems. When there occurs a transition from loosely connected organizations to a network *for* innovation that strongly connects the institutions involved, then we have the emergence of a network that bears the properties of a social system, and thus constitutes a specific “innovation system”. As Metcalfe and Ramlogan (2006: 20) put it, the ecology of organisations provides “a basis for a system [of innovation] but it is not a system of itself until subsets of the actors are connected with the intention of promoting innovation.”<sup>25</sup> Therefore, rather than *the* ‘National Innovation System’ there may be *many* “innovation networks” (that by nature are social systems) operating in a society, some of which are successful. Further, they may spread in different forms and for different purposes when a society gains a Schumpeterian dynamics.

Here arrived I must emphasise that, despite treating the state as a meta-institution, I do not see it in the command of society (Jessop, 1997). The state cannot create (this kind of) innovation systems through ‘command and control’, although it still can experiment with innovation policies informed by the knowledge of broad structural patterns of societal change (Schwerin and Werker, 2003). Therefore, within limits, the state can take action aiming to catalyze the institutional interplay within society, and promote international/inter-regional interactions between new partners. However, such a developmental role for the state (Chang, 2003) can only

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<sup>25</sup> In my view, this framework overcomes apparently conflicting stances addressing the regional level, namely between ‘clusters’ literature (Bathelt *et al.*, 2004) and RIS literature (Asheim and Coenen, 2004). Note that my understanding of innovation processes highlights the connections they make between institutions of a national society, which may have regional levels and encompass different clusters. This is also compatible with the understanding that knowledge processes build on symbolic communications, which cut across regions and societies, thereby sharing the typical properties of socio-economic systems, those of *a complex mix of hierarchic and non-hierarchic relations*.

be effective with an adequate sort of policy-making, which leads me to the subject of the next section.

#### **4. Why does it matter, and how?**

The discussion of concepts such as knowledge, culture, organisations, institutions and societies conducted in the previous sections rests on a metaphysics of *process* and an emergentist, *multi-level* ontology that I have argued elsewhere and labelled Naturalist (Bateira, 2006a). It is radically different from the metaphysics of substance and physicalist ontology implicit in the IS literature, although the adoption of cognitivist psychology usually points to ‘weak’ emergentism, which in fact corresponds to ‘non-reductive physicalism’ (Silberstein, 2001). Contrasting with the latter, the approach here argued has at least three advantages: a) it clearly places institutions at a structural level, which prevents confusion with the micro-level of individuals, their interactions/communications, and their cognitive processes; b) it allows for a variety of intertwinements between social and cultural components, which calls for an analysis of the specifics of each institution, at the same time making clear that institutions are ontologically above organisations and depend on their interplay with particular norms (values, theories, rules, etc.); c) it maintains a thread of continuity linking inert matter, life, human beings, social systems and culture, but at the same time *emphasising the specifics of each level of reality* (Hoffmeyer, 1998), which prevents reductionist approaches implicated in physic-chemical or biological analogies frequently used in the IS literature.<sup>26</sup>

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<sup>26</sup> Against the reductionist use of analogies, the following statement formulated twenty years ago is still in order: “An analogy with scientific fruitfulness would have to find a system of causal relationships between the elements of our theory, which have to be either isomorphic or homeomorphic to that of biological evolution. None of the above conditions, in our opinion, can be met. As a result the biological analogy, which served its heuristic purpose, must be dropped, and while retaining what we have learned from using the analogy, we must find an alternative” (De Bresson, 1987: 758; emphasis mine).

The approach of networks of innovation, understood in this paper as complex self-organising social systems, bears important methodological, theoretical and policy implications that cannot be dealt with in a single paper.<sup>27</sup> Thus I will be very brief about ‘why it matters’ and will occupy the rest of the section with a few topics on the ‘how it matters’. Taking account that empirical research is always guided by the researcher’s worldview, scientific paradigm, theoretical and research preferences, and also material and power interests, it is of most importance to overtly state foundational issues. This means that the above-presented discussion is not a digression that should only interest those more inclined to philosophical speculation. Because only through theoretically worked concepts can we scientifically understand empirical reality (De Regt and Dieks, 2005), the conceptual reformulations here argued certainly have important implications in the way economics research is conducted and its results interpreted. As Bennett and Hacker (2003: 408) have put it in another disciplinary context, “conceptual investigations contribute primarily to understanding what is known, and to clarity in the formulation of questions concerning what is not known.” As I hope to show in the following, if we take seriously the available multi-disciplinary research addressing human nature, knowledge and socio-cultural reality, we are led to conclude that most mainstream economics, and the policy advice it provides, is in fact permeated by problematic assumptions, which are also present in the IS literature.

