Recent economic theorising on innovation: Lessons for analysing social innovation

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Creating Economic Space for Social Innovation

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Recent economic theorising on innovation: Lessons for analysing social innovation

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Table of Contents

1 Introduction*

This paper reviews recent economic theorising on innovation from the angle of analysing social innovations (SI). The underlying document of the CrESSI project, that is, the description of work (DoW) consistently speaks of technological innovations as a basis for comparison with social innovations.[1] It is important to clarify at the outset of this contribution that actually we should consider all sorts of business (or: profit-oriented) innovations on the one hand, and social (socially-oriented or societal) innovations, on the other, irrespective of their technological or non-technological nature.[2] In other words, we should take into account not only technological (product, service, and process) innovations when discussing business innovations, but organisational and marketing innovations as well. Innovation studies also show that technological innovations are introduced rarely – if at all – without organisational innovations. Quite often marketing innovations are also required, and finding – or even creating – new markets is also crucial in some cases, in particular when radically new innovations are introduced. Moreover, non-technological innovations are vital for the successful introduction of the technological ones. (Pavitt, 1999; Tidd et al., 1997)

In a similar vein, technological innovations, aimed at tackling societal challenges, should not be neglected when considering social innovations. Further, most likely certain organisational and marketing innovations might also be useful – or even indispensible – to achieve societal goals. In sum, we should keep in mind a distinction between the nature of innovations (technological, organisational, and marketing) and the goals of innovation efforts (business vs. societal purposes). As for the goals of innovation, in real life there could be 'hybrid' cases, too, blending the business and social 'logic', e.g. services provided on a market basis, but – on purpose – employing marginalised people.

The paper is structured as follows: Some of the basic notions used in innovation analyses are considered in section 2, focusing on the subject, objectives and levels of change. Section 3 reviews how innovation is understood in particular models of innovation and analysed by various schools of economics highlighting the types of actors and knowledge perceived as relevant in these various approaches. The notion of innovation systems (national, regional, sectoral, and technological ones) and its analytical and policy relevance is explored in section 4. Lessons relevant for analysing social innovation are drawn at the end of each sub-section, and the most important of those are reiterated in the concluding section.

It is also important to set the limits for this paper. It does not touch upon measurement issues as another CrESSI deliverable has discussed established approaches aimed at capturing and measuring various types of innovations from the angle of measuring social innovations. (van Beers et al., 2015) Impacts of business innovations on inequalities and employment,[3] green technologies, innovations for environmentally sustainable development and innovation in the public sector (public services) are not considered, either, although these subjects would be essential elements of a comprehensive overview of innovation studies to assist and enrich SI analysis.

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[1] For the definition of social innovation developed by the CRESSI project, see section 2.1.

[2] Following a slightly different argument, business and social innovations are also distinguished e.g. by Pol and Ville (2009).

[3] Appendix 1 lists some papers on these issues.

2 Basic definitions used in innovation analyses and their relevance for social innovation

Although most policy-makers, journalists, natural scientists and other opinion leaders tend to think of innovation as a groundbreaking technological idea, the modern literature on business innovations is based on a different understanding. First, innovation is not an idea, but a solution introduced to the market, that is, an idea with a proven practical use. Second, not only 'world class' new solutions are defined as innovations, but these new solutions are distinguished by their degree of novelty: a solution can be new (i) to the firm introducing it, (ii) to a given market (that is, not only to the firm introducing it, but to a given country or region), and (iii) to the world. Third, besides technological (product, service, and process) innovations, organisational and marketing ones are also considered important: innovation studies clearly show that it is more of an exception than a rule to introduce technological innovations without organisational innovations and in many cases marketing and market innovations are also needed. In sum, technological innovations simply cannot be successful without applying some sort of non-technological ones. (Pavitt, 1999; Tidd et al., 1997) In particular, radical innovations often create new markets and that is, by definition, a market innovation (see below).

The above three types of innovations are defined by the Oslo Manual (OECD, 2005), aimed at providing guidelines to interpret and measure innovations introduced by businesses. Interestingly, market innovations, that is, entering into or creating new markets to purchase inputs or sell outputs (not to be confused with marketing innovations) are not mentioned by the Manual (although these are parts of the classic description of innovation by Schumpeter, and important ones, indeed). Perhaps it would be almost impossible to measure these crucial innovations. Further, financial innovations are not mentioned, either, as a separate category. Certain types of financial innovations can be interpreted as service innovations (e.g. new financial 'products'), while others (e.g. e- and m-banking) as new business practices, that is, organisational innovations using the definitions presented in the Oslo Manual.

2.1 Unit of analysis and degree of novelty

This paper follows the definition of social innovation given by the CrESSI project: „The development and delivery of new ideas (products, services, models, markets, processes) at different socio-structural levels that intentionally seek to improve human capabilities, social relations, and the processes, in which these solutions are carried out."

Another definition is given by Moulaert et al. (2013: 16): „(…) acceptable progressive solutions for a whole range of problems of exclusion, deprivation, alienation, lack of wellbeing and also to those actions that contribute positively to significant human progress and development. (…) Socially innovative change means the improvement of social relations – micro relations between individuals and people, but also macro relations between classes and other social groups."

A third definition is proposed by The Young Foundation (2012: 18): „Social innovations are new solutions (products, services, models, markets, processes etc.) that simultaneously meet a

social need (more effectively than existing ones) and lead to new or improved capabilities and relationships [or collaborations[4]] and better use of assets and resources."

A fourth one coined by Heiskala (2007: 74) as „changes in the cultural, normative or regulative structures (or classes) of society that enhance its collective power resources and improve its economic and social performance".

This paper is not meant to assess which of these definitions is more adequate than the other one(s) – that would obviously depend on a particular analytical task, and thus there is no definite answer to such a question. It is neither aimed at developing a new definition of social innovation.[5] Probably that would be an overambitious attempt, given the diversity of activities currently labelled as social innovation: „(...) the range and variety of action that constitutes social innovation today defies simple categorisation." (Nicholls et al., 2015: 1)[6]

An elementary methodological observation, however, is still in order: *the unit of analysis (observation) is different in the above definitions*. In other words, these definitions seem to be applicable (relevant) for different analytical tasks. As for the CrESSI definition, the unit of analysis seems to be a particular innovation project. The definition also indicates that this change can occur at different socio-structural levels. What is not specified clearly enough in this definition whether it is relevant for (i) a single social innovation project, (ii) a 'bunch' of social innovation projects occurring concurrently – or even in a co-ordinated way – at different socio-structural levels, or (iii) both types (both units/ levels of analysis). Taking the first interpretation, it should be added that in real life a single social innovation project actually might be a 'bundle' of technological, business model, organisational and marketing innovations, aimed at tackling a certain societal challenge.

The definition by Moulaert et al. (2013) seems to cover both single social innovation projects and a 'bunch' of social innovation projects occurring concurrently. Finally, the definition by Heiskala (2007) is only concerned with the changes in macro-level structures, i.e. not with a single social innovation project.

Nicholls et al. (2015: 3-4) introduced the notion of „levels of social innovation". The first level is *incremental*, that is, exactly the same term as the one used in the analysis of the degree of novelty of business innovations. In essence, however, it covers both incremental and radical change (see sub-section 3.2) at the level of goods (products and services) that „address social need more effectively or efficiently" (ibid: 3).

The second level, called *institutional innovation*, concerns activities that aim to „harness or retool existing social and economic structures to generate new social value and outcomes" (ibid: 3), or „reconfigure existing market structures and patterns" (ibid: 4). To avoid a possible misunderstanding, it is worth recalling that certain economics schools, notably institutional economics and evolutionary economics of innovation, as well as sociology make a distinction between organisations and institutions, the latter ones being the 'rules of the

[4] This element is added to another version of the deifnition, available at http://siresearch.eu/blog/defining-social-innovation.

[5] For a 'subtle critique' of the social innovation concept, as well as 'a more coherent set of social innovation definitions and principles', see Benneworth et al. (2015). On various conceptual framework and actual definitions of social innovation, see, e.g., Cajaiba-Santana (2014); Choi and Majumdar (2015); Edwards-Schachter et al. (2015); as well as Pol and Ville (2009).

[6] The same study makes an attempt to introduce a more systematic way to consider the various definitions of social innovation offered by various authors by distinguishing two approaches: definitions focussing on new (a) social processes or (b) social outputs and outcomes (Nicholls et al., 2015: 2).

game'. (Beckert, 2009, 2010; Edquist and Johnson, 1997; North, 1990)[7] Using that vocabulary, 'institutional innovation' actually refers to structural changes. It cannot be excluded, however, that a more detailed explication of 'institutional innovation' would state that certain structural changes (e.g. emergence of new actors in a given societal or socio-economic setting) are likely to lead to some changes in the 'rules of the game', too, and thus a more precise notion to denote these social innovations would be 'structural and institutional innovations'.

Taking the third level, „*disruptive* social innovation aims at systems change". (ibid: 3) That includes changes in power relations, social hierarchies, and cognitive frames, and could be initiated by various actors, such as members of social movements, political parties, coalitions of individuals with strong common interests (united by a specific issue) or policy entrepreneurs in state structures with a reform agenda. It seems to be an overarching term with a rather 'wide arch', but could be a good starting point for more detailed empirical analyses. For instance, having analysed real-life cases in its WP5, the CrESSI project might be able to elaborate a more refined version of this notion, distinguishing different types of changes in a given system, that is, introducing a more fine-grained granularity. The literature on business innovations also suggests that disruptive innovations can occur at various levels, not only at the level of socio-economic systems. In other words, it is easier to understand 'disruptive' as an adjective denoting the degree of novelty rather than indicating the level (subject) of change.

To disentangle different (relevant) units of analysis when studying social innovation, it might be useful to consider various notions introduced in the literature on business innovations with the intention to identify several levels of change. That issue is closely related to the degree of novelty, to be discussed in the remainder of this sub-section.

A standard question in innovation surveys relates to the degree of novelty. A given innovation can be new to the firm, to the market (in a given country or region) or to the world. For pragmatic reasons, the Community Innovation Survey (CIS) uses only the first two categories: it would be too difficult to judge by the respondents – and subsequently too difficult to check by experts – if a given innovation is new to the market in a given country (region) or to the world. Of course, in rare cases, e.g. when the first digital camera, mobile phone or tablet is introduced, it is easier to establish that a certain product is new to the world, but even in these exceptional cases there could be some difficulties to establish which product variation (by which company) has been introduced first – and successfully.

This issue is closely related to the classification of (business) innovations. In qualitative analyses the following categories can be used. New *goods* (that is, products or services) might represent an *incremental* or a *radical* change (innovation).

If we consider further units (levels) of analysis we can also think of innovations at the level of *technology systems*, that is, a set of technologically and economically interconnected goods and processes, affecting several companies or an entire sector at the same time, occasionally

[7] This paper is certainly not aimed at attempting an impossible task, namely considering how various authors use these two terms and why they do so. Yet, it should be mentioned that institutions – as the rules of the game – are increasingly used in mainstream economics, too. Further, the distinction between institutions and organisations suggested by North is disputed by Hodgson (2006), who 'married' these notions: „*Organizations* are special institutions that involve (a) criteria to establish their boundaries and to distinguish their members from nonmembers, (b) principles of sovereignty concerning who is in charge, and (c) chains of command delineating responsibilities within the organization." (ibid: 18; italics in the original) It would have been much more constructive – far less confusing – to state that organisations are governed by both internally and externally set rules.

leading to the emergence of new industries (e.g. canals, gas and electric light systems, plastic goods, electric household devices).

Being dissatisfied with the notion of 'long waves' used in analysing business cycles (mainly by Kondratiev and Schumpeter), Freeman and Perez have elaborated on the notion of *techno-economic paradigms*, that is, „the set of the most successful and profitable practices in terms of choice of inputs, methods and technologies, and in terms of organisational structures, business models and strategies. These mutually compatible practices, which turn into implicit principles and criteria for decision-making, develop in the process of using the new technologies, overcoming obstacles and finding more adequate procedures, routines and structures. The emerging heuristic routines and approaches are gradually internalised by engineers and managers, investors and bankers, sales and advertising people, entrepreneurs and consumers. In time, a shared logic is established; a new 'common sense' is accepted for investment decisions as well as for consumer choice. The old ideas are unlearned and the new ones become 'normal'." (Perez, 2010: 194)

Just to illustrate, the examples of such paradigmatic changes are the (first) industrial revolution; the age of steam power and railways (steam engines, steam ships, machine tools, railway equipment); the age of steel, electricity, electrical and heavy engineering; the age of oil and Fordist mass production (automobile, consumer durables, synthetic materials, petrochemicals); and more recently the age of information and telecommunications. (Freeman and Perez, 1988; Perez, 2010)

To sum up, the literature on business innovation analyses stresses the need to identify the *subject (or level) of change* and has developed relevant notions to perform detailed analyses. Further, *the degree of novelty* is also distinguished. These tools are summarised in Table 1.

Table 1: Subject (level) of change and degree of novelty: business and social innovations

Subject of change	Incremental change	Radical change(s)	Relevance for social innovation
Goods products and services	a more convenient, less noisy horse-driven carriage	animal-powered vehicles → automobiles	relevant
Processes production or delivery	a better organised, more efficient assembly line	automation of certain tasks at an assembly line	could be relevant in some cases
Organisations internal structure: units and their connections; behaviour and rules, routines, management and financial methods, business models guiding behaviour/ operations	a reorganised (better managed, more productive) firm	workshop → factory; setting up R&D units inside large firms in the 19th century; the emergence of the M-form (multidivisional) large firms; Fordist mass production → lean production	relevant, with some amendment: besides business organisations, several other types and 'hybrid' ones need to be considered
Markets	better connected regional markets in a given national economy	new markets are discovered and 'conquered' to obtain inputs and sell outputs (Far East, Americas, Africa, …)	relevant, with crucial amendments: how to serve the previously unmet needs of people, what other changes are needed?
Technology systems	more efficient electric lighting systems	gas lighting → electric lighting; manual household devices → electric ones	relevant if reinterpreted as a set of socially, organisationally, and economically interconnected SIs
Techno-economic paradigms	a given paradigm becomes more efficient, more widely accepted due to various types of improvements	shift from a certain paradigm to a new one	could be a relevant starting point to refine the notion of disruptive social innovations (Nicholls et al., 2015)

Source: author's compilation

In real-life cases the borders are often blurred between incremental and radical change, e.g. the 'bottom-of-pyramid' markets[8] seem to 'sit' on the border. This example also shows that technological changes (the development and production of modified or brand new products that these customers can afford) are only viable when the business model and several aspects of management and marketing methods (perception of a large group of previously 'unserved' people as a new 'market segment', adaptation of pricing, marketing and sales methods to these new opportunities, …) are changed at the same time and aligned with each other.

Some of the considerations related to business innovations might be useful when analysing social innovations in a qualitative way. Yet, compared to technological innovations, it is

[8] As Prahalad (2005) stressed, it could be a viable strategy to serve the billions of people who are at the bottom of the income pyramid, that is, perceive them as customers at a huge new market.

likely to be even more difficult to establish the degree of novelty of a given social innovation: is it new to a certain community (at a local/ neighbourhood level), to a country or to the world? Actually, the degree of novelty seems to be of lesser importance in these cases: usually intellectual property rights are not an issue for social innovators. (see also sub-section 3.3) Of course, social status (image and self-image) – being inventive and obtaining recognition for that – might play a role: it could give some impetus to be involved in certain social innovation projects. It is an empirical question to establish the role of prestige (respect and thus higher social status of social innovators) in SI endeavours.

What seems to be perhaps more relevant – but probably even more difficult than in the case of technological innovations – is to identify whether a given social innovation is an 'isolated' new solution or – using the analogy of technology systems – a part of a new 'social system', that is, a set of socially, organisationally, and economically interconnected social innovations, affecting several groups of people or an entire community (a neighbourhood, village, town or city) at the same time, occasionally leading to the emergence of new social structures, institutions, behaviour, value systems and practices at a higher level of aggregation (e.g. sub-national regions, nations or even supra-national regions [for example, the European Union]).

