From smart specialisation to smart specialisation policy

Dominique Foray
Chair of Economics and Management of Innovation, College of Management, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

Abstract

Purpose – The purpose of this paper is to focus on the distinction between smart specialisation and smart specialisation policy and it studies under what conditions a smart specialisation policy is necessary.

Design/methodology/approach – A conceptual framework is built based on historical evidence of successful dynamics of structural changes at regional level qualified as "smart specialisation". The identification of market and coordination failures that are likely to impede the occurrence of spontaneous process of smart specialisation makes a good case for a smart specialisation policy.

Findings – The paper highlights important design principles for the policy process that should help to minimise potential risks of policy failures and policy capture.

Research limitations/implications – The paper does assess the effect of smart specialisation on innovation and growth at regional level because it is too early to observe and measure effects. The paper confines itself to conjectures about the effects of such a policy.

Practical implications – The paper makes recommendations and explains some of the practicalities about the implementation of the policy at regional level.

Originality/value – The paper is one of the first dealing with the topic of smart specialisation policy.

Keywords Innovation, Regional innovation strategies, Smart specialization

Paper type Research paper

1. Introduction

The notion of smart specialisation was conceived around 2009, in a very specific place, the *Knowledge for Growth* Expert Group, composed of growth and innovation economists and established by Research Commissioner J. Potočnik in 2006[1]. The origin of the idea was strongly connected to discussions within the group about foreign R&D location in European regions and the ways in which these regions could be more attractive to global firms' location strategies (Foray *et al.*, 2009). The simple idea is that regions – in particular the less advanced and transition regions – need to build capabilities – not only generic capabilities but also capabilities within specific fields, technologies, sub-systems in order to build competitive advantages in a few market niches. The idea is neither to narrow down the development path of a region nor to produce some sort of technological monoculture. The goal of a smart specialisation strategy is to generate new options or new specialities in order to diversify the structures of the regional economy.

The notion of smart specialisation defines, therefore, a virtuous process of diversification through the local concentration of resources and competences in a certain number of new domains that represent possible paths for transformation

The author gratefully thanks the coordinators of this special issue Christos Kalandaris, Nicos Komninos and Mikel Landabaso for their encouragement and guidance as well as two anonymous referees for their very useful comments and suggestions. The author is very grateful to all of them.

European Journal of Innovation Management
Vol. 17 No. 4, 2014
pp. 492-507

1460-1060
DOI 10.1108/EJIM-09-2014-0096

of productive structures. Turning now to the notion of smart specialisation strategy, this involves putting in place a process whereby such a dynamic of new speciality development can be facilitated thanks to punctual and targeted governmental intervention in order to support in a preferential way the most promising new activities in terms of discovery, experimentation, potential spillover and structural changes. Setting up such a process in every European region has become an important objective of EU cohesion policy – known as RIS3 (Research and Innovation Smart Specialisation Strategy).

In the next section I will present the analysis of spontaneous smart specialisation dynamics, the presentation of historical examples and the formulation of stylised facts (entrepreneurial discovery, spillovers, entry and agglomeration, structural change and related variety). In Section 3, I will study in what conditions a smart specialisation policy is necessary. I will present then (Section 4) a simple graphic case of smart specialisation policy before concluding with the problems that this policy must overcome.

2. Smart specialisation dynamics

In many cases the development process leading to smart specialisation can occur in a spontaneous and decentralised way, with great success. It is triggered by an entrepreneurial vision, the discovery of a new domain and the integration of different types of knowledge to turn this discovery into reality. It is then stimulated by the spillovers generated by this discovery, the entry and agglomeration of firms around the new activity and then the growth of the latter, allowing structural change (diversification, modernisation, transition). Such a process has two faces:

(1) transforming economic (regional) structures; and

(2) building capabilities in new fields (that most frequently appear at the intersection between an existing sector and new methods to invent and to innovate (general purpose technology, innovative design, innovative business model, etc.)).

The entrepreneurial discovery, integration of dispersed knowledge, tension between private appropriation logic and spillover logic and provision of new specific public goods necessary to the growth of the new activity all represent difficulties that are not easily surmountable, often necessitating the implementation of a public policy. However, the examples below show that this is not always the case!

