KNOWLEDGE AND INNOVATION: THE STRINGS BETWEEN GLOBAL
AND LOCAL DIMENSIONS OF SUSTAINABLE GROWTH

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Abstract
The modern growth literature pays much attention to innovation and knowledge as
drivers of new developments in a competitive open economic system. This paper
reviews concisely the literature in this field and addresses in particular micro- and
macro-economic interactions at local or regional levels, based on clustering and
networking principles, in which also sustainability conditions play a core role. The
paper then develops a so-called knowledge circuit model comprising all relevant
stakeholders, which aims to offer a novel framework for applied policy research at the
meso-economic level.
1. Introduction

The phenomenon of economic growth – in terms of driving forces, distributional effects and competitive consequences – has puzzled economists over decades. Harrod (1939) and Domar (1946) pointed to the rate of savings, population growth and capital-output ratio as exogenous determinants able to explain the long-term growth of an economy. Even when instabilities result from divergences in the steady-state growth path (excess of capital supply, excess of labour supply or underutilization of the productive capacity of the economy), according to those authors, growth would take place as a result of production of technology with constant returns to scale. However, the major importance of technological change has been stressed after the pioneering work of Solow (1956) and Swan (1956) (see also Pitchford, 2002), who investigated the growth of output in the USA using a neoclassical economic growth model. Their major conclusions demonstrated that the increases in the country’s rate of savings generate increases in per capita real income, but its continuous growth should result from technological progress, exogenously determined. The continuity of the long run growth was questioned, unless in the presence of permanent change, and so various new theoretical insights were offered.

Milestones in such insights have been, for example, the improvement of the initial Solow model by: (i) Arrow (1962) when introducing learning-by-doing as a determinant of technological development; (ii) Lucas (1988) including the growth rate of human capital as a factor of technical change and long run growth; or, (iii) Romer’s (1986, and 1990), considering the technical change endogenously determined by research. The spillover effects resulting from such improvements were presented in the Marshall-Arrow-Romer model, as discussed by Acs and Audretsch (1984) and Acs (2002). For these authors technological innovation output is perceived as the product of knowledge generating inputs; consequently, technology and entrepreneurship could also play a major role at the local level in fostering and promoting growth. The concept of growth started moving from a macroeconomic issue to a microeconomic issue and subsequent to this transition, the determinants were to be found at the level of the enterprise. Grupp (1998) has reviewed a series of contributions given to the earlier discussion, putting the emphasis on the crucial aspect of technological change: the process of innovation.

The very simple empirical formulation, initially pointed out by Harrod, Domar and Solow, has taken decades of discussion and produced many different inputs in the history of economic thought, although the systemic and dynamic nature of the economic complexity has remained consensual. Hence, it is not surprising that there has been frequent acceptance of analytical methods inspired by the basic rules of the natural
sciences as a platform for economic understanding, particularly when economists have searched for an overall view on the complexity of economic reality. We can go back far into the history of economics (Hetherington, 1983) and find Adam Smith’s inspiration in Newton, or Marx’s approach to socio-economic evolution stimulated by Darwin’s view (Heyer, 1982), or yet Von Neumann and Morgenstern (1944) applying essentially a Nash equilibrium to find business solutions for economic conflicts. More recently, we can find new endeavours, for example, the use of percolation theory\(^1\) which has gained prominence in the field of network systems\(^2\).

Accordingly, in general, several studies about the complexity of economic systems have been provided, mainly by authors who were critics of the classic and neoclassical schools of economic thought. Therefore, simultaneously with the many efforts made to outline and model economic growth, different trails emerged to discuss the variety of determinants of the dynamics of economic systems.