Some aspects of the notion of techno-economic paradigms is contested among economists and economic historians dealing with technological innovations, on the one hand, and this notion is probably too complex, too demanding – too far-fetched – to be applied for analysing social innovations, on the other. One of its features could be considered, though, as a useful guiding principle in SI analyses, namely the interconnectedness of technological, organisational and business model innovations, together with the emergence of a new, widely accepted 'common sense'. Further, it could be a useful starting point in case one would like to refine the notion of disruptive social innovations, introduced by Nicholls et al. (2015).

The literature reviewed above offers some elementary guidance for SI analyses: it is crucial to identify the subject (level) of changes introduced by a given social innovation as clearly as possible, as well as the degree of novelty of these changes. Further, it is highly likely that a real life SI – especially when it is analysed longitudinally, as in the CrESSI project – is actually composed of various types of changes both in terms of subjects (levels) and degree of novelty, and thus it might be instructive to 'decompose' it by identifying the distinctive 'components', as well as the interconnections between these elements.

Non-market institutions[9] could be important in certain SI processes, but their evolution is not a major theme in innovation studies, and thus the types of changes (incremental vs. radical) affecting them is not considered here. Further, the types of changes in policies aimed at supporting SI and those in socio-economic paradigms might also be relevant when analysing SI. Again, as these are not 'standard' themes in innovation studies, Table 1 has not covered these issues.

It is also important to consider the objective of a certain change process (a given social innovation), the intended and unintended outcomes, results, and impacts, as well as the actors involved in, and affected by, these change processes. The first set of these issues is discussed in sub-section 2.2, while the latter in section 3.

[9] For an introduction to the analysis of institutional changes, especially in the fields of metropolitan public economies, and the management of common-pool resources, see, e.g. Ostrom (2007), (2010); as well as Ostrom and Basurto (2011).

2.2 Does innovation always bring a positive change?

Two definitions of social innovation considered in sub-section 2.1 explicitly state that social innovation leads to improvement in one way or another: „ acceptable progressive solutions for a whole range of problems" (Moulaert et al., 2013); and „changes (…) that enhance its collective power resources and improve its economic and social performance" (Heiskala, 2007).[10]

The main thread in the literature on business innovation is somewhat similar: innovations are supposed to lead to improvement in features of goods, productivity and performance of firms, health conditions of people, use of inputs and so forth. Ultimately, all these changes amount to an increase in the wealth of nations. It should be added, however, that business innovation, characterised as 'creative destruction', has a destructive element as well: incumbent firms – producers of existing goods – need to adjust, abandon some of their previous activities, give up certain markets, shed labour or even can be driven out of business altogether. The net impact is still assumed to be positive, given the advent and subsequent rise of the newcomers.

Having searched the EBSCO and Google Scholar databases Sveiby et al. (2009) found a mere 26 articles, published in peer-reviewed journals, that analyse undesirable consequences of innovation, that is, around 1 per 1000 article with 'innovation' or 'new product development' in its title. The authors also stress that given their search methods, certain discourses – or major issues – are not presented in the 26 articles identified and analysed by them: e.g. environmental consequences, side effects of medicines, or failed product introductions. These are substantial concerns, no doubt. They conclude that undesirable consequences of innovation are (i) analysed in other discourses than innovation; (ii) constructed with other terminologies; and (iii) from other perspectives than innovation research. Usually, undesirable consequences are considered e.g. in biology, medicine, environmental studies and sustainable development, using theoretical frameworks relying on sociology, STS (science, technology and society), ethics or other domains (ibid: 14). This is an important observation from the point of analysing social innovations: besides innovation studies, other fields of enquiries can be at least as important.

The initial, still widely held, optimistic assumption concerning business innovations has been questioned in some instances, and not only because of the financial innovations causing the 2008 global crisis. Lock-in in inferior technological trajectories had already been analysed in the 1980s (Arthur, 1989; David, 1985), and since then other types of lock-ins have been identified (see sub-section 3.3 for further details). The negative health and environmental consequences of widespread motorisation were also well-known at that time. (Barker, 1987; cited in Pol and Ville, 2009) Further, a special issue of Technology Analysis & Strategic Management addressed two major questions: „Innovation –But For Whose Benefit, For What Purpose?" (Hull and Kaghan, 2000).

More recently, building on Calvano (2007), Soete (2013) explores the drivers, mechanisms and consequences of 'destructive creation' that benefits the few at the expense of the many. Examples include innovations driven by the idea of „planned obsolescence purposely limiting the life-span of particular consumer goods" (ibid: 138), e.g. fashion goods, restrictive aftermarket practices reducing the value of existing products (by limiting backward compatibility of software packages, ceasing to supply spare parts for the previous models of machinery and electronic equipment, as well as limiting their 'reparability' in other ways). In brief, 'destructive creation' hampers prolonged use of consumer goods and drive customers to

[10] The CrESSI definition of SI considers intentions (not outcomes): „ideas (…) intentionally seek to improve human capabilities, social relations".

continuously ‘upgrade’ their gadgets. ‘Forcing’ ever more new products onto the markets eventually leads to unsustainable consumption growth patterns and environmental degradation.

A particular case is the introduction of the multiple-fuel stove, developed by large multinationals for poor people living in rural areas or slums in developing countries. This stove burns cow dung and biomass, although these fuels are not only extremely inefficient, but also dangerous to use, given the smoke inhaled from indoor fire. No wonder, Soete is rather critical towards these types of innovations: „This is where BoP [bottom of the pyramid] innovation takes on (…) a new meaning in line with its creative destruction nature.” (ibid: 139) He stresses the importance of „grassroot innovations” to reverse these processes by introducing functional solutions to satisfy the needs of ‘BoP’ users, taking into account their framework conditions (extremely low disposable income, poor physical infrastructure conditions [energy, water, transport, communications networks, etc.]), as well as the idea of ‘cradle to cradle’ innovations, based on the idea of local re-use of inputs. Although it is not mentioned by the author, reparability is also a key notion to make these innovations affordable, limit their harmful impacts on the environment, and create job opportunities.

Probably by now the most widely known cases of destructive innovations are the ones introduced in the name of ‘dispersing the risk’, but in essence allowing a few, well-informed and well-positioned actors to realise substantial profits while putting a huge burden on society as a whole. (ibid: 141-142)

Returning to social innovation, it may also have a ‘dark side’ (Nicholls et al., 2015: 5-6). Clearly, no society is homogenous, not even those members of it, who are marginalised and disempowered: they still have their own values and views, and thus might perceive a certain change process and its effects in different ways. Moreover, a particular measure/ solution that improves the situation of some groups can, in fact, affect other groups negatively – and not because they perceive in that way, but as an actual (‘neutrally/ objectively measurable’) impact.

The way, in which Lundvall (2007b) uses the term of ‘function’ in relation to national systems of innovation[11] might be applied to refine the definition of social innovation: instead of assuming (expressing) a positive impact in the definition itself, that could be stated as a function (the main objective) of social innovation. The CrESSI definition of social innovation is a point in case in this respect. It has to be stressed, though, that it only intends to cover certain types of SI, i.e. it is not aimed at providing a general definition of all sorts of SI.

3 Actors and processes of innovation: diverse analyses in competing models and economics paradigms

Besides Schumpeter, only a few economists had perceived innovation as a relevant research theme in the first half of the 20th century.[12] At that time, however, natural scientists, managers of business R&D labs and policy advisors had formulated the first models of innovations – stressing the importance of scientific research –, and these ideas are still highly influential.[13]

[11] „If I were to assign a function to the national system of innovation I would be more specific than defining it as just ‘pursuing innovation’ and propose that the function is to contribute to economic performance on the basis of processes of creation and diffusion of knowledge. This corresponds to the normative focus of those who pioneered the NSI-concept.” (Lundvall, 2007b: 15) (see also sub-section 4.3 on functions of innovation systems)
[12] The starting points for 3.1–3.3 are developed in section 2 in Havas (2015a).
[13] For further details, see, e.g. Fagerberg et al. (2011: 898) and Godin (2008: 64–66).

Since the late 1950s, more and more economists have shown interest in studying innovation, leading to new models of innovation, as well as an explicit mention of innovation in various economics paradigms. The role of innovation in economic development, however, is analysed by various schools of economics in diametrically different ways.[14] The underlying assumptions and key notions of these paradigms lead to diverse policy implications.

This section offers a brief overview of various models of innovation (3.1); juxtaposes economics paradigms as to how innovation is understood and analysed in various schools of thought (3.2); and considers STI policy implications derived from these paradigms (3.3). The relevance of these ideas and approaches for analysing social innovation is discussed at the end of each sub-section.

3.1 Linear, networked and interactive learning models of innovation

The first models of innovation had been devised by natural scientists and practitioners before economists showed a serious interest in these issues.[15] The idea that basic research is the main source of innovation had already been proposed at the beginning of the 20th century, gradually leading to what is known today as the science-push model of innovation, forcefully advocated by Bush (1945).

It is worth recalling some of the main building blocks of Bush's reasoning:

> „We will not get ahead in international trade unless we offer new and more attractive and cheaper products. Where will these new products come from? How will we find ways to make better products at lower cost? The answer is clear. There must be a stream of new scientific knowledge to turn the wheels of private and public enterprise. There must be plenty of men and women trained in science and technology for upon them depend both the creation of new knowledge and its application to practical purposes. (…)
>
> New products and new processes do not appear full-grown. They are founded on new principles and new conceptions, which in turn are painstakingly developed by research in the purest realms of science.
>
> Today, it is truer than ever that basic research is the pacemaker of technological progress. In the nineteenth century, Yankee mechanical ingenuity, building largely upon the basic discoveries of European scientists, could greatly advance the technical arts. Now the situation is different.
>
> A nation which depends upon others for its new basic scientific knowledge will be slow in its industrial progress and weak in its competitive position in world trade, regardless of its mechanical skill." (Bush, 1945, chapter 3)

By the second half of the 1960s the so-called market-pull model contested that reasoning, portraying demand as *the* driving force of innovation. Then a long-lasting and detailed discussion have started to establish which of these two types of models are correct, that is,

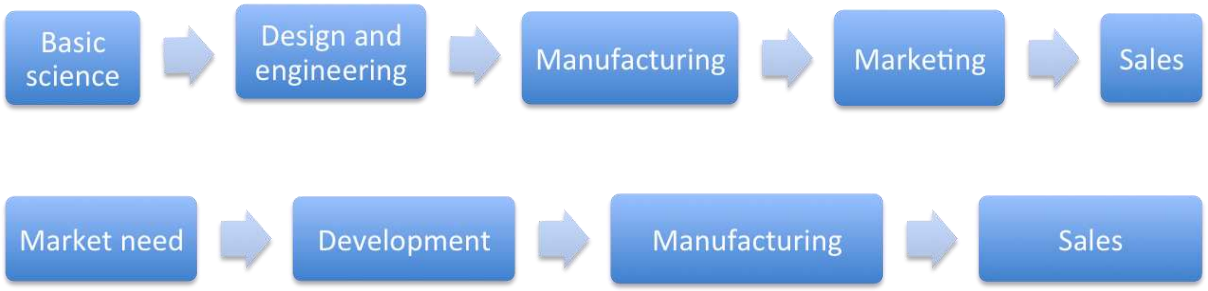
[14] The ensuing overview can only be brief, and thus somewhat simplified. More detailed and nuanced accounts, major achievements and synthesising pieces of work include Baumol (2002); Baumol et al. (2007); Castellacci (2008a); Dodgson and Rothwell (eds) (1994); Dosi (1988a), (1988b); Dosi et al. (eds) (1988); Edquist (ed.) (1997); Ergas (1986), (1987); Fagerberg et al. (eds) (2005); Fagerberg et al. (2012); Freeman (1994); Freeman and Soete (1997); Grupp (1998); Hall and Rosenberg (eds) (2010); Klevorick et al. (1995); Laestadious et al. (2005); Lazonick (2013); Lundvall (ed.) (1992); Lundvall and Borrás (1999); Martin (2012); Metcalfe (1998); Mowery and Nelson (eds.) (1999); Nelson (ed.) (1993); Nelson (1995); OECD (1992), (1998); Pavitt (1999); Smith (2000); and von Tunzelmann (1995).

[15] This brief account can only list the most influential models; Balconi et al. (2010); Caraça et al. (2009); Dodgson and Rothwell (eds) (1994); and Godin (2006) offer detailed discussions on their emergence, properties, and use for analytical and policy-making purposes.

whether R&D results or market demands are the most important information sources of innovations.[16]

Both the science-push and the market-pull models portray innovation processes as linear ones. (Figure 1)

Figure 1: Linear models of innovation

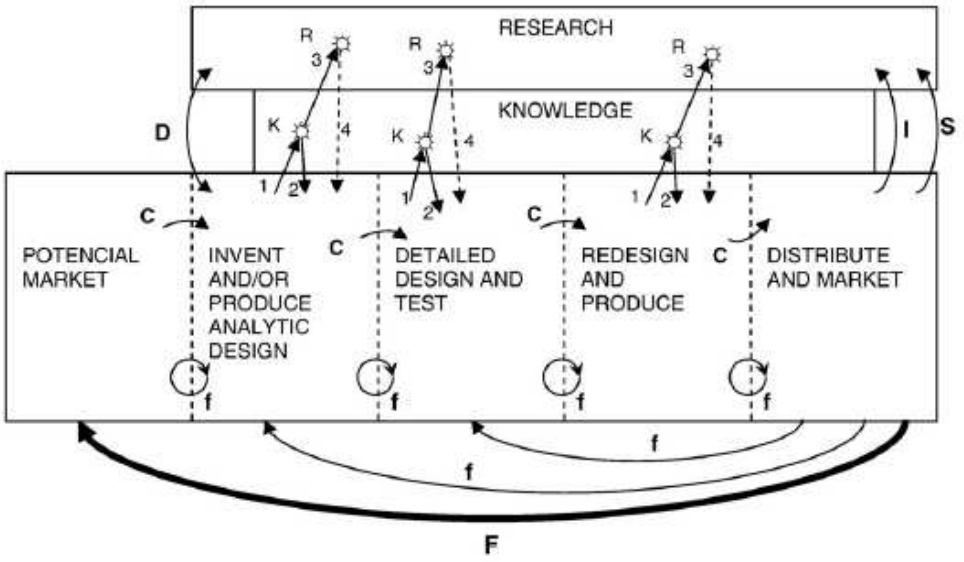


Source: Dodgson and Rothwell (eds) (1994), Figures 4.3 and 4.4 (p. 41)

This common feature has somewhat eclipsed the differences between these two models when Kline and Rosenberg (1986) suggested the chain-linked model of innovation, stressing the non-linear property of innovation processes, the variety of sources of information (already available scientific knowledge, intramural and extramural R&D activities to generate new knowledge, practical knowledge[17]), as well as the importance of various feedback loops. (Figure 2)

[16] It is telling that a recent review of this discussion by Di Stefano et al. (2012) draws on one hundred papers.
[17] „...when the science is inadequate, or totally lacking, we still can, do, and often have created important innovations, and innumerable smaller, but cumulatively important evolutionary changes." (ibid: 288)

Figure 2: The chain-linked model of innovation



Chain-linked model showing flow paths of information and cooperation.
Symbols on arrows: **C** = central-chain-of-innovation; **f** = feedback loops; **F** = particularly important feedback.

K-R: Links through knowledge to research and return paths. If problems solved at node K, link 3 to R not activated. Return from research (link 4) is problematic - therefore dashed line.

D: Direct link to and from research from problems in invention and design.

I: Support of scientific research by instruments, machines, tools, and procedures of technology.