2.1 Smart specialisation stories

Morez: the vision of Pierre Hyacinte. This was in 1796 in the region of Morez – a small town on the border between France and Switzerland. Pierre Hyacinte Caseaux discovered that from his production of nails he could switch to the production of glasses (spectacles) using the same techniques and capabilities. Very soon other nail producers started to manufacture glasses, leading to the creation of many factories within the next 20 years and the opening of a technical school to train apprentices and, Morez became a world-class centre for the manufacture of glasses. Indeed, this is a simple story! However it includes the three main episodes of a smart specialisation process: entrepreneurial discovery and spillovers (the discovery is the fact that it is possible to move from nails to glasses on the basis of a similar set of engineering capabilities and techniques); entry and agglomeration of similar and complementary businesses (cluster formation); structural changes (in the form of transition from an old

business to a new one). And this is a smart specialisation without policy, like numerous other cases in history.

Marinha Grande: Anibal's travels. In the 1930s, Anibal H. Abrantes created the first mould manufacturing company in Portugal, the main market for which was glass-making. But the latter was declining and Abrantes very quickly saw the economic potential offered by the new plastic products market. He observed the rapid development of "plastic firms" in a large number of sectors (toys, electrical equipment, household utensils and articles). He travelled all over Europe and brought back all sorts of plastic products manufactured by injection moulding for which he wanted to design and produce the moulds. He then explored the possibility of a major diversification of his companies by converting the production tooling. This entrepreneurial discovery was to have two effects (Sopas, 2001): providing an exceptional boost to the mould manufacturing industry in which the Marinha Grande cluster still plays a very important role today and encouraging the setting up of a large number of firms producing plastic articles in the same region. As in Morez, the sequence is infallible and the industrial dynamic very virtuous: entrepreneurial discovery, entry and agglomeration, structural change!

Lyon: the modern Canuts. As a result of a crisis situation faced by traditional markets in the silk industry (that began to decline in the 1960s), a dozen firms broke away from the Lyon factory to explore ways of orchestrating a fundamental transition from silk to technical fabrics (Houssel and Houssel, 1992). They were silk manufacturers who had discovered that the Americans were using glass fibre in the aeronautics sector and these firms worked on the integration of these new materials (glass fibre and then composite materials) into their processes. "This marriage between textile and chemistry opens the way to a multitude of products for new outlets in aerospace and transport equipment, sports, protection and decoration items, medical prostheses and geotextiles" (Houssel and Houssel, 1992). In the big Lyon chemical complex firms found the specialists they needed to resolve complex knowledge integration problems relating to the spinning of glass fibre, resolve warping problems and master the adhesion of the resin to the glass fibre. The nose of the Concorde supersonic airliner, the tailfin of the Airbus 330 and the sails of some of the boats participating in the America's Cup are products symbolising this successful transition. Here again entrepreneurial discovery, agglomeration and structural changes characterise this dynamic that leads to the construction of very strong competitive advantages, realised by the creation of over 2,000 jobs between the early 1970s and end of the 1980s.

Finland: pulp and paper companies. In Finland, a group of companies in the pulp and paper industry were exploring the potentials of some new applied science and technologies to improve the operational efficiency of manufacturing processes in this traditional industry (Nikulainen, 2008). A few Finnish entrepreneurs viewed nanotechnology as a promising source of valuable applications and firms in this industry were taking step to assess this potentiality. Some firms responded to these opportunities by increasing their R&D spending to explore recent advances in nanotechnology in order to develop applications for their own sector. The emergence of a new R&D collaboration network – involving incumbents, research institutions, specialised suppliers and universities – was a critical step for the assessment of the usefulness and value of developing nanotechnology applications for pulp and paper processes. Once again we see an entrepreneurial discovery process at work that assembles different actors and will lead to the development of a new activity – at the cross-roads between a new technology and a traditional sector – and structural changes (modernisation and diversification).

Simple dynamics and stylised facts. Cases like Morez, Marinha Grande, Lyon and the Finnish pulp and paper industry of successful transformation processes, many of which have one or more elements of a smart specialisation process, are numerous and have been extensively studied in the literature both in the economics of geography of innovation and regional policy and in historical studies of technological change (although not under the heading of smart specialisation).

I made these stories very simple to illuminate some stylised facts. They were of course more complicated and the production decisions of Mr Caseaux in Morez and others in Marinha Grande, Lyon or Finland were far less obvious than I have described and these smart specialisation successes were therefore low probability events and hard to predict. The four stories are also very different in their sectoral and geographic contexts, as well as their historical circumstances. But there are noticeable similarities that in a way represent the common structure of a smart specialisation dynamic.

2.2 Entrepreneurial discovery

The fundamental act underlying the described historical dynamics is an entrepreneurial discovery. It precedes the innovation stage and consists of the exploration and opening up of a new domain of opportunities (technological and market), potentially rich in numerous innovations that will subsequently occur.