As for ‘how it matters’, I first discuss some analytical implications of adopting an “emergent person” understanding of human nature and an interactivist-constructivist view of knowledge (Bickhard, 2004b; Miller, 1999). To accept that personal knowledge emerges in interactive-constructive processes of a semiotic nature means that knowledge always has *symbolic, embodied and social* dimensions, and although they are

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<sup>27</sup> For an extended discussion of the ontology of institutions cf. (Bateira, 2006b).

intertwined some appear more salient according to the context (e.g. scientific, technological, common sense, skills). In fact, what distinguishes (more or less) ‘abstract’ knowledge from ‘practical’ knowledge is not the difficulty in its “codification” into language, an idea implicit in the use by the IS literature of the “tacit/explicit knowledge” dichotomy. Nor should we understand different types of knowledge as *combinations of ‘tacit’ and ‘explicit’ knowledge*. As Gourlay (2006: 1428) states, “knowledge is not created by some relation (or ‘interaction’) between two kinds of knowledge but through human activities or practices in general, on the one hand, and through a specific sub-set of practices (‘theorizing is one practice amongst others’ (Ryle, 1963, p. 27) on the other.” Therefore, we cannot say that technological knowledge comes from the “application” of scientific knowledge; *it is knowledge of a different kind* because it emerges from a specific kind of interactions-communications: “The purpose of practical [technological] knowledge is knowing *how to deal with* the specific situations encountered in a particular case. The purpose of scientific or scholarly knowledge is knowing *how to see* specific situations as instances of a more general case that can be used to explain how what is done works or can be understood” (Van de Ven and Johnson, 2006: 806; emphasis mine). Therefore, contrary to what most IS literature holds, innovation networks are not social nets of “knowledge flow” (Cf. Sorensen *et al.*, 2006) or “learning”, in the sense that some professionals “absorb” relevant knowledge from others, or from researchers, and the latter attempt to adequately “transfer” useful knowledge to the former. Rather, *innovation networks are social systems where epistemic and social tensions between different people have to be managed*, thereby creating conditions for the emergence of new personal understandings of a competitive problem and its possible solution, and *a new “invariant of these understandings” signified in the solution to be tested by some kind of material reality*. This

complex process has been described in detail by (Star and Griesemer, 1989: 413; emphasis mine) who show (with a trade metaphor) how “the functioning of mixed economies of information with different values and only partially overlapping coin” manage to “establish protocols which go beyond mere trading across unjoined world boundaries. They begin to devise *a common coin* which makes possible new kinds of joint endeavour.”

Note that innovation networks not only mobilise ‘abstract’ and ‘practical’ knowledge but also *judgemental skills* about alternative solutions, which are assessed in terms of technical feasibility, cost-effectiveness, market value, societal constraints, etc.<sup>28</sup> In other words, *innovation networks are social systems where a new “design” emerges from interactions between persons’ different competences, skills and creativity*, when exposed to, and interacting with, foreign ones.<sup>29</sup> This vision also calls for the replacement of the so much used “absorptive capacity” expression (Arthur et al., 1997) as it derives from a deep misunderstanding of cognitive and communication processes. Further, its use has been so much referred to R&D activities that it became part of the “linear-model” rhetoric of “application of scientific knowledge to technology”. The problem is that *not only* knowledge contributes to a firm’s competitive advantage; the latter calls for a *reconfiguration of the value chain*, which is of a structural order (social and cultural) and needs the support of some material reality.

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<sup>28</sup> Although referring to a particular kind of innovation, this idea is also formulated by Arthur (2007: 285; emphasis mine): “Radically novel technologies arise more from a *context of knowings*: they arise from a practice in working with – and knowing in a deep way – certain components and functionalities and certain newly uncovered effects. Such practice is really a *form of craft*.”

<sup>29</sup> What Lündvall (2004: 34) fails to see is that ‘public knowledge’ is not a *networking* of different persons’ knowledge but rather an *emergence from* a single process (interactively-communicatively) involving different persons, which is mediated by symbolic tools. For a critique of the codificationist understanding of language cf. (Bickhard, 1987).