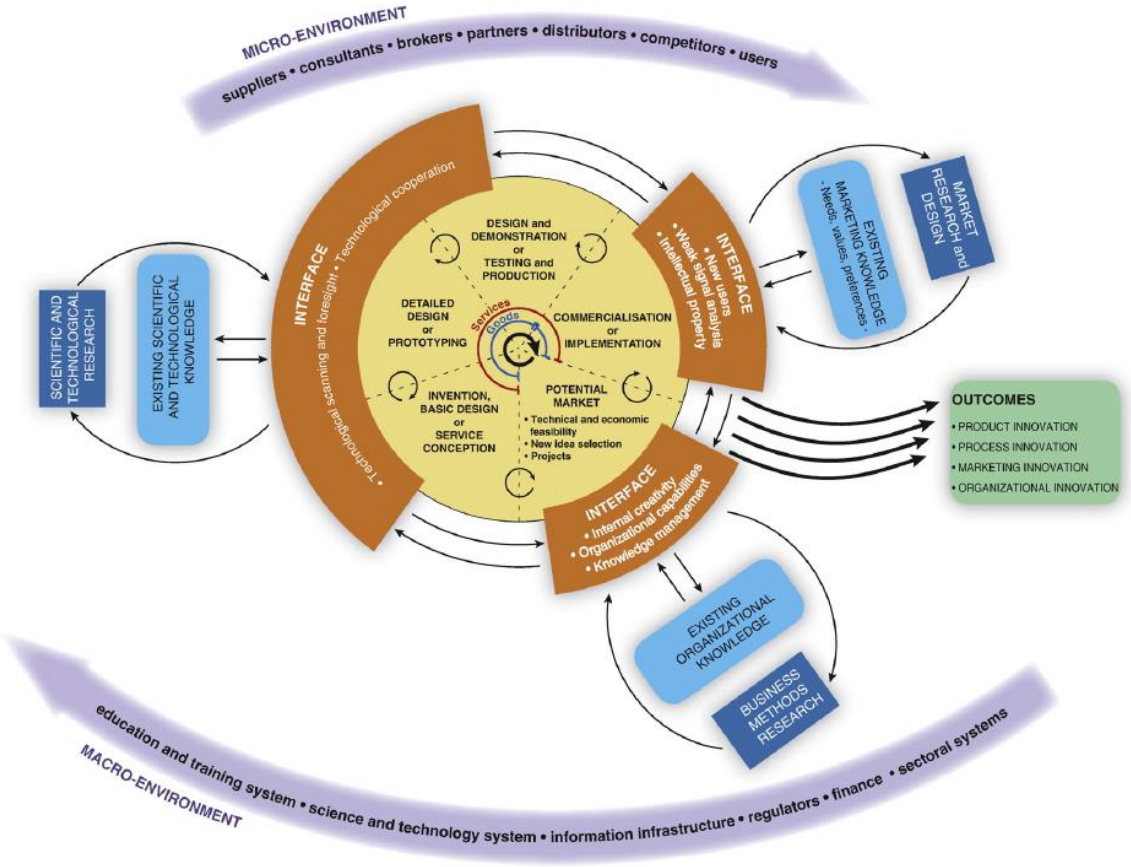
S: Support of research in sciences underlying product area to gain information directly and by monitoring outside work. The information obtained may apply anywhere along the chain.

Source: Kline and Rosenberg (1986)

The chain-link model has then been extended into the networked model of innovation; and the recent, highly sophisticated version of the latter one is called the multi-channel interactive learning model. (Caraça et al., 2009) (Figure 3) This model

> „has representational purposes and not representative ones, i.e. it *does not assume that all factors have to be in place* for innovation to be realised and successful. Rather, it tries to provide a stylised representation of the main classes of variables, and their interrelationships, which are involved in the innovation process taking place in a wide array of industries. For instance, innovative firms in 'low-tech' industries such as food-processing or textiles work closely with users in order to modify their products, whereas services firms in the finance sector are relatively heavy users of economic findings (econometrics, risk theory, etc.), and, moreover, all of these are examples of industries quite dependent on equipment suppliers (machinery, information technology, and others).
>
> Thus, the model is an analytical grid that describes and contextualises elements, but it also provides a set of flexible generalisations upon which to base our thinking when trying to explain the sources and stages of the innovation process. It points to the *ubiquitous experience-based learning processes* taking place within firms, as well as at the interfaces with users, suppliers and competitors. In addition, (…) the daily exchange of knowledge involving scholars and students in an interaction with firms is more important than when universities act as business enterprises selling knowledge in the form of patents.
>
> The model makes it clear that *not all processes of innovation are science-based and that few of them are purely science-driven*." (Caraça et al., 2009: 864-866; emphasis added – AH; footnotes are removed from the original)

Figure 3: The multi-channel interactive learning model of innovation



Source: Caraça et al. (2009)

The above *three models of innovation* are rather different in various aspects, of which two are highlighted here as highly relevant for analysing social innovation: the types of *actors* and *knowledge* are considered as decisive ones in innovation processes. The major actors in the linear models are those who produce new S&T knowledge at publicly financed research organisations or at firms' labs by intramural R&D activities. These models do not deny explicitly the relevance of already available S&T knowledge, but do not emphasise (or even mention) the importance of those pieces of knowledge, either. Other types of knowledge and skills are mentioned (market intelligence, marketing and sales methods and skills), but not stressed. In these models innovation is in essence applied science. (Bush, 1945; Kline and Rosenberg, 1986: 287)

The chain-link model also focuses on researchers and engineers employed by firms as major actors, but besides analysing intramural S&T knowledge generation process, it acknowledges the relevance of already existing pieces of knowledge, too. That is mainly S&T knowledge, as Kline and Rosenberg (1986) focussed on technological innovations. Yet, the very last sentence of their study stresses the „social contexts of the innovating organization", and thus knowing this context is clearly a key factor to be successful. This model puts a special emphasis on various feedback loops between actors (and types of knowledge) throughout the innovation process.

The multi-channel interactive learning model of innovation radically departs from the linear models: it stresses the important role of many different types of actors („suppliers,

consultants, brokers, partners, distributors, competitors, users", education, training and R&D organisations, providers of information and finance, regulators, …) as well as different types of knowledge (S&T, marketing, design and business methods). As the name of the model also highlights, it puts a special emphasis on interactions among these various actors, required for learning, that is, exploiting already available knowledge, as well as generating new pieces of knowledge.[18] In other words, besides generating knowledge, its diffusion (circulation) and exploitation is also of crucial importance, and thus to be encouraged.

In brief, this latter approach seems to be the most promising one when analysing social innovation as those processes also mobilise many different types of actors, who generate and exploit a wide variety of knowledge.

It should also be stressed that these three models share a major feature: the market selects among business innovation attempts.[19] As *for social innovations, the selection process seems to be much more complex*, with more actors playing a role, and thus bringing their own assessment (values) into play: the social innovators, who spot and 'frame' a social issue to be solved; the beneficiaries themselves, whose problems need to tackled, and whose participation is likely to be a key success factor; the policy-makers, who regulate the domain where the social innovation is to be introduced and might provide funding, too; the politicians, who set the broader framework conditions for policy-makers and other actors; other potential sponsors/ funders; and in some cases the media and other opinion-leaders, too (to a varying degree, depending on the actual case).

3.2 Treatise of innovation in the major economics paradigms

Technological, organisational, managerial changes and opening up new markets had been major themes in classical economics – without using the term innovation. (Grupp, 1998: 52–53; Havas, 2015b; Kurz, 2003:155–156; Kurz, 2012) Then neo-classical economics essentially abandoned research questions concerned with dynamics, and instead focused on static allocative efficiency. Optimisation was the key issue for this school, assuming homogenous products, diminishing returns to scale, technologies accessible to all producers at zero cost, perfectly informed economic agents, perfect competition, and thus zero profit. Technological changes were treated as exogenous to the economic system, while other types of innovations were not considered at all.

Given the empirical findings and theoretical work on firm behaviour and the operation of markets, mainstream industrial economics and organisational theory have relaxed the most unrealistic assumptions, especially perfect information, deterministic environments, perfect competition, and constant or diminishing returns. Yet, „this literature has not addressed institutional issues, it has a very narrow concept of uncertainty, it has no adequate theory of the creation of technological knowledge and technological interdependence amongst firms, and it has no real analysis of the role of government." (Smith, 2000: 75)

[18] Although it is inevitable to draw on the existing body of knowledge when generating new pieces of knowledge, this aspect of knowledge generation is often neglected by those who follow the science-push model of innovation.

[19] Just to recall, the linear models of innovation only, while the chain-link model mainly, consider/s product innovations, and thus the market selects among those that prove technologically feasible. The role of market in selecting among process, organisational and marketing innovations is not considered by these models, on the one hand, and in practice it is mainly indirect, on the other.

Evolutionary economics of innovation rests on radically different postulates compared to mainstream economics.[20] The latter assumes rational agents, who can optimise via calculating *risks* and taking appropriate actions, while the former stresses that „innovation involves a fundamental element of *uncertainty*, which is not simply the lack of all the relevant information about the occurrence of known events, but more fundamentally, entails also (a) the existence of techno-economic problems whose solution procedures are unknown, and (b) the impossibility of precisely tracing consequences to actions". (Dosi, 1988a: 222 – emphasis added) Thus, *optimisation* is impossible on theoretical grounds.[21]

Availability of *information* (symmetry vs. asymmetry among agents in this respect) has been the central issue in mainstream economics until recently. Evolutionary economics, in contrast, has stressed since its beginnings that the success of firms depends on their accumulated *knowledge* – both codified and tacit –, *skills*, as well as *learning capabilities*. Information can be purchased (e.g. in the form of manuals, blueprints, or licences), and hence can be accommodated in mainstream economics as a special good relatively easily and comfortably. Yet, knowledge – and *a fortiori,* the types of knowledge required for innovation, e.g. tacit knowledge, skills, and competence in pulling together and exploiting available pieces of information – cannot be bought and used instantaneously. A learning process cannot be spared if one is to acquire knowledge and skills, and it is not only time-consuming, but the costs of *trial and error* need to be incurred as well.[22] Thus, the uncertain, cumulative and path-dependent nature of innovation is reinforced.

Cumulativeness, path-dependence and learning lead to *heterogeneity* among firms, as well as other organisations. On top of that, sectors also differ in terms of major properties and patterns of their innovation processes. (Castellacci, 2008b; Malerba, 2002; Pavitt, 1984; Peneder, 2010)

Innovators are not lonely champions of new ideas. While talented individuals may develop radically new, brilliant scientific or technological concepts, successful innovations require

[20] The so-called new or endogenous growth theory is not discussed here separately because its major implicit assumptions on knowledge are very similar to those of mainstream economics. (Lazonick, 2013; Smith, 2000) Moreover, knowledge in new growth models is reduced to codified scientific knowledge, in sharp contrast to the much richer understanding of knowledge in evolutionary economics of innovation. When summarising the „evolution of science policy and innovation studies" (SPIS), Martin (2012: 1230) also considers this school as part of mainstream economics: „Endogenous growth theory is perhaps better seen not so much as a contribution to SPIS but rather as a response by mainstream economists to the challenge posed by evolutionary economics."

[21] On the nature of innovation, and how it is treated in economics, see also Dosi (1988b), (2013); Dosi and Grazzi (2010); Dosi and Nelson (2010); Dosi et al. (eds) (1988); Metcalfe (1998), (2010); as well as Salter and Alexy (2014).

[22] Arrow (1962) already discussed „The Economic Implications of Learning by Doing", and Rosenberg (1982) stressed the importance of learning by using (ch. 6). Recently, learning has become a more regular subject in mainstream economics, most notably in game theory. For instance, while „learning" only appeared twice in the title of NBER working papers in 1996, it occurred 5 times in 1999, 6 times in 2002, 13 times in 2008, 10 times in 2013, and 12 times in 2014, among others in the forms of „learning by doing", „learning from experience", and „learning from exporting" – but also „learning from state longitudinal data systems" and „learning millennial-style". (It should be added that at least 15-20 NBER working papers are published a week.) Taking the titles and abstracts of articles published in the American Economic Review, „learning" occurred first in 1999, then 2-3 times a year in 2002-2006; 4 times in 2008, 2011, and 2012; 5 times in 2013; 6 times in 2007, 2010, and 2014; and 7 times in 2009. These articles discuss a wide variety of research themes – e.g. behaviour of firms and other organisations, business cycles, stock exchange transactions, forecasting of economic growth, mortgage, art auctions, game theory, behavioural economics, energy, health, labour market – and modes of learning. Thus, not all these articles are relevant from the point of analysing innovation processes (e.g. „learning [one's] HIV status" is not part of an innovation process). Further, in several cases knowledge is narrowed down to patents, which is clearly a misconception. Yet, a detailed analysis of the substance of these articles is beyond the scope of this paper.

various types and forms and knowledge, rarely possessed by a single organisation. A close collaboration among firms, universities, public and private research organisations, and specialised service-providers is, therefore, a prerequisite of major innovations, and can take various forms, from informal communications through highly sophisticated R&D contracts to alliances and joint ventures. (Freeman 1991, 1994, 1995; Lundvall and Borrás, 1999; OECD, 2001; Smith, 2000, 2002; Tidd et al., 1997) In other words, 'open innovation' is not a new phenomenon at all. (Mowery, 2009)

Those *economics paradigms* that take innovation as a relevant issue (an endogenous variable) for economics, evidently consider business innovations – and not social innovations. Their notions, methods, and results, therefore, need to take with a pinch of salt when trying to establish if those can be useful when analysing social innovations. Keeping that elementary caveat in mind, however, some observations can be made.

Classical economics cannot be regarded as a cohesive paradigm in terms of having shared axioms, basic notions, research questions, methods, postulates or main theses. Yet, major representatives of this school shared an important intention: they were interested in explaining various types of changes, taking into account complex relationships, including the co-evolution of technologies (in a broad sense, that is, both products and processes), organisations, markets and various societal features, and paid attention to the diversity of contexts, in which changes took place.[23] Just to mention an obvious, and fundamental, difference among these scholars, the main concern for Marx was not (only) to explain socio-economic phenomena, but to change the socio-economic structures[24] (including „social relations, and the processes in which these solutions are carried out", using the wording of the CrESSi definition of social innovation).

In contrast, *neo-classical economics* had a strictly defined, unifying theoretical framework. This model cannot accommodate social innovations for several reasons. Just to highlight some of the most important ones, for social innovators the major goal is not optimisation in a strict economic sense. Second, social innovators do face uncertainty, too, not only calculable risks. Third, dynamic aspects are crucial, e.g. changes in the environment, in which social innovations take place. Moreover, to induce this change is indeed among the major goals of social innovations. Fourth, various types of changes – economic, technological, organisational, social (e.g. structural, behavioural) and political – are endogenous from the point of view of social innovations, and co-evolve. Policy governance sub-systems and the level of governance need to be considered, too. In other words, these changes and co-evolutionary processes cannot be treated as exogenous. Fifth, social innovators are neither 'representative agents', nor do they act on their own. They have their own specific characteristics, partly shaped by the context, in which they operate. Further, they need to interact with several other actors, and often form formal or informal networks to do so.

Mainstream economics is somewhat more in flux, compared to neo-classical economics, on the one hand. It constantly evolves by incorporating new notions, research questions, analytical tools and results from specific branches of economics. Thus, it is more difficult to define than neo-classical economics. Given its constant evolution, on the other hand, it has relaxed some of the most unrealistic assumptions of the neo-classical paradigm. It can be safely said, though, that the most important postulates, especially the one on optimisation, are still the cornerstones of this framework (Lazonick, 2013), and hence it is of a rather limited relevance when it comes to analyse social innovation.

[23] For a more detailed account, see, e.g. Havas (2015b) and the literature referenced there.

[24] Marx explicitly distanced himself from classical economics: it is not by accident that his major book is entitled „Capital: A critique of political economy".

Evolutionary economics emphasises several key features that can be highly applicable when analysing social innovation. These include the importance of dynamics; uncertainty; stressing the differences among contexts; learning; various types, forms and sources of knowledge; path dependence; processes of generating variety; selection among diverse solutions; networking and co-operation among actors; co-evolution of various types of changes.

The capability approach (CA) has not been considered in this paper in any detail. Yet, it is a major element in the overall theoretical framework for the CrESSI project. Hence it is worth stressing an important (potential) link between CA and evolutionary economics of innovation: „Learning capabilities play an important role in improving the wider set of human capabilities; therefore, CA could benefit from paying attention to innovation systems."[25] (Bajmócy and Gébert, 2014: 96)

While social innovations can certainly exploit technological innovations, their essence tends to be organisational, managerial and behavioural changes. Thus they draw on different types (scientific and practical) and forms (codified and tacit) of knowledge, stemming from various sources (organised and systematic R&D activities, as well as other types of search processes, e.g. those 'informed' by practitioners). In other words, the observation of evolutionary economics of innovations on the diversity of knowledge sources applies *a fortiori* to social innovation: analysts and decision-makers should be aware of the diversity of social innovations, too, in terms of their nature, drivers, objectives, actors, knowledge bases, and process characteristics.