It is clear that the entrepreneurial discovery, which lies at the origin of each of the historical dynamics presented, does not only amount to innovation – although it increases its probability – it does not just amount to a basic research phase either as it is essentially oriented towards the market and applications. It is the demonstration that something is possible – for example moving from the manufacture of nails to glasses; developing from traditional silk manufacture to a production of technical fabrics; integrating nanotechnologies into the wood pulp production process; shifting from one potentially declining market to a new growing one. Entrepreneurial discovery is the essential phase, the decisive link that allows the system to reorient and renew itself. Indeed, the entrepreneurial discovery that drives the process of smart specialisation is not simply the advent of an innovation but the deployment and variation of innovative ideas in a specialised area that generate knowledge about the future economic value of a possible direction of change.

As far as I am aware, the earliest economic conceptualisation of "discovery" as opposed to innovation is to be found in the works that Hirshleifer (1971) devoted to knowledge and information. In his works he developed a formal expression of discovery information as a compound event A which consists of the joint happenings: "state a is true (something is possible)" and "this fact is successfully exploited (what is possible is created)". The first event has a probability Πa while the second event has a probability ΠA with $\Pi a > \Pi A$. The discovery process provides information about Πa: something is possible that will happen with a probability ΠA.

The discovery A may be about the potential of a general purpose technology application to transform processes in a traditional sector (case of pulp and paper). Or it may be about the possibility of a diversification path based on the exploitation of potential economies of scope and internal spillovers (case of moulding firms that diversify their products from the glass-making industry to new markets, as in the Marinha Grande case). Or the discovery is about the possibility of a transition path from a low-productivity area to a higher one (from traditional silk to technical materials in Lyon)[2].

All these cases do indeed describe entrepreneurial explorations, experiments and discoveries (not simple innovations) which are about: first, the complementarity

between a general purpose technology (or a key enabling technology) application and a traditional sector[3]; or second, potential economies of scope between two different lines of business that can stimulate a diversification process; or third, a transition path from an existing set of collective capabilities to the foundations of a new business. An entrepreneurial discovery is a new area of structural change that opens up, into which a whole segment of an industry can move to explore it and generate numerous innovations.

Entrepreneurial knowledge and economic knowledge. The various stories presented above place the notion of entrepreneurial knowledge at the centre of the process. Entrepreneurial knowledge – composed of vision and integration between different bodies of knowledge – plays an essential role in the discovery of a new domain; it is the driver of the discovery process. Entrepreneurial knowledge involves much more than knowledge about science and techniques. Rather, it combines and relates such knowledge about science, technology and engineering with knowledge of market growth potential, potential competitors as well as the whole set of inputs and services required for launching a new activity. From the policy point of view that will be introduced later in this paper, entrepreneurial knowledge is thus a precious input to generate relevant information during the priority-setting process.

It would be a mistake to think that the entrepreneurial discovery process generates only technological knowledge – what works from a technological point of view. No! The discovery focuses especially on economic knowledge – the knowledge of what works (and does not work) economically, as elaborated by Hayek and which is central to the general theory of economic dynamism developed by Phelps (2013). The entrepreneurial discovery process is basically economic experimentation with new ideas, which, of course, will to a great extent emanate from scientific and technological inventions.

Figure 1 presents and links both types of knowledge within the entrepreneurial discovery framework: the one (entrepreneurial knowledge) that must be mobilised and integrated as an input of the discovery process and the one (economic knowledge) that represents the output of this discovery process.