As a matter of fact, so far, the multiple modelling efforts, developed at a macroeconomic level, have been accompanied by empirical observations leading to an improved theoretical understanding of how the innovative processes could stimulate economic activity over the course of the history of mankind. Hence, what innovation is about and how it drives the growth and prosperity of nations and localities (Schumpeter, 1934, 1954; Freeman, 1987; Fagerberg, 2003, 2004), in the long run, has become the centre of many debates. Among these, two different approaches (it could be argued whether or not they are convergent) led by different schools (the regulatory and the evolutionary) have emerged in the area of the social sciences\(^3\). Certainly, common elements of both schools have served in the last 20 years to contribute to the construction of a general theory of the dynamic behaviour of the capitalist economy (Di Matteo et al., 1989), helping to find a compromise between institutions and regulations (e.g., environmental constraints) in the discussion related to growth and the role of innovation in this process.

In this context, Schumpeter (1934) made a key move to better understand the determinants of economic growth. He was persuaded not only by Marx’s works but also by List (1841), who emphasized the role of science, technology and human capital in explaining how different social and institutional frameworks enable national systems to grow.

\(^1\) For a better understanding, see Grimmett (1997).
\(^2\) Cohendet (1997) analyses “the conditions of emergence and the properties of irreversibility on a network of economic agents facing technological choices among competing technologies” (p. 93).
\(^3\) Today, what distinguishes the evolutionary from the regulatory perspectives is the different emphases put on innovation and institutions as engines of growth. For the former, the expansion periods are related to the introduction and diffusion of new methods and products strictly related to product life cycles, whereas for the latter, growth is a result of how power in institutions sustains the capitalist market system.
In the same vein, Rosenberg and Frischtak (1984) have focused on Schumpeter's view of technological innovation and how it can be at the centre of both cyclical instability and economic growth, with the direction of causality moving clearly from fluctuations in innovation to fluctuations in investment, and from that to cycles in economic growth. These authors questioned the causal links of Schumpeter's argument that innovations may cluster in certain points in time just \( \ldots \) \textit{when entrepreneurial perception of risk and returns justifies innovative commitments. These clusterings, in turn, lead to long cycles by generating periods of acceleration (and eventual deceleration) in aggregate growth rates} (p. 7). The authors' view, expressed about 20 years ago, when innovation was understood within a concept of linear causality, represents a macroeconomic justification for the perception of the complexity existing in any updated interactive model of innovation.

Despite the extensive number of different perspectives linking innovation to growth, it seems to be commonly accepted that one way to describe the progression of change is to interpret dynamics as a continuous production of new products or processes. But the mechanism presupposes a simultaneous adjustment of society to new needs or requirements, engaging most of the attention of those theorists who try to recognize the extent of informational flows and interchanges that this reciprocal movement represents. Economic growth is increasingly positioned in a force field of global competition and need for sustainable development.

The subsequent demanding endeavour to combine, in the production chain, innovation with the coordination capacity of organizations, presents much more than a theoretical challenge, and rather a social reshaping. In this sense, the cognitive sciences (particularly, psychology, sociology and organizational management) are slowly participating in the construction of a new multidisciplinary view which should be useful to improve the understanding of sustainable growth, development and social awareness, as well as their respective links.

\footnote{And, not to forget, space. Arguments in this direction have been formulated by Davelaar and Nijkamp (1997).}

\footnote{\textit{...We are left without a precise knowledge of what are the necessary and sufficient changes in the environment which, even conceptually, can bring out a bandwagon-like diffusion of some number of basic innovations. In other words, there is no well-specified set of elements that effectively link and elucidate the direction of causality between the basic innovations, the 'general level of profitability and business expectations', and their diffusion in the form of a swarm of new products and processes. More generally, nowhere in the literature is there to be found an unambiguous treatment of causality, within a neo-Schumpeterian framework, which establishes the precedence of innovation clusters over investment outlays and aggregate movements in the economy} (p. 8)}

\footnote{See, for example, the arguments within the context of innovation policy instruments drawn by Christensen (2003).}
2. **Embeddedness, Proximity and Learning as Forms to Reinforce Trust and Reduce Entrepreneurial Risk**

Beginning with the works of Penrose (1959) and Wernerfelt (1984), the drivers of innovation may be better perceived from the resource-based view of the firm, accepting its heterogeneous character. The approach uses the firm as the unit of analysis and studies its resources and capabilities in order to understand the firm’s strategic behaviour (Knudsen, 1995). In this context, knowledge is recognized as a key resource for firms and other economic agents, while both codified knowledge and tacit knowledge are pertinent aspects for innovation.