Mainly focused on epistemic processes, the IS literature overlooks that *innovations are also social and material outcomes of successful developmental processes* emerging from firm's internal and external interactions. In line with this view, Volberda and van den Bosch (2004) have recently argued against the excessive emphasis of Dutch and EU innovation policies on R&D knowledge production and the associated neglect of managerial and organisational changes, without which the former will have a diminished impact.

Again, and in a wider sense, "innovation" is *not only* about using new knowledge; it is mostly about *making happen, and manage, articulated changes in the material, social and cultural structure of the organisation that become validated by society*. This is an endeavour that cannot be solved by the organization/firm alone, and thus requires "specific relational investments" with uncertain outcomes (Nooteboom, 1999a).<sup>30</sup> At this light, "innovation networks" (networks *for* innovation) necessarily draw on different types of knowledge, creativity, skills, governance norms, interests and powers, which is why they typically involve members of different kinds of organisations (firms, universities, business services, trade unions, intermediary agencies, policy-makers, etc.), which belong to different institutions. In this sense, "innovation networks" are *historically specific, institutional articulations* of a particular society (Whitley, 2000).<sup>31</sup>

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<sup>30</sup> Here I emphasise that organisations are also social systems; they are made of social relations, which is an ontological domain distinct from the domain of ideas, rules and values that make up the culture of the organisation. Therefore, my socio-cultural understanding of firms differs from the "individual knowledge"-centred understanding of New-Austrian economics (Cf. Loasby, 2001).

<sup>31</sup> On this point, see the contribution of (Hage and Hollingsworth, 2000: 997): "Not only do institutional environments influence the structure of idea innovation networks, but changes in the idea innovation networks can feedback and bring about changes in a society's institutional environment." However, note that the authors treat institutions as the "environment" of organisations and networks while I treat institutions as socio-cultural systems that emerge upon interactions between 'organised' individuals, between organisations as such, and between the latter and the rest of society. Institutions,

This view of innovation networks as ‘local articulations’ between institutions leads me directly to the second theme of my ‘how it matters’ discussion. In a first stage, IS researchers adopted a national point of view and only provided macro-policy suggestions about financial incentives to university-firms cooperation, venture capital, patenting regulations, architecture of formal links between R&D research and intermediary agencies, attraction of MNEs subsidiaries, etc. In a second stage of the IS literature, such policy framework has been translated into the regional level in order to account for regional specificities. Although much of this is certainly necessary, *such a ‘planning approach’ in policy advice still misses the complexity of institutional dynamics and its links to innovation processes*. This weakness should be expected, at least for the following reasons: 1) rational choice theory combined with a “knowledge spillovers” rhetoric still frames the understanding of innovation processes by a large number of scholars (Cf. Breschi and Lissoni, 2001), which leads to unawareness of the complex and heterogeneous (epistemic, material, cultural and social) processes that make up networks of persons with much different biographies and institutional roles; 2) adopting a New-Institutionalist framework, most scholars are led to ignore the emergent nature of institutions and their co-evolution, and thus overlook the autonomy of social reality most present in the ‘downward causation’ of institutions over actors’ interests and motivations (Chang, 2005), and the historical timing that developmental change takes (Howells, 2005); 3) for lack of analytical depth about the nature of institutions, scholars most frequently forget that development dynamics involves *both* changes in community’s cultural web (norms, business paradigms, science and technology) *and* political struggles for power between social groups with

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individuals and organisations not only enable and constraint but also *constitute each other*.

divergent interests and projects for society, and thus tend to forget that *developmental coalitions* between actors intervening at different spatial scales are indispensable for policy effectiveness (Swingedouw, 2003).

Perhaps because the ideals of modernity are still dominant in economics, the top-down “Benchmark NIS model” has exerted (and still exerts) a large influence on policy-makers (Groenewegen et al., 1999), both at national and regional level, which mostly contributes to the appeal of “best practice” recommendations for innovation policies despite the much dubious validity of such approach (Hospers and Beugelsdijk, 2002). In fact, if we take account of the specificity of developmental challenges in sub-national territories, which relate to the particular structure and dynamics of their ‘institutions’ (Iammarino, 2005)—different composition, interplay, and pace of change within and between the local profile of organisations-culture entanglements, and their specific relationships to the wider society and the rest of the world—it is easy to understand why successful regions cannot be used as benchmarks. Here I must acknowledge that in the RIS literature many authors are sensitive to regional specificities. However, because they see institutions as an *environment* of innovation processes rather than *constitutive* of these same processes, in most cases they only attribute an exogenous, conditioning role to institutions. The case of (Tödtling and Trippl, 2005: 1206) is paradigmatic: institutions are understood as also comprising organisations, and are pictured as part of the socio-economic and cultural environment (“rules and behaviour characteristics of firms and actors”) and its “innovation relevant organisations” (Ibid, 1206). This clearly illustrates different theoretical views and different policy focus, which merit additional discussion.