Evolutionary economics has also noticed the *highly uneven speed of progress*, that is, performance improvement, in various fields, e.g. rather fast development in space exploration, drugs, medical imaging and telecommunications, on the one hand, and hardly any change in improving education, on the other. One of the major reasons explaining these differences is that these fields have different underlying knowledge bases and the types of knowledge required for advancing progress can be developed at a different pace. (Nelson, 1977, 2011)

Without trying to capture all the major building blocks of this thorough analysis of learning processes, a few key features are highlighted here, which seem to be fairly relevant when analysing social innovations. First, this evolutionary account of learning stresses that „the ability to learn from variation, from experiments natural or deliberate" is a key to achieve progress. (Nelson, 2011: 684) Clearly, experimentation is a completely different 'ballgame' when the 'subjects' are human beings: ethical, societal and political considerations become vital (as opposed to a number of technological experiments, notwithstanding the significance of these issues in some of those fields). Second, progress is a rather vague notion; it should be translated (observed) as a better performance. Measuring performance, however, is far from being a trivial task, even when it comes to technological or economic performance (in a somewhat narrow sense). Progress can only be measured in an appropriate, context-specific way even in these realms. But to compare performance, and thus being able to learn (what directions of search seem to be promising, i.e. what efforts should be redoubled, and what doesn't work, and thus should be abandoned) one needs a reliable yardstick: „the criteria for better performance must be clear and relatively stable, and competing practices must differ non-trivially in efficacy under those criteria. Further, the evidence of efficacy must be relatively sharp, and available in timely fashion." (ibid: 684) That seems to be a tall order

[25] One might assume that by „innovation systems" the authors actually mean the systems approach to innovation, more precisely, the emphasis of learning and learning capabilities in evolutionary economics of innovation, the theoretical foundation of the systems approach to innovation.

even for a relatively 'simple' technological innovation, and *a fortiori* so for social innovations.[26]

3.3 Market and system failures: policy rationales derived from economic theories

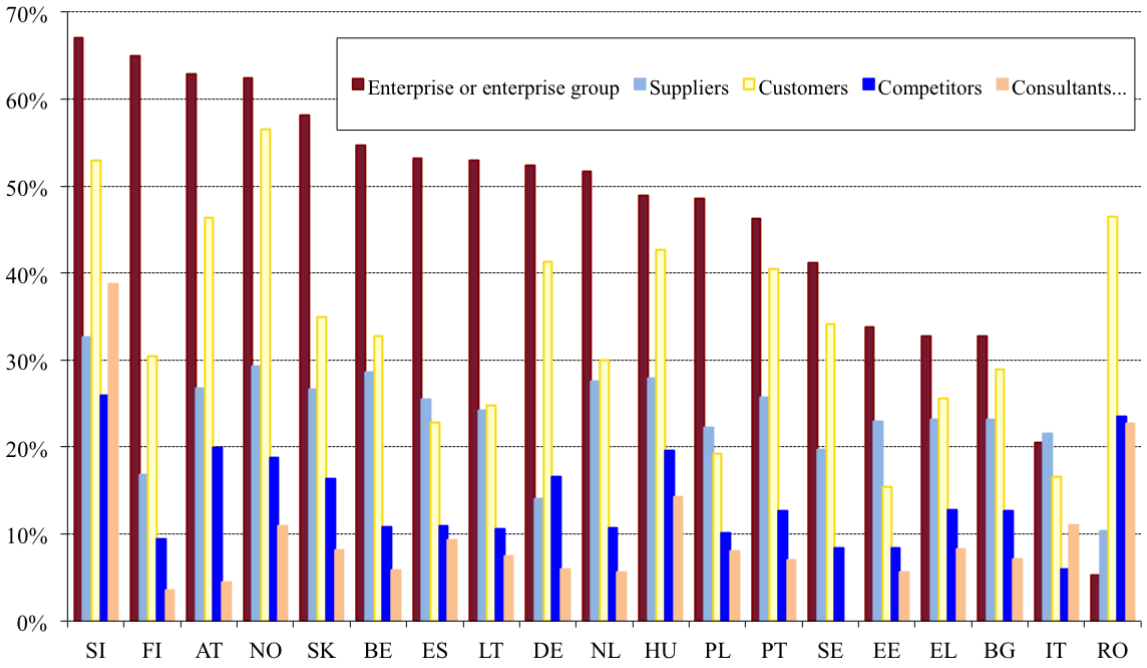
Different policy rationales can be drawn from competing schools of economic thought. Mainstream economics is primarily concerned with market failures: the unpredictability of knowledge outputs from inputs, the inappropriability of full economic benefits of private investment in knowledge creation, and the indivisibility in knowledge production lead to a 'suboptimal' level of business R&D efforts. Policy interventions, therefore, are justified if they aim at (a) creating incentives to boost private R&D expenditures by ways of subsidies and protection of intellectual property rights, or (b) funding for public R&D activities.

Evolutionary economics of innovation investigates the role of knowledge creation and exploitation in economic processes; that is, it does not focus exclusively on R&D. This school considers various types and forms of knowledge, including practical or experience-based knowledge acquired via learning by doing, using and interacting. As these are *all* relevant to innovation, scientific knowledge is far from being the only type of knowledge required for a successful introduction of new products, processes or services, let alone non-technological innovations. R&D is undoubtedly among the vital sources of knowledge. Besides in-house R&D projects, however, results of other R&D projects are also widely utilised during the innovation process: extramural projects conducted in the same or other sectors, at public or private research establishments, home or abroad. More importantly, there are a number of other sources of knowledge, also essential for innovations, such as design, scaling up, testing, tooling-up, trouble-shooting, and other engineering activities, ideas from suppliers and users, inventors' concepts and practical experiments (Hirsch-Kreinsen et al. (eds), 2005; Klevorick et al., 1995; Lundvall (ed.), 1992; Lundvall and Borrás, 1999; Rosenberg, 1996, 1998; von Hippel, 1988), as well as collaboration among engineers, designers, artists, and other creative 'geeks'. Further, innovative firms also utilise knowledge embodied in advanced materials and other inputs, equipment, and software.

The Community Innovation Survey (CIS) defines its own set of categories as highly important sources of information for product and process innovation: the enterprise or the enterprise group; suppliers of equipment, materials, components or software; clients or customers; competitors or other enterprises from the same sector; consultants, commercial labs or private R&D institutes; universities or other higher education institutes; government or public research institutes; conferences, trade fairs, exhibitions; scientific journals and trade/technical publications; as well as professional and industry associations. All rounds of CIS clearly and consistently show that firms regard a wide variety of sources of information as highly important ones for innovation, but given space limits, only the 2010–2012 data are reported in Figures 4–5.[27]

[26] On the inherent difficulties of social impact measurement, see, e.g., Nicholls (2015). It is also worth recalling that sub-section 2.2 has already questioned if (a) social innovation is necessarily and always 'good'; and (b) a certain change (social innovation) has the same type of impacts on various social groups.
[27] Data for the 2006–2008 and 2008–2010 periods are presented in Appendix 2.

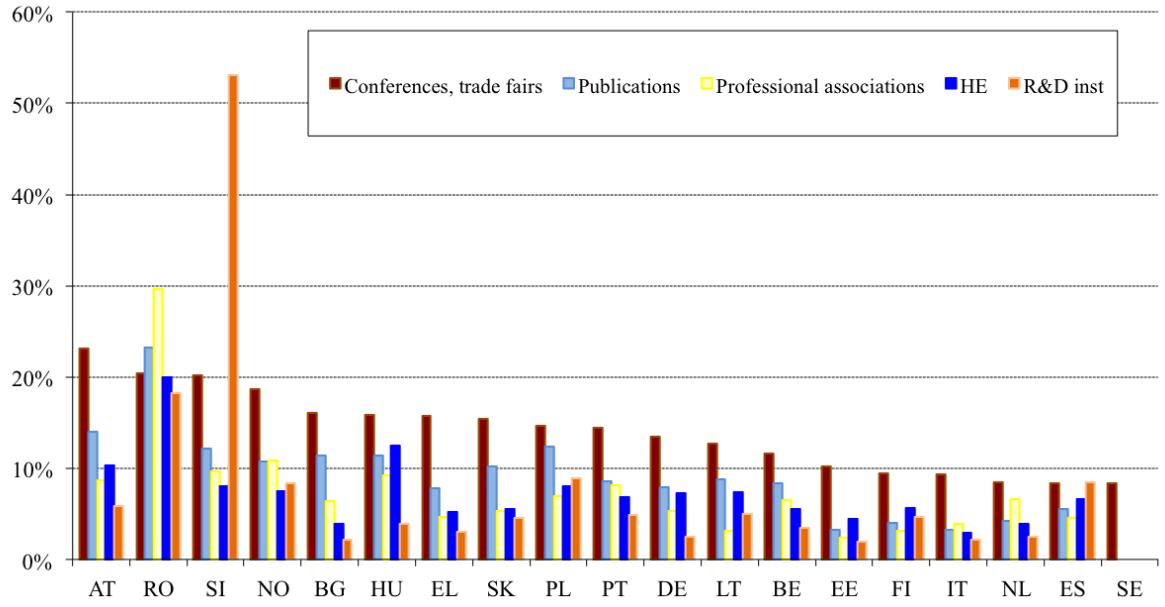
Figure 4: Highly important 'business' sources of information for product and process innovation, EU members, 2010–2012



Source: Eurostat, CIS2012

Note: Data for Cyprus, Luxembourg and Malta are not included in this figure.

Figure 5: Highly important 'scientific' sources of information for product and process innovation, EU members, 2010–2012



Source: Eurostat, CIS2012

Note: Data for Cyprus, Luxembourg and Malta are not included in this figure.

The wide variety of knowledge drawn on in innovation processes is a crucial point to bear in mind as the OECD classification of industries only takes into account expenditures on formal R&D activities, carried out within the boundaries of a given sector.[28] In other words, a number of highly successful, innovative firms, exploiting advanced knowledge created externally in distributed knowledge bases (Robertson and Smith, 2008; Smith, 2002) and internally by non-R&D processes, are classified as medium-low-tech or low-tech, because their R&D expenditures are below the threshold set by the OECD.

In sum, evolutionary economics of innovation posits that the success of firms is largely determined by their abilities to exploit various types of knowledge, generated by both R&D and non-R&D activities. Knowledge generation and exploitation takes place in, and is fostered by, various forms of internal and external interactions. The quality and frequency of the latter is largely determined by the properties of a given innovation system, in which these interactions take place. STI policies, therefore, should aim at strengthening the respective innovation system and improving its performance by tackling *system(ic) failures* hampering the generation, diffusion and utilisation of any type of knowledge required for successful innovation.[29] (Edquist, 2011; Foray (ed.), 2009; Freeman, 1994; Lundvall and Borrás, 1999; OECD, 1998; Smith, 2000) From a different angle, conscious, co-ordinated policy efforts are needed to promote knowledge-intensive activities in all sectors, by all actors.

The market failure argument implies that (a) R&D activities (naturally: technological ones) should be promoted by public policies, and one of the tools to do so is (b) a strong protection

[28] The so-called indirect R&D intensity has been also calculated as R&D expenditures embodied in intermediates and capital goods purchased on the domestic market or imported. Yet, it has been concluded that indirect R&D intensities would not influence the classification of sectors. (Hatzichronoglou, 1997: 5)

[29] In an attempt to systematically compare the market and systemic failure policy rationales, Bleda and del Río (2013) introduce the notion of evolutionary market failures, and reinterpret „the neoclassic market failures" as particular cases of evolutionary market failures, relying on the crucial distinction between knowledge and information.

to intellectual property rights (IPR) because that provides incentives for private actors to invest in R&D activities.[30] Clearly, while certain types of technological innovations can be important components ('ingredients') of social innovation processes, too, this type of policy support is unlikely to be the most pertinent one to promote social innovation. Further, protecting IPR does not seem to be a major concern for social innovators: as already mentioned, gaining recognition as a creative social innovator is more likely to entice people to launch social innovation projects than (expected) proceeds from licences. As for policies meant to foster social innovation, it is undoubtedly more relevant to promote the dissemination and exploitation of relevant types of knowledge than constrain these processes.

The system failure concept can be extended to social innovation without any theoretical constraint. That does not mean, however, that system failures can be identified easily. Indeed, to establish what elements of an innovation system are missing or fledgling, what institutions ('rules of the game') hamper innovation processes and hence need to be changed is a demanding and thus time-consuming task. Just to illustrate the difficulties encountered by analysts, a few types of system failures identified by (business) innovation scholars are listed in Table 2 with some initial ideas as to their relevance for analysing social innovation.

Table 2: System failures in innovation systems and their relevance for analysing social innovation

System failures hampering business innovation	Relevance for analysing social innovation

Evolutionary failures
• generation of technological opportunities
• learning by firms (accumulation of capabilities)
• lock-in in inferior technology (competence trap), trade-offs
  o exploration vs. exploitation (current vs. future profits)
  o variety generation vs. selection
  o tight IPR vs. exploration of new approaches/ diverse competence base
	Not directly relevant, but could be used as a source of inspiration, e.g. as failures to generate opportunities for social innovation, learning by social innovation actors.

System failures (problems) • missing or weak elements ('nodes', actors) • missing, weak, or inappropriate connections among the actors • transition (system dynamics)	Directly relevant (with minor adjustments)
Policy failures • weak learning (e.g. from previous practice, interactions with other actors, and good practices) • inflexibility in implementation • lack of understanding of sectoral characteristics • poor (no) vision-building • ineffective co-ordination of policies	Directly relevant

Source: Types of system failures are identified by Malerba (2009)

[30] Following the US practice, more recently several countries extend this way of regulation to publicly financed research organisations, too, in an attempt to boost the commercialisation of their R&D results. Analysts are divided on this issue: many of them are rather sceptical if this a wise and productive policy – but this debate is not directly relevant for the main theme of this paper, and thus no further details are discussed here.

It should also be noted that studying social innovation is a more recent activity than investigating business innovation, and thus analysts and policy-makers can rely on a lesser amount of experience and a 'slimmer' body of accumulated knowledge to identify system failures as a basis for adequate policy interventions.

3.4 System failures in a capability approach

As already mentioned, the capability approach (CA) is not considered in this paper in detail, it is worth recalling briefly here that Bajmócy and Gébert (2014) has attempted to revisit innovation policy issues from the CA angle. One of their interesting results is set of new system failures. (Table 3)

Table 3: The outlines of innovation policy in the capability approach

Rationale for policy making	The failure of the innovation system to contribute to the expansion of capabilities: • technological change creates wealth at the expense of other freedoms [or: others' freedom – AH], • technological change creates opportunities that cannot be effectively used to achieve valuable „functionings" for the community.
System failures	Institutions, organizations and links fail to generate and diffuse knowledge: • that contributes to the identification and alteration of ideologies and hegemonies lying behind current innovation processes, • that would be necessary to identify the feedbacks of the system on which we act on when we use technologies (failure to encompass the „side-effects" of technology), • on the ability of the society to adapt to changes, • on the moral judgement of the society and incorporate this information into innovation processes.
Reflecting to the differences of systems	Besides the uniqueness of innovation systems, the differences regard: • the capabilities deemed to be valuable, • the factors of conversion, • the ability to adapt to changes, • the possibilities of agency, • that the moral judgement on new technologies should also be considered.
Forming of innovation policy	Beside unpredictability, uncertainty and bounded rationality policy making should reflect the fact, that: • the required set of knowledge is scattered amongst a large number of local actors (including non-experts), • innovation policy necessitates value commitment.

Source: Table 2 in Bajmócy and Gébert (2014)

4 Innovation systems

This section first briefly considers the harbingers of the notion of (national) innovation system, and then the structure and functions of an innovation system are introduced. Finally, the policy relevance and the actual use of the systems approach is discussed and some observations for analysing social innovations in a systemic manner are offered.

4.1 A retrospect on the antecedents of the notion

Business innovations – just as practically all other economic activities – literally 'take place', that is, they occur in space. While focussing on spatial aspects of economic activities might be perceived as a relatively new phenomenon, given the recent rise of economic geography to prominence, actually economic geography itself is not that new at all – that is why some authors call the current stream of literature 'new' economic geography. Moreover, agglomeration was already 'discovered' in economics by Marshall in the late 19th century. Thus, space-based analyses of innovation activities are in line with economics traditions.