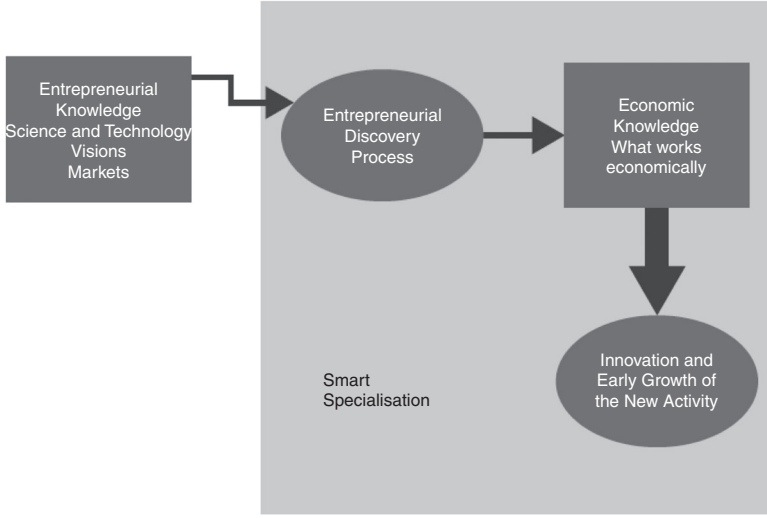


Figure 1.
Entrepreneurial knowledge and smart specialisation

The locus of entrepreneurial discovery. The processes of entrepreneurial discovery and exploration of new domains of potential innovations usually require the integration of divided and dispersed knowledge (see Appendix). This is why the organisational forms most appropriate for entrepreneurial discovery are the network, association or partnership, forms allowing the integration of knowledge originating from firms, research laboratories, specialised suppliers and clients. We also observe the presence of more horizontal associations, allowing for example the collaboration of small firms that share certain infrastructures and services for collective exploration of a new domain.

However the large integrated company is also a possible locus since it is by definition capable of assembling very diversified knowledge and carrying out risky discovery projects by financing its projects with its own resources. In her recent work, S. Berger (2013) gives numerous examples of German companies that create new industries through an internal entrepreneurial discovery process: "What (we) saw in company after company was the repurposing of key technologies to develop wholly new products and services [...]. New businesses are being created, not usually through start-ups – in contrast to the American model – but through the transformation of old capabilities and their reapplication and repurposing for new ends" (Berger, 2013, pp. 134-137). Berger's book is brimming with examples of companies, moving from autos to solar modules, from semiconductors to solar cells or from machines to make spark plugs to machines that make medical devices like artificial knees (Berger, 2013, p. 137). These are very illuminating cases of entrepreneurial knowledge structuring (often thanks to relations between the large company and one of its clients that poses a very specific industrial problem), exploration of the new domain (e.g. the application of core wet chemistry technologies to solar cell equipment) and economic knowledge production (via the implementation of new equipment at the client company) (Berger, 2013, p. 134). The organisational characteristics of the large integrated company enable all this to be accomplished.

Therefore, numerous organisational forms are possible for integrating divided and dispersed knowledge and managing the risks of entrepreneurial discovery projects, from the research laboratory-backed start-up to the large integrated firm, and all sorts of forms of networks in between.

2.3 Spillovers and entry of similar or complementary businesses

Discoveries are characterised by a strong learning dimension. The social value of the discovery is that it informs the whole system that a particular domain of R&D and innovation is likely to create new opportunities for the regional economy. This is not the standard model, whereby an innovator excludes others from the use of the innovation in order to appropriate the largest fraction of the benefits. Discoveries and subsequent emerging activities have the potential to provide learning spillovers to other agents in the regional economy. Thus, as Rodrik (2004) argues, the reward for entrepreneurial discoveries (if it is needed, i.e. in case of informational externality problems) has to be structured in such a way that it will maximise these spillovers.

While entrepreneurial discovery signifies the opening up of exploitation opportunities, entry constitutes the confirmation that others see this discovery as meaningful. When the initial experiment and discovery are successful and diffused, other agents are induced to shift investments away from older domains with less growth potential to the new one. According to Hirshleifer (1971), public information about the discovery (about Πa) is socially valuable in redirecting productive decisions.

Entry is a key ingredient of smart specialisation so that agglomeration externalities can be realised: the discovery of a potential domain in which a region could become a leader should very quickly result in multiple entrants to the new activity. This is the onset of the clustering phase of a smart specialisation process; i.e. the formation of regional concentration of co-located activities and resources in related fields.

2.4 Structural changes and related variety

The potential success of discoveries and new activities that aim at exploring and opening up a new area of opportunities will ultimately translate into some kind of structural changes within the economy. The outcome of the process is thus much more than a "simple" technological innovation, but rather a structural evolution of the whole regional economy. Different logics of structural transformations can be identified:

- Transition is characterised by a new domain emerging from an existing industrial commons (a collection of R&D, engineering and manufacturing capabilities that sustain innovation). The case of silk/textile firms in Lyon exemplifies such a transition pattern from traditional technologies for old declining markets to new technologies allowing these firms to enter new markets.
- Modernisation is manifest when the development of specific applications of a general purpose technology produces a significant impact on the efficiency and quality of an existing (often traditional) sector. A good case in point is the example mentioned above of the development of nanotechnology applications to improve processes and products in the pulp and paper industry. There are many other examples, such as the development of ICT applications in tourism and the exploration of biotech potentials in the agrofood industry. In all these instances, the intersection between the development of applications of a general purpose technology and a mature sector defines a space of opportunities in which entrepreneurs' experiments and discoveries can be expected to produce socially useful knowledge.
- Diversification, in a narrow sense, is a third pattern. In such cases the discovery concerns potential synergies (economies of scope) that are likely to materialise between an existing activity and a new one. Such synergies make the move towards a new growing market attractive and profitable.
- Radical foundation is a fourth pattern. In this case, a new domain is founded with no direct link with existing structures.