Although the first studies on knowledge assets emphasized the firm’s own codified knowledge resulting from its internal R&D capacities, nowadays researchers accept the major role of external sources of knowledge in the firms’ capability to innovate (see amongst others, Nijkamp et al., 1994; or Albino et al., 1999; Nooteboom, 1999). Considering that cooperation goes much beyond knowledge transfer⁷, it is still under discussion whether the cooperation between research institutes and industrial firms enhances innovation as argued by Antonelli and Calderini (1999), or, on the contrary, whether such links are of minor importance, as defended by Diederen et al. (2000)⁸. In any case, it seems to be commonly accepted that the impact of the cooperation with research institutes is mainly sector-related. In general, high-tech firms tend to cooperate more often with research institutes than firms producing in low technology areas⁹. So that the innovation literature has also identified a second role for R&D in the innovation process (Cohen and Levinthal, 1989, 1990; Zahra and George, 2002), besides a direct input, it is a determinant of absorptive capacity, i.e. of a firm’s ability to assimilate and make use of external knowledge.

Additionally, some authors have stressed the key role of ‘good communication’ between industry and research institutes for the successful transfer of technological knowledge (Kaiser, 2002). Sometimes, a certain lack of acceptance may partly explain

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⁷ For instance, the university provides skilled workers and training opportunities for staff, as well as public spaces (Lester and Piore, 2004, Lester, 2005).

⁸ Most probably, this should be the consequence of both the sectorial links and the *embeddedness* level of the firm.

⁹ The explanation for this is that R&D-based innovations, which typify high-tech firms, often result from cooperation with research institutes, whereas innovations that are primarily experience-based, as is the case in small low-technology firms, seldom require this type of cooperation.
why low technology firms tend to be sceptical concerning partnerships with external researchers\textsuperscript{10}.

Indeed, the strategic choice of low-tech firms with regard to innovation is highly influenced by vertical cooperation with suppliers and customers. In such cases, the development of new products or processes often takes into account, above all, the new demands, as well as the market changes\textsuperscript{11}.

Moreover, in relation to firms’ attitudes towards the absorption of codified knowledge, it is important to underline that firms rely on the lessons from the success and failure of similar companies to improve their own strategic decisions, as signalled by Maskel (2001). However, if firms are small, they will lack the means to carry out exhaustive cost-benefit analyses, and cannot pay for innovations with high-risk profiles (Senker, 1998, 2001).

A novel contribution was made by Van Geenhuizen and Nijkamp (1997), when detecting a spatially heterogeneous technology acceptance resulting from spatial irregularities in the receptivity of firms to new technologies. In that study, this was partly explained by organizational and strategic distances among actors, but it remains to be seen whether this situation is not the result of different integration levels of firms into the respective environmental contexts (embeddedness), giving rise to asymmetrical assimilation of tacit knowledge.

Indeed, after Nelson and Winter’s (1982) first discussions on the particularities of tacit knowledge, many other contributions have proved its importance as a component of the innovation process (Dosi, 1997; Nonaka and Takeuchi, 1995; Johannessen et al., 1999; Nonaka et al., 2000). According to Nightingale (1998) and Kaiser (2002), tacit knowledge is not a mobile resource, deriving from lifetime experience, practice, perception and long-term learning. Tacit knowledge should, therefore, be perceived as a common asset and a positive contribution for the productive processes, spatially located.