A recurring question in economics and economic policy was discussed in 1980-1983 by the OECD Ad-hoc Group on Science, Technology and International Competitiveness: why some countries are more competitive than other? That discussion was informed by a background report by Chris Freeman (Freeman, 1982 [2004]), in which the notion of 'national innovation system' appeared for the first time (Lundvall, 2004: 531).

Godin (2010) goes even further back in time when he stresses that „Freeman's conceptual construction of an innovation system really begins with" the first edition of *The Economics of Industrial Innovation* (1974), which is not read by anyone anymore, being replaced by a second and then a third edition (1982, and 1997, respectively), in which the „the argument on innovation system is less apparent" (ibid: 3, 6).

Godin (2009), in a somewhat contrasting manner, claims that Freeman „had been advocating system analysis since the early 1960s", by citing one of his reports to the OECD:

> „'There is no reason why these methodologies [operational research, system analysis and technological forecasting], developed for military purposes but already used with success in such fields as communication and energy, could not be adapted to the needs of civilian industrial technology' (OECD 1963b, 73; 1971)." (ibid: 492)

One of the conclusions offered by Godin (2009) is a sociological one:

> „What the framework on National Innovation System certainly brought to a system approach that had existed for thirty years was a name or label. Such labels are important for academics as well as governments to highlight issues and bringing them to the intellectual or political agenda." (ibid: 494)

Freeman (1995) recalls the 'history' of this notion differently in the opening sentence of his classic article: „According to this author's recollections, the first person to use the expression 'National System of Innovation' was Bengt-Ake Lundvall" (p. 5). Without trying to establish who has actually coined this term, it should be added that Lundvall took part in the discussions of the OECD Ad-hoc Group on Science, Technology and International Competitiveness in 1980-1983 as a delegate of the Danish government (Lundvall, 2004: 531).

Interestingly, Helmar Krupp published an article in 1983 entitled „Overview of policy issues: Panel report on the functions of non-university research institutes in national R&D and

innovation systems and the contributions of universities".[31] The article opens with the following observations:

> „Universities are elements of national R&D and innovation systems, which comprise a great variety of customers and suppliers of R&D and innovation-related functions. *We must understand the working of such national R&D and innovation systems as a whole* in order to be able to specify the role and the future potential of universities as a part." (Krupp, 1983: 251; emphasis added - AH)

It is also worth noting that Helmar Krupp was the Director of the Institute for Systems Analysis and Innovation Research (FhG ISI),[32] established in 1972.

An even earlier antecedent, at the firm level, though, was an article entitled „An innovation system for the larger company", published in 1970 (Collier, 1970).

In brief, the idea to analyse innovation in a systemic manner had been 'in the air' for quite some time, in various forms and at different levels of analysis, but it has been still an important achievement to 'systemise' this way of thinking by introducing analytical rigour by Freeman, Lundvall, and Nelson concerning the national level analyses, as well as by Cooke, Asheim, Malerba and other major contributors concerning the regional and sectoral levels, respectively.

Summing up this brief retrospect, the notion of national innovation systems was a central concept in Freeman (1987) to analyse Japan's technology policy and economic performance and has become a widely used term, leading to other major contributions on national innovation systems, e.g. chapters in Part V in Dosi et al. (eds) (1988); Lundvall (ed.) (1992); and Nelson (ed.) (1993), just to recall the first important publications.[33]

Since these pioneering pieces of work, the system(s) approach has become widely accepted in the academic literature analysing business innovations. Indeed, this strand of the literature has become so huge that no one can even attempt compiling a comprehensive review – only some of the major features can be highlighted.[34] As already hinted at, regional, sectoral and technological innovation systems have also become subjects of intense analytical efforts (Asheim and Isaksen, 2002; Asheim and Gertler, 2005; Braczyk et al. (eds), 1998; Breschi and Malerba, 1997; Carlsson, 1994; Carlsson (ed.), 1995, 1997; Carlsson et al., 2002; Cooke,

[31] In the 'modern' understanding of national innovation systems the set of R&D actors, 'the rules of the game' governing their activities, as well as their interactions constitute a sub-system of the national innovation system.
[32] Most likely he had intense interactions with Freeman and Lundvall, given the small size of the community of innovation (policy) scholars at that time, and might have also been involved in the work of the OECD Ad-hoc Group on Science, Technology and International Competitiveness in 1980–1983.
[33] For further aspects of the evolution of the systems approach, see, e.g., Carlsson et al. (2002); Edquist (1997), (2001), (2005); Fagerberg et al. (2012); Fagerberg and Sapprasert (2011); Freeman (1995), (2002); Godin (2009), (2010); Lundvall (2004), (2007a), (2007b); Lundvall et al. (2002); Martin (2012); Pavitt (1999); and Smith (2000).
[34] Using data retrieved from the ISI Web of Science Fagerberg and Sapprasert (2011) shows that the 'system' literature grew much faster – around 2-3 times faster in 1998–2001 and 2003–2006, while 4–5 times faster in 2002 and 2007–2008 – than the innovation literature at large in 1996–2008 (p. 670; for further details, see Appendix 3). A more recent, simple search in Scopus returns 1,280 documents – including journal articles (60.9%), conference papers (18.1%), book chapters (12.4%), reviews 3.6%), editorials (1.7%) and books (1.4%) – with „innovation system*" in their title, published between 1992 and 2015. (Figure A6 in Appendix 3; see also Figure A7 for the results of a different search) An apparently 'pedantic' remark actually hints at the limitations of these types of exercises: while the concept of national innovation system is the main topic for Lundvall (2004), it is not included in that list of 1,280 documents, simply because of its title. Scopus returned 0 documents with „innovation system*" in their title for 1987–1991. In other words, e.g. Freeman (1987) is not included in Scopus. For that matter, neither Lundvall (ed.) (1992), nor Nelson (ed.) (1993) is recorded there.

1992, 2001; Cooke and Morgan, 1994; Cooke et al., 1997; Edquist (ed.), 1997; Malerba, 2002; Malerba (ed.), 2004; Mowery and Nelson (eds), 1999).

4.2 The structure of an innovation system

A standard starting point for any system analysis is to delineate it, that is, identify the boundaries of a given system. In the case of national and regional innovation systems these are the geographical borders. For sectoral systems, the boundaries are defined by the goals of a given analysis, of which a 'sector' is the subject. In other words, the level of aggregation of the goods depends on the research questions. It might well be the case that sectors are defined at a relatively high level of aggregation, and sub-sectors are also identified for certain analytical purposes. (Malerba (ed.), 2004: 17) Thus, a sectoral system of innovation is not necessarily the same as a statistical sector. Finally, technological innovation systems are not predetermined, either; they are also defined by the questions and levels of analysis. The latter can be (i) a knowledge field (e.g. digital signal processing), applied in several products; (ii) a product (e.g. industrial robots), in which several technologies (knowledge fields) are embodied; and (iii) a market (e.g. health care), where different types of products (from various technology fields) are traded, related to each other by the same institutional arrangement, and thus are subjects to a common selection environment. (Carlsson et al., 2002: 238)

Once the components are demarcated, the various types of connections (interactions, flows) between them are also major features: the components and the links (interactions) among them jointly define the operation – and hence the performance – of a system. Finally, it is also important to consider changes at various levels, as well as the types of system changes. These issues are addressed below in turn.

A general definition of national innovation system (NIS) would claim that a NIS is composed of all the major actors engaged in creating, exploiting and diffusing innovations; their interaction; those economic, social, political, organisational, institutional, and other factors that influence innovation processes, as well as the relations between, and co-evolution of, these factors.[35] In other words, the NIS concept is deeply rooted in understanding innovation as a cumulative and interactive process, already discussed in detail in sections 3.1–3.2. A standard observation in system theories is that the interrelationships and interaction between the components are as important in driving processes and determining performance as the components themselves. This observation is of particular relevance for innovation systems, given the interactive nature of innovation processes. For the same reason, institutions (the 'rules of the game') governing the interactions (co-operation and competition) and flows (of knowledge, funds) among actors are also decisive features of an innovation system.

The major actors and sub-systems of a NIS are depicted in Figure 3. At the core are firms as major actors, and their various types of innovation activities are also highlighted: search for new market opportunities; invention, basic design or service conception; detailed design or prototyping; demonstration, testing and production; commercialisation.

They rely on their internal creativity, organisational capabilities and knowledge management practices. To develop these capabilities and practices, they co-operate with other actors

[35] For further details and critical remarks on various definitions (or the lack of a clear definition), see, e.g., Freeman (1995); Edquist (1997: 14), (2001: 225), (2005: 182–183); Lundvall (2007a), (2007b); McKelvey (1991); Miozzo and Walsh (2006); and Niosi (2002).

involved in business methods research, who, in turn, can be private (profit-oriented) or publicly financed (not for profit) organisations or individuals.

Firms also scan their environment for relevant S&T knowledge and are engaged in their own foresight activities (of which results are only for internal use) and/ or publicly financed (national or sectoral) ones, producing freely available knowledge concerning possible future developments. To obtain new S&T knowledge, they co-operate with other firms, public research organisations (including universities) and commercial labs.

Further, they co-operate with current and potential new users, utilise their existing knowledge on markets, and conduct or commission market research.

To sum up their interactions from a different angle, in their *micro-environment* firms interact with suppliers, legal, technological, financial, marketing, HR, and environmental consultants, various types of brokers, partners, users, distributors, and competitors. Concerning their *macro-environment*, they rely on the education and training system, the R&D sub-system, and information service providers, comply with, and occasionally influence, various types of regulations, benefit from public support, and obtain external private funding through various channels in different ways and forms.

Various sub-systems of national innovation systems can be identified, differentiated by their main activities: most notably governing policy design and implementation processes; performing R&D and innovation activities; training people; connecting actors by transferring information, knowledge, and capital; providing management, IPR, legal, incubation, problem-solving and other types of services, etc. It is not intended in this short sub-section to develop a detailed 'map' of these sub-systems, but it is important to stress that actors can be active in various sub-systems, i.e. there is no one-to-one match between actors, activities, and sub-systems. For example, research and innovation performers can influence policy formation processes, might transfer information and knowledge, as well as provide services to other actors.

The importance of the macro-environment clearly indicates why the national level is still of relevance even in the 'age of globalisation'[36] – and without denying the significance of regional and sectoral levels.

Although NIS is a widely used concept, there is no strict, universally accepted NIS definition. Without trying to list and assess all the variations, only two versions are mentioned here as a sort of warning – and with great reluctance. Before doing so, it should be reiterated that firms exploit various types of knowledge for their innovation activities. (section 3) Applying this general observation to the Danish case, and relying on data obtained through the DISKO survey, Jensen et al. (2007) made an elementary distinction between two modes of innovation: (a) one based on the production and use of codified scientific and technical knowledge (in brief, the ST[I] mode), and (b) another one relying on informal processes of learning and experience-based know-how (called DUI: learning by Doing, Using and Interacting).

This distinction has major theoretical, policy, and managerial implications. Any simple statistical analysis reveals that the so-called high-tech sectors – supposed to be drivers of economic development, due their intense ST mode innovation activities – have a fairly low weight either in output or employment even in the most advanced economies. Further, innovation studies have shown that technological innovations can hardly be introduced

[36] To identify various type of impacts and assess the actual strengths of factors advancing globalisation would require a standalone – and possibly rather lengthy – literature review. Suffice it to say here that elements of both reality and mythology can be found behind the often diametrically different claims concerning globalisation.

without organisational and managerial innovations. Moreover, the latter ones – together with marketing innovations – are vital for the success of the former ones. (Pavitt, 1999; Tidd et al., 1997) Finally, the most successful companies are the ones that consciously combine the ST and DUI modes of innovation. (Jensen et al., 2007)

Returning to the definition of NIS, some authors and policy-makers speak of the 'narrow understanding' of a national innovation system. That covers only those actors – more precisely: their activities, interactions among them, and the relevant institutions governing these processes – that are engaged in innovation activities based on R&D results, that is, the so-called ST mode of innovation. In other words, this understanding neglects the DUI mode of innovation, in spite the fact that these latter types are at least as important for improving economic performance than the former ones.

In contrast, the 'broad understanding' of the national innovation system considers all actors – together with their interactions, the institutions guiding their activities and interactions, as well as their micro- and macro-environment – engaged in innovation activities, regardless of the mode of innovation, be it ST and/or DUI.

As already stressed, the ST mode of innovation constitutes a relatively small share of innovation activities, and thus considering only these is certainly a major mistake either from a theoretical, policy, or managerial point of view. The so-called narrow understanding of NIS is, therefore, a misleading concept.[37]

Given that R&D-based (technological) innovations are rarely the decisive constituents of social innovations, it would be *an even more severe mistake to apply the so-called narrow understanding of NIS* – more generally: a 'narrow' systems approach – *when analysing social innovations*.

No doubt, the NIS concept needs to be adapted to the actual cases to be analysed (by identifying what actors, what types of interactions and what institutions are the most pertinent ones for the social innovation in question), but having done so in an appropriate way, it can indeed be *a useful 'focusing device'* (Lundvall, 2007a: 98-99): it could help *organise and focus the analysis of social innovations, too, explain what and how has happened and offer a sound basis for drawing policy proposals, as well as recommendations for social innovators for effective actions.*

As for a specific aspect of interactions, Lundvall (2007a: 101) suggests considering „*orgware*" and „*socware*", referring to how people relate to each other inside a given organisation and across organisational borders. These could be thought-provoking notions when analysing social innovations, especially those in providing public services (or in other domains characterised by long-established, formalised organisations) involving innovators

[37] Following Lundvall (2007a), (2007b), two – partly interrelated – reasons can be mentioned why this, somewhat misleading, interpretation has emerged and is widely used. First, in advanced countries the academic research organisations are also highly developed and play a clearly visible role in innovation processes via generating S&T knowledge. The fact that the DUI mode of innovation –relying on other types of knowledge – is important in these countries, too, is overlooked by those authors who follow the 'narrow understanding' of NIS. Second, those economists (and policy-makers), who only accept quantitative analyses as being scientific, also favour this approach, because it is much easier to get access to various R&D and patent indicators than measure the processes and outcomes of organisational learning, the generation and exploitation of practical knowledge, just to mention a few major 'ingredients' of the DUI mode of innovation. The relevance of these economics (econometrics) models is, therefore, limited to analysing certain aspects of the ST mode of innovation, e.g. the role of various types of academic and business R&D units in generating knowledge – more generally, comparing the diverse types of 'Triple Helix' settings –, and the impacts of various IPR regimes. Further, this approach fails to fully understand the role of innovation in economic performance, and thus capture – quantify – the economic impacts of innovation efforts.

from public bodies and NGOs, as well as when considering the relations between social innovators and those who are affected by a given social innovation. In these types of cases it is certainly an important feature how people interact („relate to each other") inside a given organisation, as well as when they work for different organisations and thus need to cross organisational borders to interact and co-operate when designing and implementing a social innovation.

Each innovation system has different components and a set of idiosyncratic interactions among its actors (elements, or nodes), and thus it also develops its own unique dynamics. Changes could, and indeed do, occur at various levels:

- actors (routines, strategies, …)
- knowledge bases (or knowledge infrastructures)
- technological paradigms and trajectories, (or 'search and problem solving heuristics', 'technological guideposts', 'dominant design', …)
- sub-systems (e.g. R&D performers; STI policy governance sub-systems; financial, management, legal, IPR, S&T information and other service providers specialising in meeting the needs of innovators …)
- institutions (legally binding and voluntarily set regulations and codes of conduct, unwritten rules of the game, commonly respected norms, …)
- functions (see sub-section 4.3)
- …

All changes at these various levels could be decisive on their own, and their co-evolution (co-occurrence) is of special significance for analysing system dynamics. Again, these ideas can be used as *a starting point* – a sort of analogy – *when identifying various levels of change in social innovation processes, as well as the co-evolution of these changes*.

Finally, it is worth distinguishing two types of dynamics: continuous adaptation of a given system (that is, learning, constant, gradual adjustments and improvements while keeping the major characteristics of a steady [or: 'normal'] state of the system in question) vs. transition from a certain type of system to a different (new or somewhere else already existing) one. This distinction is rarely made in the NIS literature,[38] although the first type of dynamics is a 'bread and butter' in the literature. For example, Lundvall (2007a: 101) stresses that innovation processes, and ultimately the operation and performance of national innovation systems may be understood „as an intricate interplay between micro and macro phenomena where macro-structures condition micro-dynamics and vice versa new macro-structures are shaped by micro-processes." Innovation systems are, therefore, complex, self-organising and characterised by co-evolution – and thus constantly evolving (changing).