It is important to have some sort of typology of structural changes in mind because it will provide policy makers with the possibility to think ahead – looking at my regional economy, where, in or between which sectors are structural changes most desirable ? – and will produce information in what kind of domains or sectors entrepreneurial discovery could be socially valuable.

One can see from the cases above that, in general, entrepreneurial discoveries relate to existing structures and local knowledge. Modernisation, diversification and transition are forms of evolution whose point of departure is existing productive capabilities, which are determined by local technological and productive contexts and stimulated by the integration of new knowledge. All cases described exemplify processes of transformation that link the existing productive structures to new domains of potential competitive advantages. All these cases involve the generation of related variety (Frenken *et al.*, 2007; Neffke *et al.*, 2009; Boschma and Frenken, 2009).

Related variety is the fundamental logic of translating entrepreneurial discovery and subsequent new activity into structural change. This means that technological contexts matter for evolution in terms of pathways for innovation. Most trends initiated by an entrepreneurial discovery process are related to the existing productive structure, which they will transform via processes of modernisation, diversification or transition. As a result, "regions diversify by branching into industries that are related to their current industries" (Neffke *et al.*, 2009).

However, the fourth pattern is different in this respect. It involves the less frequent case of the radical foundation of a new domain. This case does not fall into the related diversification pattern and involves the opening up of exploitation opportunities unrelated to any existing productive assets.

To summarise this first section, we have seen that history is brimming with successful smart specialisation processes that occurred spontaneously, without any policy, thanks to the discovery and coordination capacities of the private agents themselves. This is an ideal situation that is of course unlikely to happen for many reasons; hence the necessity for policy and strategies when regional systems are suffering from collective myopia or inertia or more simply need to start afresh.

3. From smart specialisation process to policy

The notion of entrepreneurial discovery lies at the heart of the smart specialisation logic. And yet entrepreneurial discoveries may not be produced in sufficient quantity for reasons of imperfect appropriability, lack of capabilities and difficult credit access. A discovery, if successful, launches the development of a new speciality aimed at transforming the system; however, this speciality may remain sub-critical in terms of scale, network, clusters, complementary investments and specific public goods for numerous reasons stemming from coordination failures. Resources must then be concentrated on a small number of new activities, which will therefore be priorities, in order to reach the critical thresholds and minimum efficiency scale that will allow these activities to develop.

The processes in Morez, Lyon or Finland might be an exception and the big policy question is therefore to ask what are the structural conditions and policies in a given region that will increase the likelihood of such events and that there will be a good number of experiments and discoveries – some giving rise to real solid drivers for regional economic growth? While cases of smart specialisation processes without a policy do exist, in many instances market and coordination failures make policies indispensable.

4. Graphical representation of a smart specialisation policy in Region X

I can provide a graphical representation of what is at stake with a smart specialisation policy. Why do I think that smart specialisation can make a difference *vis-à-vis* the older horizontal policies? Let's take Region X, not very well advanced, and I construct a measure of knowledge convergence – some kind of composite index including several indicators concerning higher education, scientific publications, patent intensity, R&D intensity, venture capital, and so on. For the last decades, the region has devoted most of its resources to horizontal policies – i.e. policies aimed at improving general framework conditions and targeting "whole populations" (of firms, people) to upgrade capabilities. But the results are somewhat discouraging.

There is still a big knowledge gap between this region and the leading ones. This is by the way what the first evaluation exercises regarding the effect of structural funds

in RTDI for the period 2000-2009 have shown: no significant contribution of this policy to economic growth (Landabaso, 2013; Muscio *et al.*, 2013)[4].

Of course these horizontal policies need to be continued through European as well as national programmes but in addition to these policies, Region X is implementing a smart specialisation strategy and prioritises two, three or more new activities and these new activities – because of resource concentration as well as a proper method to identify and select them – will approach the frontier of knowledge convergence. The next figure presents some hypothetical examples.