Considering that firms easily absorb tacit knowledge when exposed to external links, proximity, a concept earlier associated with cost reduction, readdresses the innovation debate. Whether institutional or geographic, the stakeholders’ capacity to easily interact becomes a positive externality. Common traces like language, codes of communication, conventions, personal contacts, past history, or successful informal interactions (Gertler, 2001; Gertler and Wolfe, 2004; or Nightingale, 1998) take place,

\textsuperscript{10} The proliferation of many private or public/private partnerships devoted to create interfaces among industry and universities illustrates his view.

\textsuperscript{11} The case of innovation in the food industry is doubtless an important example of innovation in the context of small low-tech firms deeply rooted in their environments, as pointed out by, amongst others, Galizzi and Venturini (1996), Christensen et al. (1999), and Vaz (2004).
therefore increasing trust and reducing risk. An allusion should be made to Bertuglia et al. (1997) who clarified how urban areas could become incubators of change once they decide to be centres for cultural opportunities and geographical connectivity. From this perspective, the region plays a critical role in innovative entrepreneurship.

The importance of spatial embeddedness for enterprises stems from the role that knowledge creation plays in innovation. While codified knowledge is losing part of its strength as a source of competitive advantage, tacit knowledge is reinforcing its significance as a means of adapting to new requirements and therefore, spatial proximity to sources of relevant knowledge creation is becoming central in current scientific attention (Arndt and Sternberg, 2000). In small firms, particularly when they lack opportunities to be aware of new developments in ICTs or to organize information transfer over longer distances (Blundel, 2002), proximity tends to be a significant advantage. A third example, which is currently very topical, is the role of the university in stimulating new booming research or service activities (Lester, 2006).

A different aspect, also related to the advantages of proximity and embeddedness, concerns the involvement of the entrepreneur with local social structures. In this case, embeddedness may turn into an efficient mechanism to improve the use of local resources, market opportunities or advanced institutional structures, all very positive contributions to the enlargement of tacit knowledge. The notion of regional culture is important here as a facilitator of innovativeness

In conclusion, we tend to agree with Lundvall and Johnson (1994) who state that if knowledge becomes the most important resource for firms and organizations, the process of learning develops into one of its most important processes.

3. Creativity, Clustering and Networking as a Contribution to Productive and Efficient Entrepreneurship

Both creativity and innovation are major contributors to technological change and have been studied from multiple scientific angles. However, whilst innovation has been investigated from a macro- to a micro-perspective, as described earlier, creativity has only been examined as an individual output, but never as a social task or as a result of joint actions in a sequential process.

Amabile (1996) proposed one of the most comprehensive models of creativity, by defining a combination of variables able to influence organizational creativity, at the level of the individual, of the group, and of the organization. As it does not address how organizations may interact among themselves to generate new ideas, both innovative and useful, this model remains still incomplete. In addition to this view of creativity as a capability, the literature also characterizes it as a process and as a product, but, so far,
very few attempts have been made to analyse creativity as a phenomenon crossing organizational borders or emerging from more adequate facilitating environments.

One of the authors who has defined creativity as the product of complex interactions between the individual talent and the socio-cultural context was Csikszentmihalyi (1999), adding an indispensable contribution to the study of creativity.

Taking on Csikszentmihalyi’s view, it is reasonable to accept that creativity – similarly to innovation – can occur within a network of organizations, linked by common interests and acting within a network of common goals. Both creativity and innovation can be either fostered or blocked by the degree to which organizations share values, beliefs, and knowledge. This view reinforces the idea of networking.