In contrast, the distinction between these two types of dynamics is a crucial one in several other fields of research, e.g. in the (Dutch) transition management 'school' (aka the multi-level perspective approach) or in comparative economics (aka comparative economic systems) dealing with economic reforms (institutional changes and their repercussions) in

[38] A simple – or even simplified – explanation could be that the NIS literature at its inception considered market economies only, and thus a transition to a new system could not possibly be conceived as a major research question. This approach is still rather weak in the former centrally planned economies – compared to mainstream economics –, and even when it is applied, the subject is rather the performance (or other aspects) of the current national system than the transition process from the angle of innovation processes and systems. A notable exception is Smits et al. (2010), but the main topic of that paper is innovation policy. In contrast, the sectoral system of production and innovation and the technological innovation systems 'strands' of the innovation systems literature are fairly strong in analysing major shifts (transitions) when considering the history (emergence) of a given sector (technological innovation system).

various economic systems and transition processes from centrally planned to market economies.

Keeping in mind *these two types of dynamics might be of relevance for analysing social innovations, too*.

A few elementary examples of these two types of dynamics are presented in Table 4 at four levels of economic analysis, that is, considering products and firms, too, besides the sectoral and national levels.

Table 4: Two types of dynamics in economic analyses at various levels

	Continuous adaptation (learning, gradual improvements/ fine-tuning)	**Transition**
Products	Improved manual (mechanical) typewriters	Mechanical → electric typewriters → PCs, laptops → tablets
Firms	Continuous adaptation to the external environment, fine-tuning of practices, methods, structures (demand in a market economy; new control mechanisms and incentives in a centrally planned economy)	Change in ownership (nationalisation; or privatisation) Fundamental changes in products/ technologies/ markets (IBM, Nokia, Toyota, …)
Economic sector	Entry/ exit of firms Expansion or contraction of the sector (without radical changes in products and technologies)	Existing sectors shift to a new principal product (analogue → digital camera) Emergence of entirely new sectors to exploit new patterns in division of labour (preparation and preservation of food by households → food industry), and/ or new technologies and business models (chemicals, pharmaceuticals, steel, automotive, electronics, …)
National economy	Evolution ('fine tuning') of capitalism Economic reforms in a planned economy	Feudal → capitalist economy Planned → market economy

Source: author's compilation

4.3 Functions of an innovation systems

Functions of innovation systems have been defined from various angles. One approach has been to focus on the main activities or key processes in system evolution that are of relevance from a policy design point of view. In other words, this approach is taken when policy analysts aim at identifying or explicating a rationale for policy interventions (already followed), or 'building' (proposing) a new policy rationale. In case one is not satisfied with the easy-to-understand and simple-to-implement market failure argument – which is actually an excessively simplified concept, if contrasted with the nature of innovation processes and the complexity of innovation systems – it is a major task, indeed, to build a compelling set of arguments that would underpin ('justify') policy interventions. While the overall objective – that is, to improve the performance of the system – is clear, it takes considerable analytical efforts to identify which elements/ activities/ processes of a given system should be targeted by policy measures to achieve desirable impacts. Moreover, this is only the first step in policy planning; it can provide a sound foundation for the next one, indeed, but designing an appropriate policy mix is a further, and far from trivial, task.

This approach has been taken by several authors who have composed, and widely disseminated, their own lists of the functions (main activities/ key processes) of innovation systems. Edquist (2005), (2011) has identified 10 main activities of NIS, while Kubeczko et al. (2006) applied a set of 3 main functions (covering the activities and functions outlined by Edquist and Johnson, 1997; and Johnson, 2001) in order to analyse the contributions of different innovation systems (NIS, RIS, SIS) to innovation and diffusion in the context of environmental innovation. A group of other authors, focussing on technological innovation systems (TIS), has compiled a list of 7 functions/ key processes (Bergek et al., 2005, 2008, 2010; Hekkert et al., 2007; Jacobsson and Bergek, 2013).

Another approach has been proposed by Lundvall (2007b: 14): „the function [of a national system of innovation, NSI] is to contribute to economic performance on the basis of processes of creation and diffusion of knowledge. This corresponds to the normative focus of those who pioneered the NSI-concept."

These two approaches use the same notion – function – for two different purposes, and not necessarily at the same level of analysis. The first one is aimed at identifying the main activities (or key processes) of an innovation system (either a technological, a sectoral, a regional or a national), which can be used to underpin policies aimed at improving the performance of the system in question. The second one stresses the main function (contribution) of a national innovation system in relation to a national economy (as its sub-system). The first approach is more a descriptive one – although it is aimed at assisting policy planning, and thus has a 'pinch' of normative nature –, while the second is clearly – and explicitly – normative. It is rather unfortunate, therefore, that the same notion is used in these two, rather different meanings.

Taking the first approach to functions of innovation systems, Edquist (2005: 190–191) has listed the most important ones as follows:

(1) Provision of research and development (R&D), creating new knowledge, primarily in engineering, medicine, and the natural sciences

(2) Competence building (provision of education and training, creation of human capital, production and reproduction of skills, individual learning) in the labour force to be used in innovation and R&D activities

(3) Formation of new product markets

(4) Articulation of quality requirements emanating from the demand side with regard to new products

(5) Creating and changing organisations needed for the development of new fields of innovation, e.g. enhancing entrepreneurship to create new firms and intrapreneurship to diversify existing firms, creating new research organisations, policy agencies, etc.

(6) Networking through markets and other mechanisms, including interactive learning between different organisations (potentially) involved in the innovation processes. This implies integrating new knowledge elements developed in different spheres of the SI and coming from outside with elements already available in the innovating firms.

(7) Creating and changing institutions – e.g. IPR laws, tax laws, environment and safety regulations, R&D investment routines, etc. – that influence innovating organisations and innovation processes by providing incentives or obstacles to innovation

(8) Incubating activities, e.g. providing access to facilities, administrative support, etc. for new innovative efforts

(9) Financing of innovation processes and other activities that can facilitate commercialisation of knowledge and its adoption

(10) Provision of consultancy services of relevance for innovation processes, e.g. technology transfer, commercial information, and legal advice.

These 10 functions can be reinterpreted probably in several ways for analysing social innovations. It might be useful to state the obvious, though, before making an attempt to adapt and then apply this list to study social innovations: these 10 functions are mainly relevant at a *system level*, and only a few of them at a 'project' level. Taking some of the CrESSI cases, the in-depth analysis of social housing, non-conventional health care, and water supply might benefit from applying an adapted functional approach, similar to the one applied by Kubeczko et al. (2006). In these cases probably the local (city) level is the appropriate one, although some factors determined at the national level are also of crucial relevance (politics, funding, availability of technologies and skilled people, certain elements of the regulations, …) As for the Kiútprogram, some of the functions – especially those that are relevant for creating the necessary framework conditions and resources for this type of initiatives – could also be subjects of enquiry. Using other examples as illustrations, the hygienic transition from cesspools to integrated sewer systems in the Netherlands (1870–1930) and the transition to sewer systems (1890–1930) could also be relevant cases, both discussed in Geels and Kemp (2007).

Having this caveat in mind, an adapted list of functions is presented below, with a 'virtual' question mark added to each bullet points:

(1) Provision of research and development (R&D), creating new knowledge, primarily relevant for social innovation processes, but also for technological innovations to be exploited in social innovation processes (e.g. creating new civil engineering and social policy knowledge needed for social housing projects)

(2) Competence building (provision of education and training, creation of human capital, production and reproduction of skills, individual learning) to be used in social innovation activities, as well as in other activities underpinning social innovations (training for social innovators)

(3) Formation of new services relevant for social innovations (e.g. new forms of catering, child care, and library services provided at social housing sites)

(4) Articulation of quality requirements emanating from the demand side with regard to new services relevant for social innovations, as well as products used in social innovation projects (e.g. articulation of quality requirements concerning the new types of building materials used for social housing projects)

(5) Creating and changing organisations needed for the development of new fields of innovation, e.g. enhancing social entrepreneurship, creating new research organisations and policy agencies specialising in issues pertinent for social innovations

(6) Networking through relevant fora (channels) and mechanisms, including interactive learning between different individuals, informal groups and formal organisations (potentially) involved in social innovation processes. This implies integrating new knowledge elements developed in different spheres of the innovation system and coming from outside with elements already available in the informal groups and formal organisations engaged in social innovation activities.

(7) Creating and changing institutions – e.g. tax and social contribution laws, environment and safety regulations, social science practices, etc. – that influence social innovators and innovation processes by providing incentives or removing obstacles to social innovation

(8) Incubating activities, e.g. providing access to facilities, administrative support, etc. to promote social innovation efforts

(9) Financing of social innovation processes and other activities that can facilitate exploiting knowledge for social innovations

(10) Provision of information and consultancy services of relevance for social innovation processes, e.g. knowledge sharing platforms, advice on financial, tax, social security and legal issues.

WP5 of the CrESSI project might test if these modified functions of innovation systems can be used in any meaningful way when analysing social housing, non-conventional health care, or water supply, while WP6 can consider if any of the above ideas can assist in distilling policy implications.

The other list is composed of seven functions, presented in several publication outlets and occasionally applied to analyse various TIS (Bergek et al., 2005, 2008, 2010; Hekkert et al., 2007; Jacobsson and Bergek, 2013). Bergek et al. (2010: 121) presents these seven functions as follows:

(1) Knowledge development and diffusion

(2) Influence on the direction of search and the identification of opportunities

(3) Entrepreneurial experimentation and management of risk and uncertainty

(4) Market formation

(5) Resource mobilisation

(6) Legitimation

(7) Development of positive externalities

Again, one of the possible reinterpretations for social innovation is presented below:

(1) Development and diffusion of knowledge relevant for social innovations

(2) Influence on the direction of search processes and the identification of opportunities for social innovations

(3) Social entrepreneurial experimentation and management of risk and uncertainty associated with social innovation

(4) Formation of 'niche', or 'nursing' markets as a learning space for social innovation, followed by 'bridging' markets and finally 'mass' markets: fora where 'supply' and 'demand' for social innovation can meet (as an example, see the two historical Dutch cases analysed by Geels and Kemp, 2007)

(5) Mobilisation of resources needed for social innovation (funds, skilled people, …)

(6) Legitimation: creating social (and political?) acceptance; a social innovation needs to be perceived appropriate and desirable for various groups of people (politicians/ regulators, sponsors, citizens at large, those who are directly affected, …)

(7) Development of positive externalities (again, see, e.g. the two historical Dutch cases analysed by Geels and Kemp, 2007)

Taking either list of functions, clearly there are several interactions among the various functions, but these are not addressed here.

Although sections 4.2–4.3 have focussed on the national level, needles to stress that the other levels are equally important, too. Actually, it is an 'artificial' slicing for analytical purposes/ convenience: an actual firm is located in local, regional, sectoral, technological and national innovation systems in the same time. *For social innovators, these various levels seem to be highly relevant, too*. The *national level* is decisive e.g. in terms of the level of economic development and dynamics; influencing social structures, interactions among various social actors, channels and opportunities for mobility (social dynamics), as well as the role of NGOs and other bottom-up initiatives; designing and implementing social policies; shaping the types of values respected/ followed by large groups of citizens; providing human resources for social innovation; and setting the legal infrastructure. The regional level could strongly affect most of the economic, social, ethical and regulatory factors mentioned above, as well as the supply of human resources – depending on the governance structure of a given country, that is, the division of competences, responsibilities and resources of decision-makers at national vs. region levels.

The 'adapted' notion of *sectoral* systems of innovation could be of relevance, too, when analysing social innovation if one thinks of various services (partly or entirely provided as public services) e.g. education, health care, social care, (social) housing, water supply, and district heating as sectors. Indeed, these are similar at a certain level of abstraction to economic sectors in terms of having (a) their own particular set of products and services; (b) actors carrying out market and non-market interactions for the creation, production and sale/ provision of products and services; (c) 'common' inputs and demand for products and services; (d) specific knowledge base and learning processes; (e) interactions among the actors in the form of communication, exchange, co-operation, competition and command; (f) processes of change and transformation through the co-evolution of various elements of the sector(al system); and (g) all these shaped by sector-specific institutions ('rules of the game'). (adapted from Malerba, 2002)

The same goes for the technological systems approach. It is also concerned with the knowledge base exploited – and to a large extent developed – by an emerging system, its actors, institutions ('the rules of the game'), the relationships among the components, the functions performed, and its performance. These could be meaningfully adapted to the tasks one is faced when analysing social innovations without an explicit innovation system in place yet.

4.4 Policy relevance and actual use of the systems approach

As already discussed in section 3.3, the innovation systems approach implies that the quality and frequency of interactions needed to generate, exploit and diffuse knowledge and innovations are determined by the properties of a given innovation system. STI policies, aimed at improving the performance of a given innovation system, therefore, should rectify system failures hindering these interactions. To follow this way of thinking requires substantial analytical efforts to underpin policies, as well as strong policy design capabilities.

The market failure rationale is an abstract concept; its policy implications are supposed to apply to any market in any country, and at any time. Moreover, it looks easy to understand

and implement.[39] But exactly for being abstract, it cannot provide appropriate guidance for policy design, and thus it is not that easy to implement. It neither offers any clue as to how to identify areas of market failure, nor any indication on the appropriate levels of public support. (Smith, 2000: 85) Further, a policy action tackling a market failure would, in most cases, lead to another market failure. Patents, for example, distort prices to the detriment of customers, and may also result either in over- or under-investment in R&D, neither of which is 'socially optimal'. (Bach and Matt, 2005)

The system failures argument, in contrast, cannot offer a 'one-size-fits-all' recipe. Instead, it stresses that it is an empirical task to identify what type of failure(s) is (are) blocking innovation processes in what part of a given innovation system in order to guide the design of appropriate policies.[40] Besides thorough analyses, it is likely to demand extensive, wide-ranging dialogues with stakeholders, too. That would require apparently extra resources (which are not incurred in a 'traditional', widely used way of decision-making): time, money and attention of policy-makers. It thus can – and indeed, should be – seen as an investment into improving policy processes, and indirectly the policy governance sub-system, too.

Identifying systemic 'problems' – by their nature specific to a particular innovation system – is not a trivial task and the possibility of summarising widely applicable, easy-to-digest, and thus appealing, policy 'prescriptions' in one or two paragraphs is excluded on theoretical grounds.

The systems approach implies, too, that several policies affect innovation processes and performance – and perhaps even more strongly than STI policies. (Fagerberg, 2015; Havas and Nyiri, 2007; Havas, 2011; Laranja et al., 2008) Hence, the task of designing effective and efficient policies to promote innovation is even more complex as policy goals and tools need to be orchestrated across several policy domains, including macroeconomic, education, investment promotion, regional development, competition, and labour market policies, as well as health, environment and energy policies aimed at tackling various types of the so-called grand challenges.[41]

In sum, the systems approach – albeit being demanding – seems to be a highly relevant one to underpin policies. Indeed, several authors claim that – besides becoming a popular notion in the academic literature – the systems of innovation approach has been widely adopted by policy-makers, too, both at national level[42] and by international organisations (Dodgson et al., 2011; Edquist, 1997; Lundvall, 2004, 2007a; Sharif, 2006, Smits et al., 2010).[43] A large

[39] As already discussed in section 3.3, this policy rationale is not suitable to underpin measures aimed at promoting social innovation.

[40] For various taxonomies of system(ic) failures, see, e.g. Bach and Matt (2005); Malerba (2009); and Smith (2000).

[41] In an interesting cross-tabulation of innovation research themes and policy perspectives, den Hertog et al. (2002) identified 'black boxes', that is, themes not covered by research and also unknown (unidentified) by policy-makers. Given the importance of non-STI policies affecting innovation policies, it would be useful to add a black box at a 'meta level', too: that is, the impacts of non-STI policies – or even more broadly, those of the framework conditions – on innovation processes and performance.

[42] Sweden was so much committed to apply the systems approach in practice that her innovation policy agency, established in 2001, was named Swedish Agency for Innovation Systems (VINNOVA).