What are the three things that have been prioritised? These are new discovery activities (R&D and innovation) that complement existing structures and assets. They are likely to generate informational spillovers on the feasibility and future value of certain paths of structural change through R&D and innovation in an important sector (or at the intersection between sectors) of the regional economy. By way of explanation, the first activity involves the connection between a public laboratory specialised in animal genetics, a strong and high-quality but traditional breeding sector and some specialised suppliers of technological solutions. The aim of this first activity is to shift an important traditional sector into the modern part of the economy by integrating into the former the appropriate scientific knowledge. The second activity involves a group of firms belonging to the traditional ceramics sector, which want to explore a new domain of diversification through the development of advanced ceramics – a development that will allow these firms to target new market niches. The third activity emerges from a high-tech cluster and is about the development of advanced photonics in the area of new renewable energy.

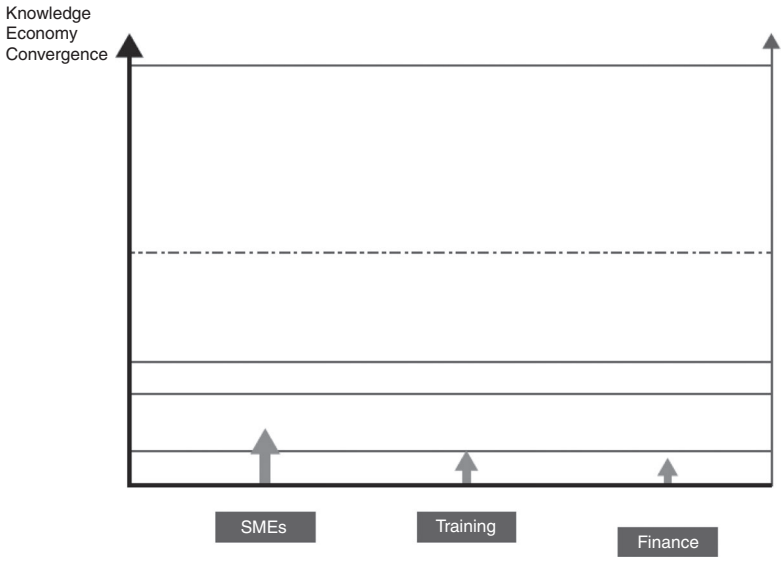
4.1 Vertical policy

It is clear therefore that I am not talking here of horizontal priorities, such as improving human capital, accelerating transfer of technologies, creating incubators, upgrading SME capabilities or having good universities, but of vertical priorities regarding some specific fields, technologies, perhaps companies. A vertical policy is a policy that selects projects according to preferred fields, sectors or technologies while an horizontal policy is only responding to demands that arise spontaneously from industry. The change of logic – from horizontal to vertical – can be justified almost negatively by the incapacity of recent horizontal policies to shift a large number of regions into the knowledge economy (Muscio *et al.*, 2013; Percoco, 2013). This does not mean that these policies must be rejected – we do not know what would happen to these regions without them! It simply means that for the less advanced and transition regions the usual horizontal policy was not enough – i.e. had relatively few effects on the knowledge gap as well as on real economic convergence. Policy makers cannot therefore rely on these policies alone and a more vertical, targeted and preferential intervention logic – to concentrate resources on a few new activities originating from a decentralised and well-conducted entrepreneurial discovery process – must be experimented with.

But the new policy logic involves new implementation. Between Figures 2 and 3, several things have happened: a structuring process of entrepreneurial knowledge, a discovery procedure and the constitution of scales or organisation of a critical mass of resources in a few selected domains.

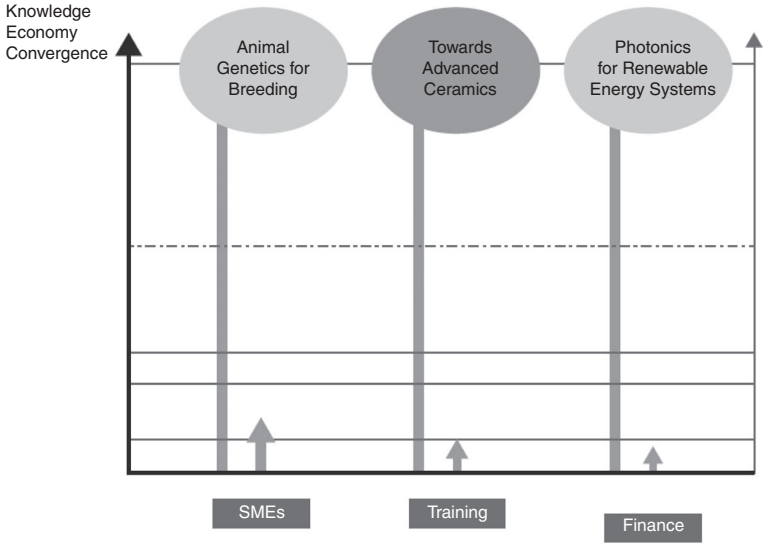
4.2 Structuring entrepreneurial knowledge