The literature related to organizational theory has taken a different approach to the dilemma of networks. In fact, the writings on clustering have contributed to understanding the form and the reason for organizations and institutions to join and face competitive confrontations. Porter and Sölvell (1998), for example, explained that a cluster offers an environment for the development of a common language, social bonds, norms, and values, i.e. social capital. Pouder and John (1996) took a deeper view, and tried to understand the cognitive reasons behind the existence of a cluster. They explained that, in a cluster, managers and decisionmakers share a wide range of values, cognitive references, perceptions, and experiences (called normative isomorphism), and hence they tend to establish connections and follow the same patterns of organizational behaviour (e.g., competing, collaborating, and so on). Furthermore, negative consequences of such isomorphism may emerge as well: since they all share a particular culture and a set of beliefs, there is a risk of strategic myopia, which reinforces imitating and non-innovative kinds of behaviours. This is also a very important argument to consider if, in terms of economic development, we aim to perceive possible negative externalities from excessive clustering.\footnote{This has not been a frequently addressed issue (Gerlach et al., 2004).}

In practice, however, sharing a set of values and beliefs can be highly positive as far as creative and innovative activity is concerned. In fact, if all entities within the cluster share the same propensity for creating and innovating, and for risk-taking and change, then one can expect that the whole cluster will show such a pattern of creation and innovation. Therefore, networking for entrepreneurial efficiency is an important issue to be pursued.

Ménard (1993, 2000) takes a different direction to explain – in a way closely related to the ideas developed by Coase (1937, 1946, 1960), who redefined the nature of the institutional landscape of firms – that it is the asymmetric amount of information happening within inter-organizational relations that validates the need for networking.
This author refutes Hayek’s thesis (1989), who trusted market organizations and individuals to transfer into prices all the required information to achieve equilibrium. Ménard’s view is fully justified by the fact that heterogeneity is a frequent characteristic in information transactions but with an incomplete expression in market prices. This view is also strengthened by the neo-institutionalist argument that formal or informational transaction costs often represent very high expenditures to firms and organizations.

Arising from a completely different perspective, Aubin and Forray (1998) also provided evidence to suggest that micro-behaviour tends to give rise to local clustering rules. Within the theory of networking systems, an organizational niche (which is a network structure) can easily integrate any technology of more complex structures. A particularity of this process was formulated by Bounmy (1998), in a model of technological choices with social learning as a determinant. The fact that he points out the speed in information acquisition to justify leadership in adopting new technologies clears up doubts that informational flows – and in our view knowledge flows too – can indeed be time- and cost-consuming, frequently encouraging convenient imitating attitudes if proximity amongst enterprises or networking systems is not present.

4. Integration of Macro-, Meso- and Micro-determinants of Growth in Knowledge Flows

As previously seen, knowledge creation, diffusion and its use are of great importance to keep the multiple determinants of growth contributing to permanent change and they reflect, based on microeconomic attitudes, the macroeconomic oscillations of global productive activity. Malhotra (2002, 2003) felt challenged to discuss the models available to measure the amount of national knowledge assets, discussing their restrictions and proposing new indicators and methodologies. Several limitations have been perceived in his study, but the most relevant ones seem to be related to the cognitive nature of knowledge.

Apart from the fact that human-embodied knowledge is non-physical, not possible to contain, not directly measurable and incompatible with financial accounting (OECD, 1996, 2001), knowledge assets can only be calculated if there is a clear understanding of their potential use in the economy. This means that a significant part of the actual value of knowledge may depend on the success of future results.

This phenomenon can be seen when valuable historical background knowledge of less privileged communities disappears over time, narrowing the respective knowledge bases while other prosperous communities are able to integrate past values of knowledge in their present successful performances in a process that may even
overestimate the value of the respective present knowledge bases. In itself, the value of knowledge assets has been relative to the time period and the growth level.

As a result of the existing efforts to develop rigorous criteria to measure knowledge assets\textsuperscript{13} and, in spite of the multiple measurement models developed\textsuperscript{14}, most of the available indicators related to knowledge are pertinent for analyses of national performance in terms of global development.

It is often uncritically accepted that, for a better understanding and measurement, knowledge assets can exhibit a sequential model: \textbf{Inputs} → \textbf{Processes} → \textbf{Outputs} → \textbf{Outcomes}, for which Inputs represent structural or financial investments for development purposes; Processes are to track the use of specific financial, structural and human capital inputs; Outputs stand for the effective use of the inputs, resulting in tangible and intangible outputs for the target users, and Outcomes correspond to precise results.