As already stated, firms are autonomous systems. Beyond the legal act of foundation, they emerge upon carefully networked *social relations* that are organised according to a particular distribution of



interests/resources/powers, which intertwine with different types of *cultural entities* (technological knowledge, management knowledge, market knowledge, norms of behaviour, values, signs of status, etc.). Firms belong to the organisational ecology that constitutes the ‘economy’, an institution of a society. A similar understanding applies to a university research centre, an organisation that belongs to the ‘science/education’ institution, or a training centre jointly managed by the state and an industry union, which is an organisational interface between ‘state’ and ‘economy’ institutions.

The IS literature has a much different understanding: a) usually treats culture as a stable background of customs and values typically labelled “informal institutions”; 2) understands scientific and technological knowledge as something that does not belong to culture; 3) overlooks the social nature of organisations, which are mostly viewed as a locus of epistemic processes. Differently, in this paper I put forward that managers, engineers, university researchers, and service providers, all of them participate in innovation networks (when they do) *as members of organisations that belong to different institutions, and thus have different (functional) cultures, which are embedded in the territorial culture where they operate*. Tödtling and Trippl (2005) conclude their paper suggesting that a regionally differentiated innovation policy is needed, a statement that I fully subscribe. However, the policy advice they finally provide (for “peripheral regions”) amounts to:

“fostering “catching-up learning”. Adequate policy measures include amongst others the attraction of external companies and attempts to embed them into the region. Furthermore, firms should be linked to external clusters and knowledge providers and to higher spatial innovation systems (national, European)” (Ibid, 1215).

The degree of generality of such policy orientations is striking as they could be proposed for any developing economy; *they clearly ignore what is*

*at stake.* Questions of how local actors are motivated to co-operate and engage in networks for innovation (between themselves and with foreign partners), how conflicting interests within the region arrive at a common vision of the future and a development strategy, how innovation-promoting norms, values and governance structures are “instituted”, how firms change their strategies, all of this is absent in the analysis and the advice. In fact, *“how institutions change” is the crucial question that is seldom addressed in the IS literature, and yet it is what development is about.* Indeed, the IS literature maintains a too close connection with “endogenous growth” rhetoric at the price of overlooking that we are dealing with complex institutional interdependencies of a society’s development, not simply growth.

A Naturalist understanding of knowledge and institutions suggests that innovation policy should go beyond the correction of negative externalities and give priority to the stimulation of innovation networks where institutional interactions are poor. As Metcalfe and Ramlogan (2006: 25) have clearly stated, “the evolutionary policy maker is not an optimising supplement of the market, correcting for imperfect price signals in such a way as to guide private agents to a better innovation mix.” In fact, a rational choice-based view of human behaviour (also applied to policy-making), usually associated to the understanding of socio-cultural phenomena as patterns of individuals’ behaviour is the dominant view in policy advice. Much differently, an emergentist view of institutions clearly suggests that, despite being a meta-institution endowed with regulatory and enforcement powers, the state is not in position to command changes in society. Contrary to an image of “controlled” change that underlies top-down strategies, the perspective here argued favours a “shaping” image of state action, one that could take different forms according to the level of uncertainty present in the process (Palmer and Dunford, 2002). Such

orientation calls for articulated *multi-level policies*: at the national level, adopting a developmental strategy (Chang, 2003) to address continental integration and globalisation forces; at the sub-national level, acting as a catalyst of organisations' connections and strategic foresight.<sup>32</sup>

Actually, this role of “animateur” is not new and has been experimented in different regional contexts (Asheim et al., 2003; Braczyk et al., 1998; Gertler and Wolfe, 2004; Morgan and Nauwelaers, 1999). An early example of scholar interest for this kind of policy-making has been provided by Storper (1997), who argued for a policy strategy in developing regions based on ‘talk’ and ‘confidence’-building as a first step.<sup>33</sup> Talk between regional actors is a means to achieve mutual understanding, and it needs patient efforts to overcome distrust and create weak precedents that could underpin a minimal basis for the next steps. This approach should not be mistaken with a blind adoption of the ‘associational economy’ approach, which tends to be optimistic about the power of local initiatives. It is frequently forgotten in this literature that, as an outcome of highly complex, non-controllable interactions between different types of systems, regional governance is prone to failure not only because of internal obstacles but also because of unfavourable national, EU and global ‘downward causation’ mechanisms (Jessop, 1997). This is the difficult problem of multi-scale policy integration also acknowledged by Metcalfe and Ramlogan (2006: 25): “innovation policy does not stand alone but only as an integrated package of industrial and trade policies that not only result