Entrepreneurial knowledge is the critical input in the discovery process (Figure 1). In some of the cases presented above (Morez, Lyon, pulp and paper in Finland),



Notes: Horizontal lines describe the knowledge gap between various less developed regions and the top ones in some dimensions of the knowledge economy (SMEs' innovation capabilities, access to finance, training investments)

Figure 2.
Horizontal innovation policy in Region X



Notes: Horizontal lines describe the knowledge gap between various less developed regions and the top ones in some dimensions of the knowledge economy (SMEs' innovation capabilities, access to finance, training investments)

Figure 3.
Vertical (smart specialisation) policy in Region X

entrepreneurial knowledge is generated, structured and developed spontaneously, by the actors themselves, allowing entrepreneurial discovery projects to be accomplished without the need for any other policy than the one that ensures the consolidation of framework conditions.

But these cases are perhaps exceptional! Entrepreneurial knowledge is fragmented and dispersed; it is not available in compact form within one single entity (Bresnahan, 2012). Some elements of this knowledge are also likely to be located elsewhere. Entrepreneurial knowledge is not necessarily located in high-tech companies, but firms as well as local universities and public laboratories, medical schools and hospitals, public services, and communities of practices are possible repositories of elements of relevant entrepreneurial knowledge.

The scarcity and fragmentation of entrepreneurial knowledge as well as its uncertain locatability create a strong case for policy intervention in order to support the generation and/or integration of the knowledge needed for entrepreneurial discoveries and the development of subsequent new activities. Furthermore, numerous factors – that can be grouped under the title of market failures – can prevent a sufficient number of entrepreneurial experiments from being carried out in certain domains or even in the entire regional economy (see Appendix). Therefore the main question for policy makers is: who has or where is the entrepreneurial knowledge and how to integrate the fragmented knowledge base so as to generate exploration and discovery projects? This is demonstrated by what occurs between Figures 2 and 3.

It is therefore obvious that a critical policy task involves mobilisation of the available entrepreneurial knowledge as well as the construction and integration of the entrepreneurial knowledge that is dispersed and distributed among several entities.

4.3 A problem of identification and discovery

While the identification of actions of a horizontal policy does not give rise to too many problems (Figure 2), the selection of new activities in a vertical policy logic is far more difficult: the government does not have innate wisdom. We must guard against the intellectual logic imposed by the principal-agent model, according to which the principal (the government) knows from the start which specialities should be developed and therefore confines itself to setting up the incentives for private industry to carry out the plan! (Rodrik, 2013). "What if, as I and many others assume, there are no principals […] with the robust and panoramic knowledge needed for this directive role?" (Sabel, 2004, p. 3). In that case, the discovery and collective experimentation process forms an integral part of political action and must be carried out within the framework of strategic interactions between the government and the private sector.

The information necessary for prioritisation must, therefore, come from entrepreneurial discoveries made by firms, laboratories, and specialised services based on the integration of their knowledge. The discoveries and new activities identified in Figure 3 have been considered as being potentially rich in spillovers, innovations and structural changes, thanks to the *ex ante* evaluation of these projects within the context of intense and continual interactions between government and industry. This is also demonstrated by what occurs between Figures 2 and 3.

Then the constitution of scales and the generation of critical masses of resources will be organised and the policy process will manage the transition from the entrepreneurial discovery phase to the increasing returns (clustering) phase. Because of resource concentration, as well as the absorption of knowledge and competences

from outside, these new activities are likely to soon move towards the frontier in terms of knowledge convergence (Figure 3).

This is the main idea: having this vertical policy schema in addition to the horizontal programmes in order to enable a region to diversify by the development and consolidation of new specialities or new activities that will facilitate the transformation, revival and renewal of productive structures and generate spillovers towards the rest of the local economy.

5. The great challenge of policy design

5.1 Avoiding distortions and government failures

The goal of a smart specialisation strategy is therefore to favour the emergence and development of a few "innovation microsystems" dealing with particular market niches and mostly related to existing productive structures and assets in order to transform them through R&D and innovation (structural changes).