This linear model has merits, but alerts us also to the fact that the accounting of knowledge assets based on investments in inputs may not be a reliable \textit{proxy} for the actual performance outcomes resulting from such investments\textsuperscript{15}. Clearly, further restrictions should be considered as well: (i) the first one related to finding adequate disaggregated data, which is a common problem related to many socio-economic indicators. Recent sampling and data mining techniques may be helpful to solve such a problem efficiently; (ii) the next concern is the lack of certainty that investments made on the location of knowledge inputs will result in knowledge outcomes sited nearby, particularly in the case of codified knowledge. Because of its relative mobility, a gap could very easily occur; and (iii) finally, the time lag between the investments made for inputs in knowledge and the accomplishment of outcomes is, certainly, unpredictable and may very well be quite long. Also, in this model, efficiency in knowledge management could be evaluated by addressing the institutional capacity to favour near values between the Inputs and the Outcomes of the model. Amongst others, the institutional proximity and the robustness and flexibility of the information systems should help to decrease hindrances to separate such values.

By not incorporating new developments in the recent history of economic thought and being developed strictly on the basis of organizational management, the previous model is too limited to reflect the dynamic force of knowledge upon structural

\textsuperscript{13} We refer here to the World Bank’s Knowledge Assessment Methodology and Scorecards (World Bank Institute, 2002), or the many specificities and conceptual contributions from OECD to reconcile knowledge assets and human and social capital (OECD, 1996, 2001).

\textsuperscript{14} Annex 1 summarizes most of the existent models on knowledge flows.

\textsuperscript{15} For example, there is increasing evidence to question the relation between ICTs and business performance.
change and growth. And therefore, a new approach is warranted. An effort to surmount such a limitation is proposed in the following diagrammatic representation.

A reflection of the knowledge circuit within a process of sustainable growth suggests a multilevel model able to improve the analytical tools required to better understand the complexity expressed by all the determinants of knowledge and innovation outlined earlier. This requires a trans-disciplinary effort and represents a methodological challenge. Figure 1 shows an interactive and multilevel model for which knowledge assets are circulating simultaneously between the micro- and macro-levels of economic activity. An exterior cycle represents the global conditions for change related to the macroeconomic conditions for growth; an intermediary cycle reproduces the knowledge diffusion taking place at the mesoeconomic level, the level at which institutional relationships take place. The boundaries of economic effects are crossed by other relevant issues related to organizational management and the cognitive sciences; in a next, almost interior cycle, knowledge application happens through innovation which may only result in new products and processes. In a subsequent phase, shown by the centre of the representation, both microeconomic restrictions related to the strategic and technical decisions of firms, and local political choices driven by governance structures and environmental determinants, decide how the innovations should be used.

Figure 1. Knowledge circuit in the process of sustainable growth
Observed from a more detailed perspective we would speculate on a cyclical process of flows from the existing “path dependencies”, “competitive advantages”, “regulations”, “national innovation systems” and framing “financial supports” moving into a micro economical context. This process is better explained in Figure 2 which provides a complement to the previous description and illustrates how most of the knowledge flows occur at the meso-economic level representing for both, regions or sectors continuity among knowledge creation, knowledge diffusion and knowledge use. In this circuit technological learning, networking in the institutional proximity, and embeddedness within the regional development conditions are the instruments used by institutions (we have considered firms and regional policy agents) to absorb and transmit such flows. As earlier, here also innovation is signalled as a moment in which knowledge creation happens, while Firms and Other Stakeholders represent the circumstances in which knowledge use takes place.

![Figure 2. Knowledge and innovation at the mesoeconomic level](image)

**Source:** Vaz and Cesário (2007)
The attitudes of firms and policy makers are represented in their behavioural patterns, allowing scientific measurement (Vaz et al., 2006), public intervention, and strategic prediction, all of which foster novel prospects for a better understanding of the causality of growth. This scheme also contains strategic handles for innovation and entrepreneurship policy at local levels where networking and clustering is usually prominently present. On this regard, much literature has been devoted to the mechanisms facilitating the spillovers of knowledge from the producing source into the receptive market (Fischer, 2006). Not without controversy, entrepreneurship seems to be one of the engines of such mechanisms (Mueller, 2007).