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<sup>32</sup> In a convergent perspective cf. (Iammarino, 2005: 498) who argues, with respect to the Italian society, the need “to integrate the top-down view with the bottom-up (micro-to-meso) perspective—tackling also the internal dynamics of regionally embedded social, economic and institutional structures, whose analysis in terms of historical origins and evolution of regional cultures, may further help to refocus the nationally-biased ‘Listian’ view of innovation systems.”

<sup>33</sup> In a similar vein, see Lündvall (2001: 281): “What is needed is to bring the right parties together in minor cooperative activities so that they can start to build trust”.

in new local capabilities but make it possible to exploit these capabilities in an internationally competitive fashion.”<sup>34</sup>

Therefore, from the above-presented conceptual revision I deduce far-reaching policy implications that go beyond programmes for R&D infrastructures, creation of intermediary agencies, property rights legislation, embedding FDI investment, and even power devolution to regions. Although this certainly is part of the story, developmental processes are much more complex than what is usually assumed by mainstream economics, and by the classical cybernetics view that abounds in IS literature. Societal development is a highly complex process involving the co-evolution of institutional systems at different spatio-temporal scales, *which calls for interaction and reflexivity in public policy-making* (Schwerin and Werker, 2003), *and new foundations for innovation policy* (Metcalf and Georghiou, 1997). This theoretical claim is consistent with a main conclusion of a large-scale study of innovation policy tools used in eleven EU regions: “The idea of an interactive mode of policy implementation means not only that services should be both designed and delivered in co-operation with the beneficiaries, but also that the policy implementers can be partners in the supported action or project, so that learning can happen both ways” (Nauwelaers and Wintjes, 2003: 199).

## **5. Conclusion**

In the preceding discussion I have stated that, like organisations, societies are autonomous systems; they are social systems open to the world and are organised upon interacting structures of different kind (e.g., institutions, cultural system, natural system, territories). Building on such a view, and

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<sup>34</sup> On this point I acknowledge that EU is in great need of a federalist macroeconomic policy that could integrate fiscal, monetary, science and technology, trade and social policy in order to overcome current damages to economic growth, and thus negative effects on national and regional level policies that stem from *lack of a societal regulation at the EU level*.

recurring to recent contributions of different sciences, I have proposed a new understanding for knowledge, culture, institutions and innovation processes that I label a Naturalist approach. It keeps a thread of evolutionary continuity between persons, social systems and culture, while assuming the autonomy of emergent *levels* (interactional-communicational, structural) and *domains* (social, cultural) of reality (Emmeche, 2004). In this way we are able to integrate and go beyond the institutional and evolutionary traditions that dominate contemporary heterodox economics, a preliminary step in what, hopefully, could be a promising research direction.

The institutionalism embraced in this paper suggests a new paradigm for innovation policies based on hard dialogue between policy-makers, scholars providing policy advice and the relevant actors. This relational kind of policy-making should be supported by a close dialogue among scholars working on the fields of innovation and regional development (Howells, 2005), and extended to Institutionalists researchers in sociology, political science and cultural studies (Keating *et al.*, 2003; Seabrooke, 2007; Thelen, 2004).

Current political conflicts of a novel nature, dramatic rates of unemployment and the rising of unsustainable inequalities, to which add worrying ruptures in the earth ecosystems, constitute a challenge for social scientists to provide fresh theoretical contributions and sound policy advice that could ease the transition for a new institutional configuration of modern societies and their multi-level organisation (Perez, 2004). It is not an easy task for social theory, and particularly for the field of economics, which strongly resists to reinvent itself in a science landscape that mostly has left behind the modernist worldview (Nowotny *et al.*, 2001). Even so, there may be some ground for an optimistic statement about the emergence of a new paradigm in innovation policy (Mytelka and Smith, 2002: 1478):

“the interaction of policy needs and intellectual endeavour has created space in which the new field could grow.”

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