[43] „One of the most striking features of innovation policy discussions in national governments and international policy organizations has been the adoption of the terminology of systems thinking and in particular the language of National Innovation Systems (NISs)." (Dodgson et al., 2011: 1145)

„The approach is also very much used in a policy context – by national governments as well as by international organizations like the OECD and the European Union. The approach seems to be very attractive to policy-makers who look for alternative frameworks for understanding differences between economies and various ways

number of OECD publications seem to confirm these claims; the notion of national innovation system even appeared in the title in several cases (OECD, 1997, 1999, 2002).

Yet, quite a few of these authors also stress non-negligible problems as to how the systems approach is followed by policy-makers:

> „Despite significant input from innovation researchers on the value of innovation systems thinking, the [Australian National Innovation] Summit's outcomes were largely shaped by neo-classical economic orthodoxy and a continued science-push, linear approach advocated by the research sector." (Dodgson et al., 2011: 1150)

> „This wide diffusion in policy circles is a mixed blessing. The concept has been both used and abused. Quite often policy makers pay lip-service to the concept while neglecting it in their practice." Lundvall, 2007a: 97)

> „The 'system' terminology may have had a negative impact on the use of the concept in public policy. Certain policy makers have interpreted the 'system' in a mechanistic way assuming that the system can be easily constructed, governed and manipulated. The lack of clear definition has contributed to such misinterpretations. One type of mechanistic interpretation is found in regional development strategies based upon the assumption that 'clusters' and 'regional systems' may be built from scratch through policy initiatives." (Lundvall, 2007a: 100)

Another type of misunderstanding by policy-makers can be summarised in the following statement: „We are not developed enough, therefore we do (can)not have a national innovation system." Clearly, there is a national innovation system in all countries where there is at least a single firm engaged in innovation activities. In other words, a poor performance of an innovation system does not mean that it does not exist. The reasons behind that poor performance might be manifold: some major components (nodes), that can be found in most well-performing systems, could be missing from the system; their performance might be unsatisfactory; the quality and intensity of interactions among the players might be low; the institutions governing the activities and interactions of the major players might be inappropriate; and other types of system failures might be also at play. The framework conditions for innovation can also be rather unfavourable.

Further analyses have also indicated that the systems approach is far less accepted than suggested by the above claims. By discussing the indicators selected for the European Innovation Scoreboard (more recently: Innovation Union Scoreboard), as well as the use of these and related indicators in a 2013 league table of innovation performance of EU countries, Havas (2014), (2015a) has shown that the science-push model of innovation prevails among the EC STI policy-makers. Glancing through various EU and OECD reports also confirms that the systems view has not become a systematically applied paradigm in policy circles[44] – in spite of a rich set of policy-relevant research insights.[45]

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to support technological change and innovation." (Edquist, 1997: 3)

„The innovation systems approach enjoys wide currency in Scandinavia and Western Europe, in both academic and policymaking contexts." (Sharif, 2006: 745)

„At present, the IS [innovation systems] approach is becoming the de facto standard in the world of innovation policy, even though its applications can be, and is, very diverse, and demonstrates (...) severe shortcomings." (Smits et al., 2010: 425)

[44] A recent OECD policy document equates innovation with R&D at several points: „Innovation today is a pervasive phenomenon and involves a wider range of actors than ever before. Once largely carried out by research and university laboratories in the private and government sectors, it is now also the domain of civil society, philanthropic organisations and, indeed, individuals". (OECD, 2010: 3, emphasis added) The same

A report for the European Research and Innovation Area Committee (ERAC) also confirms that national-level decision-makers still focus on promoting the ST mode of innovation in most EU member states. (Edquist, 2014a, 2014b)

Two policy implications can be drawn from the systems approach to business innovations for policy-makers or policy analysts dealing with SI endeavours. The first one has already been discussed in section 3.3: *the system failure concept can be extended to social innovation*, but identifying systemic 'problems' is a fairly demanding task. The second one is fairly similar to the one concerning policies meant to support business innovations: *several policies affect SI processes and performance*, too – including education, labour market, regional development, health and social policies – and perhaps even more strongly than direct SI policies. The task of designing effective and efficient policies to promote social innovations is, therefore, a complex one: policy goals and tools need to be orchestrated across these – and potentially further – policy domains, depending on the types and root causes of marginalisation and disempowerment.

5 Concluding remarks

This paper has reviewed (i) the basic definitions used in innovation analyses, (ii) the linear, networked and interactive learning models of innovation; (iii) three major economics paradigms; (iv) the policy rationales derived from these paradigms; and (v) some substantial contributions to the innovation systems literature – all from the angle of their relevance for analysing social innovation.[46] As the detailed observations, conclusions and suggestions for further research are presented at the end of each sub-section, this section only highlights some of the major implications for analysing social innovation.

The literature on business innovation analyses stresses the need to identify *the subject (or level) of change* and has developed relevant notions to perform detailed analyses. Further, *the degree of novelty* is also distinguished. In real-life cases the borders are often blurred between incremental and radical change, e.g. the 'bottom-of-pyramid' markets seem to 'sit' on the border. This example also shows that technological changes (the development and production of modified or brand new products that these customers can afford) are only viable when the

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document has a sub-section entitled „Low-technology sectors innovate", but the bulk of the text is on R&D.

A current EU document also consistently equates knowledge with R&D: investment in knowledge is understood as changes in R&D intensity, knowledge intensity of economic sectors is measured by BERD, and „knowledge upgrade" is defined as increased R&D intensity. (EC, 2013a: 7, 9, 10, 11) The same document, just like many other EC documents (e.g. EC, 2013b), speaks of a „research and innovation system", and thus implicitly suggests that the (public) research system is not a sub-system of the national innovation system, but a separate entity. Research and innovation is used in a very loose way, practically as synonyms: „There are still considerable differences between Member States in terms of their research and innovation efficiency. For a given amount of public investment, some countries achieve more excellence than others in science and technology." (ibid: 9)

[45] Several possible reasons for the persistence of the science-push model are also considered in Havas (2104), (2015a).

[46] Other strands of the economics literature – or some of the former ones through a different lens – are reviewed for the CrESSI project by Houghton Budd and Naastepad (2015) and Kubeczko (ed.) (2015a), while measurement issues are discussed in Havas (2015c), (2016) and van Beers et al. (2015).

business model and several aspects of management and marketing methods are changed at the same time and aligned with each other.

Compared to technological innovations, it is likely to be even more difficult to establish the degree of novelty of a given social innovation: is it new to a certain community (at a local/ neighbourhood level), to a country or to the world? Actually, the degree of novelty seems to be of lesser importance in these cases: usually intellectual property rights are not an issue for social innovators. That is an important empirical question if open source policies are employed to promote social innovations, and if yes, what policy tools are effective in what circumstances.

In certain cases it might be relevant – albeit far from trivial – to identify whether a given social innovation is an 'isolated' new solution or – using the analogy of technology systems – a part of a new 'social system', that is, a set of interconnected social innovations, affecting several groups of people or an entire community (a neighbourhood, village, town or city) at the same time, occasionally leading to the emergence of new social structures, norms, institutions, behaviour, value systems and practices at a higher level of aggregation (e.g. sub-national regions, nations or even supra-national regions, for example, the European Union).

A major feature of the notion of techno-economic paradigms could be a useful guiding principle when analysing social innovations, namely the interconnectedness of technological, organisational and business model innovations, together with the emergence of a new, widely accepted 'common sense'. It could be a useful starting point to refine the notion of disruptive social innovations, introduced by Nicholls et al. (2015).

In sum, it is crucial to identify the subject (level) of changes introduced by a given social innovation as clearly as possible, as well as the degree of novelty of these changes. It is highly likely, though, that a real-life social innovation – especially when it is analysed longitudinally – is actually composed of various types of changes both in terms of subjects and degree of novelty, and thus it might be instructive to 'decompose' it by identifying the distinctive 'components', as well as the interconnections between these elements.

'Destructive creation', on the one hand, and *the 'dark side' of social innovation*, on the other, (unintended or unavoidable negative consequences of efforts to improve the situation of a certain group on the life of other groups) strongly indicate that – contrary to widely held 'unconscious' views – both business and social innovations could bring unfavourable changes, too.

As social innovations mobilise many different types of actors, who generate and exploit a wide variety of knowledge *the multi-channel interactive learning model of innovation* seems to be the most fruitful to analyse these processes.

The three innovation models considered in the paper share a major feature: the market selects among business innovation attempts. As *for social innovations, the selection process seems to be much more complex*, with more actors playing a role, and thus bringing their own assessment (values) into play: social innovators; beneficiaries; policy-makers; politicians; other potential sponsors/ funders; and to some extent the media and other opinion-leaders.

Various economics paradigms treat (business) innovation – if not neglect it altogether – in diametrically different ways: consider different notions as crucial ones (e.g. risk vs. uncertainty, information vs. various forms, types and sources of knowledge, skills and learning capabilities and processes); offer diverse justifications (policy rationales) for state interventions; interpret the significance of various types of inputs, efforts, and results differently, and thus – implicitly – identify different 'targets' for measurement, monitoring

and analytical purposes (what phenomena, inputs, capacities, processes, outcomes and impacts are to be measured and assessed).

Mainstream economics has relaxed some of the most unrealistic assumptions of the neo-classical paradigm, but the most important neo-classical postulates, especially the one on optimisation, are still the cornerstones of this framework. It is of a rather limited relevance, therefore, when it comes to analyse social innovation.

Evolutionary economics is concerned with several key notions that could be relevant when analysing social innovation: the importance of dynamics; uncertainty; differences among contexts; learning; various types, forms and sources of knowledge; path dependence; processes of generating variety; selection among diverse solutions; networking and co-operation among actors; and co-evolution of various types of changes.

Social innovations draw on different types (scientific and practical) and forms (codified and tacit) of knowledge, stemming from various sources (organised and systematic R&D activities, other types of search processes, e.g. those 'informed' by practitioners). Diversity is, therefore, a key notion. Analysts and decision-makers should be aware of the *diversity of social innovations*, too, in terms of their nature, drivers, objectives, actors, knowledge bases, and process characteristics.

The market failure argument implies that a strong intellectual property rights (IPR) regime needs to be introduced. This policy approach is unlikely to be the most germane one to promote social innovation. Further, gaining the recognition of being a creative social innovator is likely to be a stronger driver than protecting IPR. Overall, policies should rather promote the dissemination and exploitation of knowledge to foster social innovation than constrain these processes.

The system failure concept can be extended to social innovation without any theoretical constraint. Yet, it is a demanding and thus time-consuming task to establish what elements of an innovation system are missing or fledgling, what institutions ('rules of the game') hamper social innovations and thus what policy actions would be appropriate to induce the necessary changes.

The systems approach to (business) *innovation* could provide useful guidance to organise and focus the analysis of social innovations, too, explain what and how has happened and offer a sound basis for drawing policy proposals, as well as recommendations for social innovators for effective actions.

It also implies that *several policies affect SI processes and performance* – and perhaps even more strongly than direct SI policies. The task of designing effective and efficient policies to promote social innovations is, therefore, a complex one: policy goals and tools need to be orchestrated across several policy domains, most likely including education, labour market, regional development, health and social policies. Depending on the types and root causes of marginalisation and disempowerment policy objectives and tools from other policy domains might need to be considered.

The notions of *orgware* and *socware* (suggested by Lundvall) refer to how people relate to each other inside a given organisation and across organisational borders. Taking these angles could be a fruitful approach, especially when analysing social innovations involving innovators from public bodies and NGOs, as well as when considering the relations between social innovators and those who are affected by a given social innovation. In these cases it is certainly an important feature how people interact („relate to each other") inside a given organisation, as well as when they work for different organisations and thus need to cross organisational borders to interact and co-operate when designing and implementing a social

innovation.

Two types of dynamics have been identified that are relevant for analysing economic changes: continuous adaptation of a given system vs. transition from a certain system to a different one. This distinction could also lead to important results when analysing social innovation.

Innovation systems are identified as being regional, sectoral, technological, and national ones. *These various levels are highly relevant for social innovators, too*. Similarly, the various types of functional analyses innovations systems might provide relevant starting points – broad guidance – for analysing social innovations.

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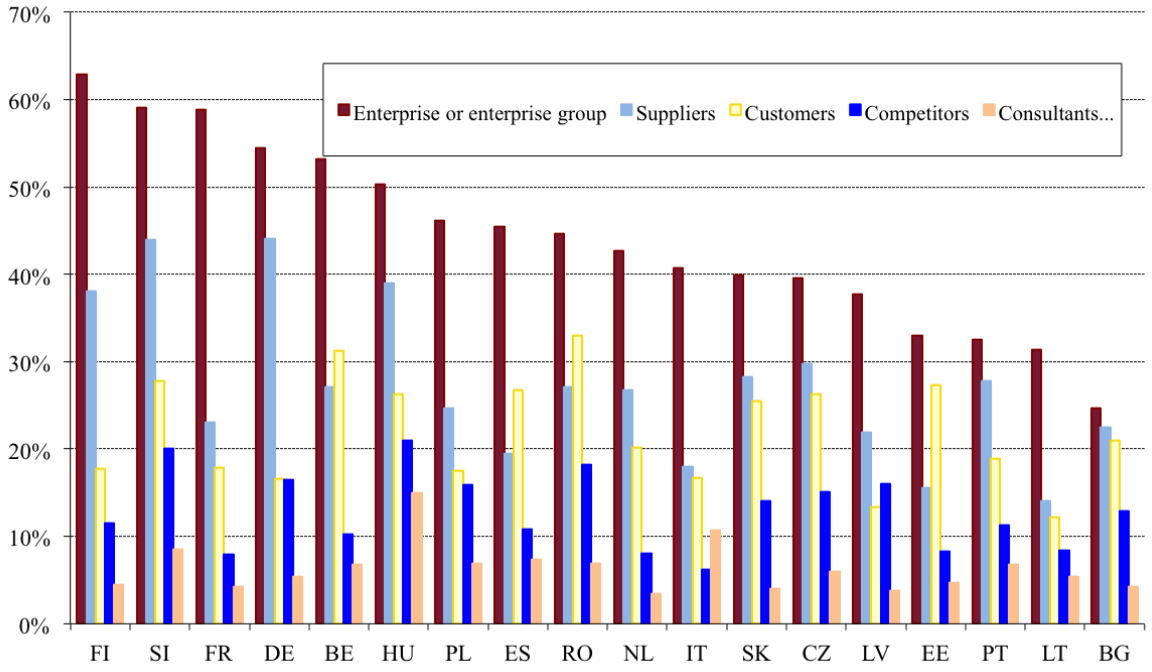
Appendix 2: Sources of information for innovation

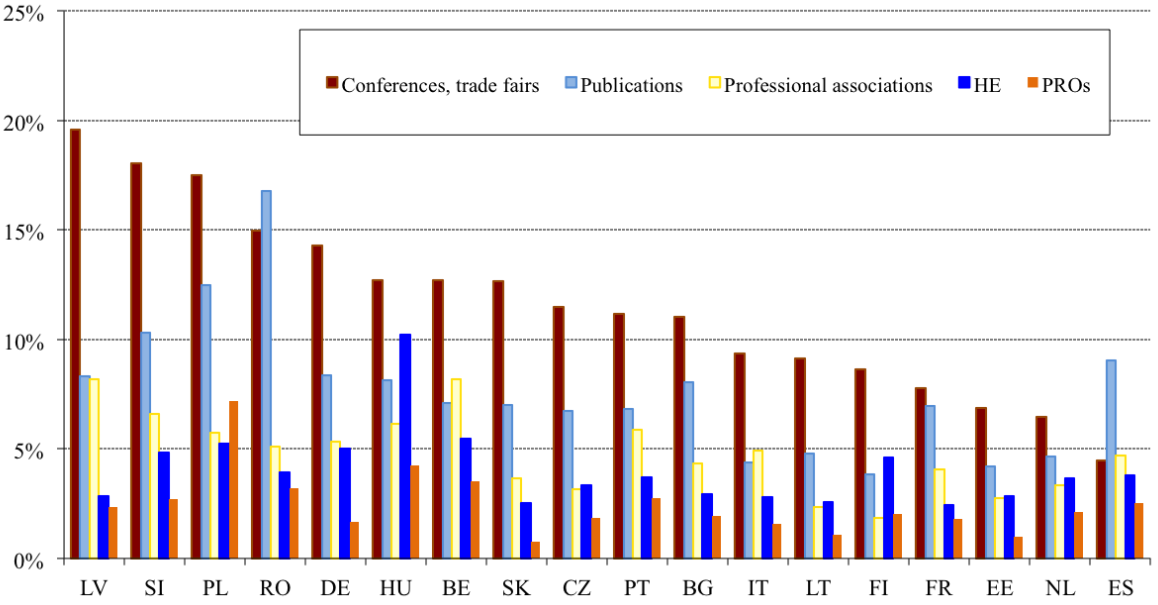
Figure A1: Highly important 'business' sources of information for product and process innovation, EU members, 2006–2008



Source: Eurostat, CIS2008

Note: Data for Cyprus, Luxembourg and Malta are not included in this figure.