5. Conclusion

Much of the past history of economic thought has been devoted to growth based on wealth creation. However, our present concerns are mostly related to sustainability restrictions resulting from a firm’s need to increase production in terms of continuous uncontrolled consumption. This and other apparent contradictions regarding our global society call on a new understanding of growth (Stough, 2006): there is a change in the speed of destruction of natural resources and a loss of significance of non-skilled human capital, while the allocation of space offers competitive advantages resulting from new transportation systems. Long-term growth faces paradigms that require a shift of attention towards long term sustainability.

In this paper we concentrate on those determinants of growth that may offer a positive contribution to sustainability. Our study reviews several concepts related to innovation and knowledge in order to justify that it is more appropriate to focus on sustainable growth, in particular if restrictive conditions impose a narrow equilibrium between production and consumption. Nowadays, there is little acceptance of efficiency losses and production waste, and awareness should be the self-regulator for those major determinants of growth such as investment, innovation, consumption and wealth.

To develop the arguments put forward in our paper, we have assumed that knowledge is the key for sustainable growth. We accept it as a mobile asset able to generate advantages for wealth creation and productivity and to bring awareness about the macroeconomic conditions of growth and the microeconomic limits for production and consumption. This is because its impact on human capital increases the capacity to produce more and better and at the same time it creates responsiveness within the institutional context to the restrictions of a global but environmentally-fragile system. Our arguments focus on the mesoeconomic level, where actors appear to progress with different behavioural patterns to relate, cooperate and exchange all kinds of information. In the process, knowledge will flow and multiply, giving to the different actors, both at
macro- and microeconomic levels, the opportunity to accumulate, share and use it. The ongoing global context has from this perspective a multiplier effect that speeds the intensity of flows and enlarges its spectrum to a world wide proactive exercise.

The model presented here assumes knowledge flows as regulators between the past (historical heritage or path dependencies), the present macroeconomic conditions (the country’s competitive advantages, international regulations and others) and the local existing forms (proximity, learning, embeddedness in local development conditions). The firms’ and other actors’ role is to use this context when innovating in order to produce efficiently. This will happen if the different social actors and policy makers have transmitted the exact information on the populations’ needs to consume, the firms’ capacities to produce, and the particular environmental restrictions they have to deal with.

The model aims to prompt further applied research and proper methods to measure the amount of circulating knowledge assets and their respective speed in producing information for sustainable growth. The empirical observation of such flows at a global level can be a hard task because of the data availability requirements. Eventually, observations made at a local dimension could permit us to identify specific restrictions that may, in the long term, better achieve local development targets or advances for the competitive advantage of firms and/or locals.

If the previous reasoning sounds policy-oriented, we nevertheless believe that questions driven by managerial goals could find adequate answers derived from the foregoing discussions in this paper. For example: How can economic agents feel stimulated to invest and innovate when permanently confronted with restrictive conditions? Or, which attributes do firms require in order to continue to be productive and efficient? Knowledge flows promote learning, encourage proximity, and induce embeddedness, and these are all forms which reinforce trust and reduce entrepreneurial risk. In order to encourage innovation, the firms’ most important strategic choices should be based upon creativity, clustering, and networking as a contribution to productive and efficient entrepreneurship in a global and open economy where competitive forces and sustainability requirements are present at the same time.

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References
Amabile, T.M. (1996), Creativity in Context, Westview Press, Boulder, USA
Christensen, P.R., A. Cornett and K. Philipsen (1999), “Innovations and Innovation Support for SMEs. The Triangle Region of Denmark”, SMEPOL report no. 2, Centre for small business research, Southern Denmark University, Kolding