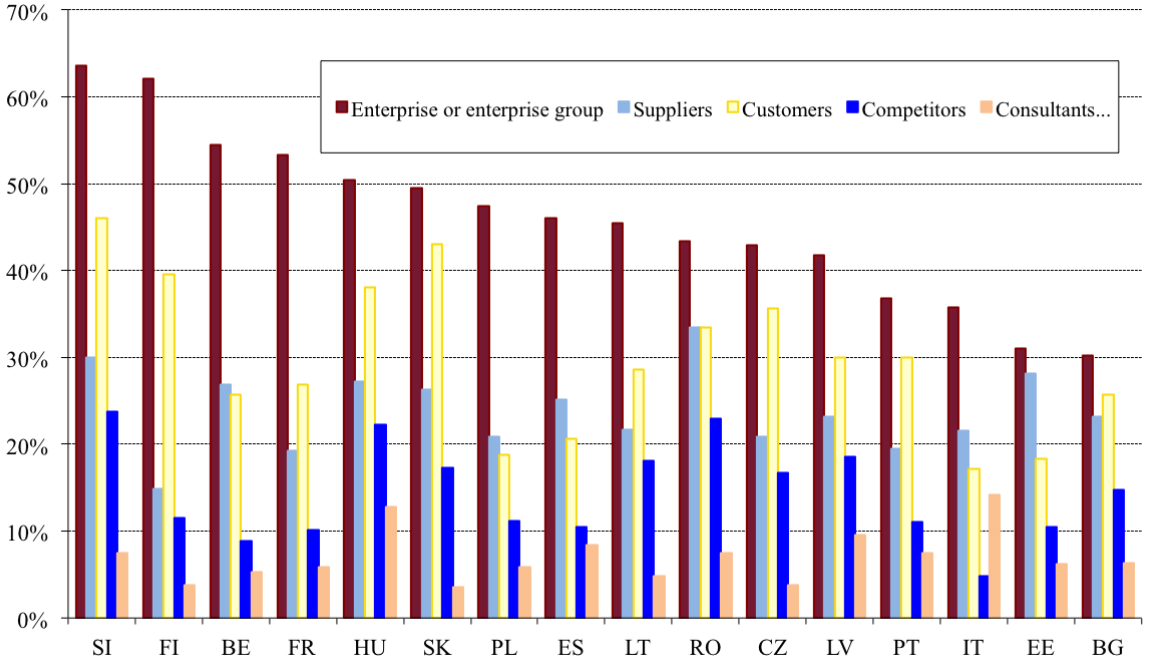
Figure A2: Highly important 'scientific' sources of information for product and process innovation, EU members, 2006–2008



Source: Eurostat, CIS2008

Note: Data for Cyprus, Luxembourg and Malta are not included in this figure.

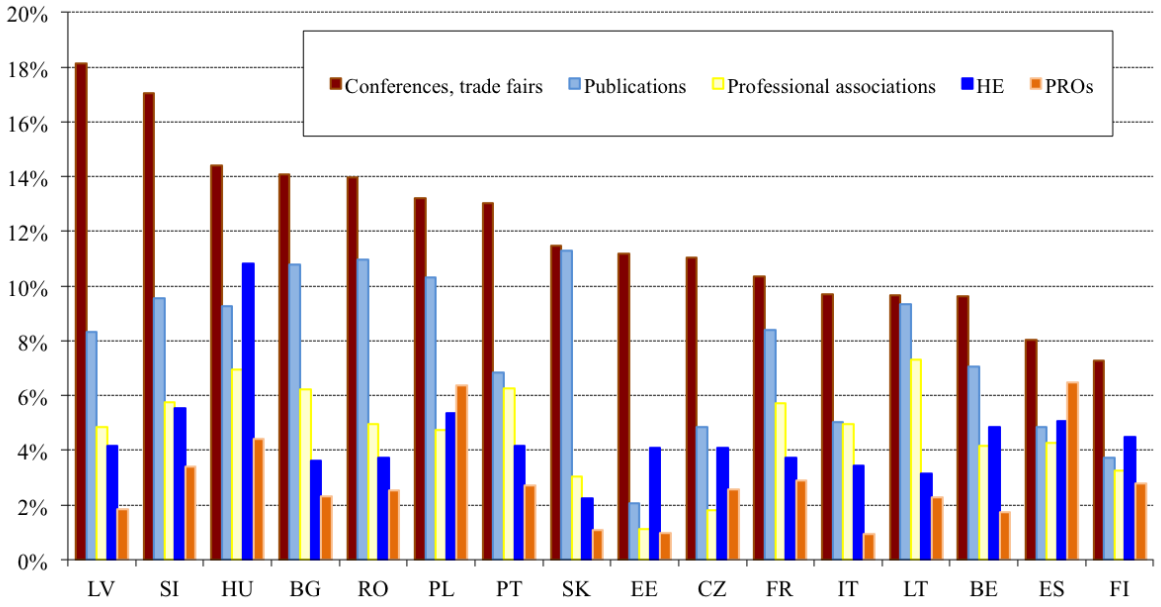
Figure A3: Highly important 'business' sources of information for product and process innovation, EU members, 2008–2010



Source: Eurostat, CIS2010

Note: Data for Cyprus, Luxembourg and Malta are not included in this figure.

Figure A4: Highly important 'scientific' sources of information for product and process innovation, EU members, 2008–2010



Source: Eurostat, CIS2010

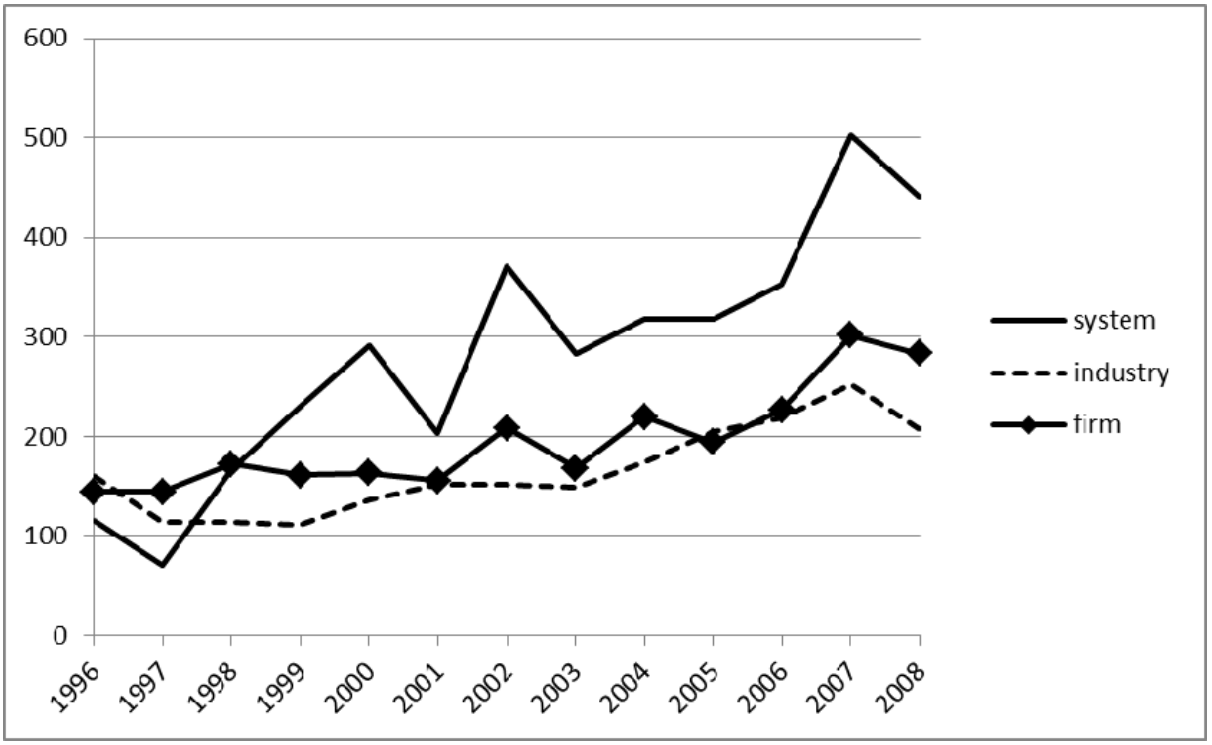
Note: Data for Cyprus, Luxembourg and Malta are not included in this figure.

Appendix 3: The expanding literature on innovation systems

Appendix 3 first presents some details of the bibliometric analysis conducted by Fagerberg and Sapprasert (2011), briefly summarised in section 4.1, and then some more recent data on the extensive expansion of the innovation systems literature.

> „To illustrate the change of focus in the scholarly literature, a search for publications containing combinations of 'innovation' and 'system' in the title – a characteristic of the new branch – was undertaken in the ISI Web of Science, and the result was compared with similar information for publications having 'innovation' and 'industry' or 'firm', respectively, in the title. Figure 2 reports the number of new articles added to the ISI Web of Science each year between 1996 and 2008 for 'innovation and system', 'innovation and industry' and 'innovation and firm', respectively, when the average number of articles in each group over the years 1993–1995 was set to 100. The results clearly confirm that the 'system' literature has grown much faster than the innovation literature at large." (Fagerberg and Sapprasert, 2011: 670)

Figure A5: Recent trends in innovation research [Figure 2 in its source]

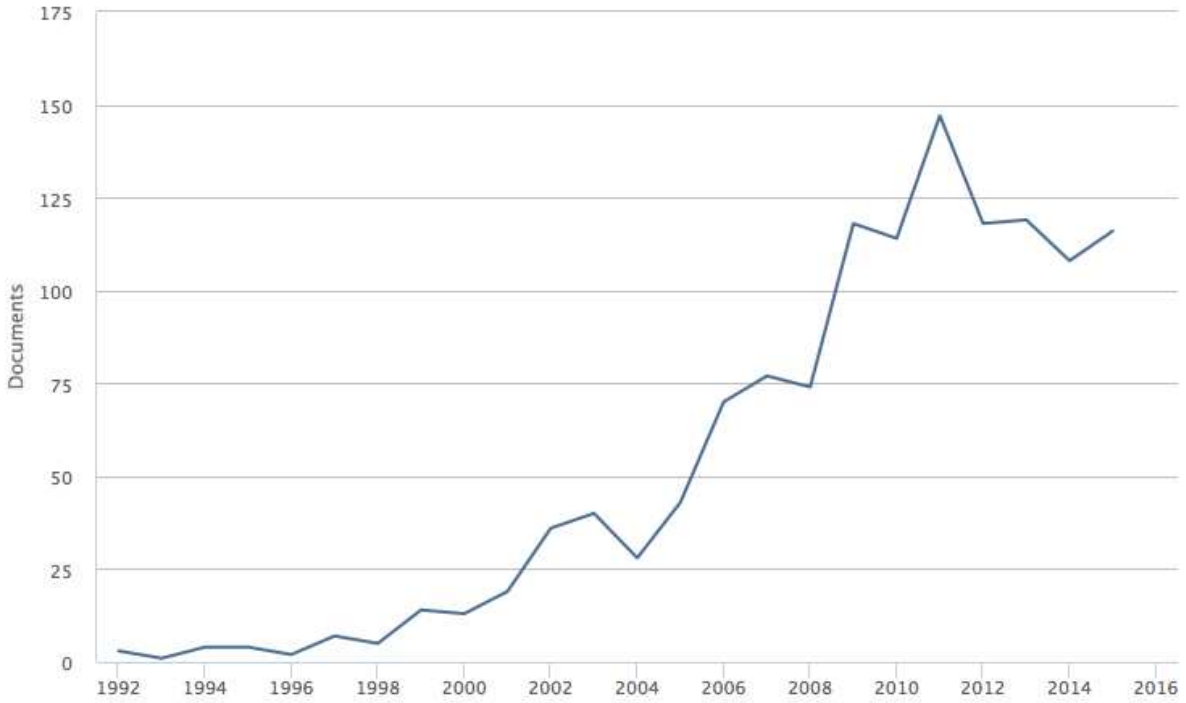


Source: Fagerberg and Sapprasert, 2011

The authors' calculations based on data from ISI Web of Science

Note: System, industry, firm, 1993–95 = 100

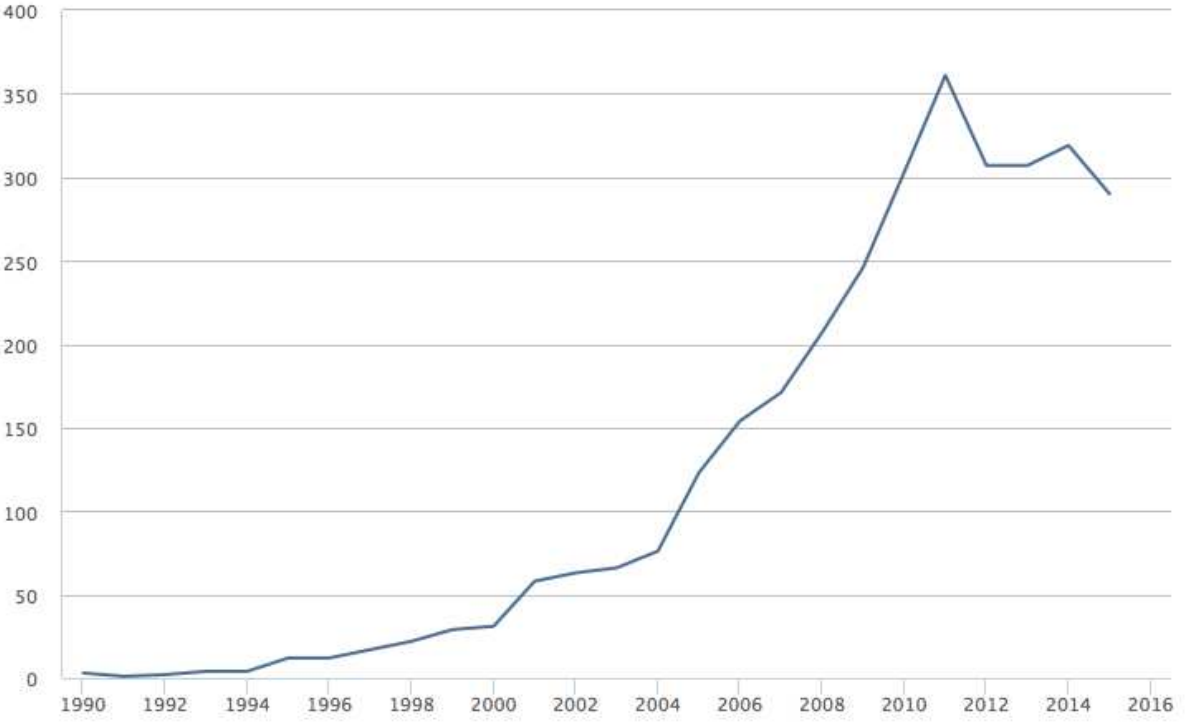
Figure A6: The number of documents recorded in Scopus with „innovation system*" in their title, published between 1992 and 2015



Source: Scopus, search run by the author

Total number of documents: 1,280; none in 1987–1991

Figure A7: The number of documents recorded in Scopus with „innovation system*" in their abstract, published between 1990 and 2015



Source: Scopus, search run by the author

Total number of documents: 3,188, none in 1987–1989

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Creating Economic Space for Social Innovation

The CRESSI project explores the economic underpinnings of social innovation with a particular focus on how policy and practice can enhance the lives of the most marginalized and disempowered citizens in society.

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