But we now need to respond to all of the usual criticisms and questions that mainstream economics would raise against the case of a non-neutral policy! For instance, Ann Krueger (2012), commenting on the works of Justin Yfu Lin, a great promoter of the new structural economics framework, writes: "Although it is certainly true that not everything can be done at once, focus on selected areas for large investments to the neglect of the rest of the economy is a highly questionable strategy. Why it would be preferable to allocate scarce capital so that some activities have excellent infrastructures while others must manage with seriously deficient structure is not clear: without further evidence, it would appear to be a distortion". Ann Krueger would have plausibly expressed the same objections to smart specialisation policy! Ann Krueger is part of this large group of economists who accept the need for industrial policy, but strongly argue that intervention has to be limited to horizontal and non-neutral interventions and not extended to preferential policies that discriminate across activities[5].

The difficult policy challenge facing smart specialisation is therefore to emphasise the vertical logic of prioritisation, while avoiding the government failures usually associated with the top-down and centralised bureaucratic processes of technology choices and selection. How to prioritise and favour some R&D and technological activities, some sub-systems or some fields, while not dissipating the extraordinary power of market-driven resource allocation in boosting decentralised entrepreneurial experiments? Vertical prioritisation is difficult; this is why smart specialisation is about defining a method to help policy makers identify desirable areas for innovation policy intervention.

These questions are not "simply" academic! They are very topical in policy circles and business communities, as demonstrated by the number of recent articles published on this subject in *The Economist*[6].

5.2 Smart specialisation and the new industrial policy agenda

This kind of question obviously lies at the heart of the agenda of the so-called *New Industrial Policy* developed in particular by Rodrik (2004, 2007), Hausmann and Rodrik (2003), Trajtenberg (2002, 2012) as well as Aghion (2012) and Aghion *et al.* (2011). One item on this agenda is reconciling vertical priority-setting (perhaps sectoral policy in Aghion's view) and a decentralised innovation economy *à la* Baumol or Phelps, i.e. acknowledging the fact that innovation needs to come from grass roots and not from the top.

According to the intellectual logic of this *New Industrial Policy* school, smart specialisation can be viewed both as a policy objective to encourage regions and countries to take risks in selecting a few priorities and a process to help policy makers identify domains and activities for potential specialisation.

6. Conclusion

This paper focused on the distinction between smart specialisation – as virtuous dynamic of development of new specialities that can emerge spontaneously in the economy – and smart specialisation strategy (or policy) – a notion that involves putting in place a policy process aimed at facilitating this dynamic when it cannot develop spontaneously. The paper began with the analysis of spontaneous smart specialisation dynamics, the presentation of historical examples and the formulation of stylised facts (entrepreneurial discovery, spillovers, entry and agglomeration, structural change and related variety). Next I studied in what conditions a smart specialisation policy is necessary. I then presented a simple graphic case of smart specialisation policy before concluding with the problems that this policy must overcome (entrepreneurial knowledge structuring, identification and discovery, local resource concentration and distortions).

The good news is that the "theory" is in progress thanks to the research programme of some evolutionary and geographical economists (Boschma, Frenken, Neffke and co-authors) who are building the theory and producing the empirical evidence of industrial and structural changes (origins, effects, measurement) at regional level. This will provide a sound framework for developing more detailed, precise and evidence-based smart specialisation policy prescriptions.

Notes

1. This group was co-chaired by the Commissioner and an academic (B. van Ark and then D. Foray). The Group included P. Aghion, P.A. David, J.P. Fitoussi, M. da Graça de Carvalho, B. Hall, M. Kager, G. Licht, J. Mairesse, R. Marimon, S. Metcalfe, M. Mrak, M. O'Sullivan, A. Sapir, A. Giannitsis and R. Veugelers.
2. These examples are taken from the following case studies, respectively: Nikulainen (2008), Navarro *et al.* (2011), Bailey and MacNeil (2009), Houssel and Houssel (1992).
3. I have discussed the centrality of general purpose technology in some patterns of smart specialisation in Foray, David and Hall (2009).
4. Veugelers and Mrak (2009) analyse the poor performance of the catching up Member States (i.e. Greece, Portugal, Spain,Ireland, Slovenia, Romania, Bulgaria, Poland, Hungary, Slovakia, Estonia, Lithuania, Latvia, Czech Republic) with respect to their knowledge economy convergence.
5. Rodrik (2007) proposes an interesting argument about this school of thought: horizontal interventions are a limiting case more than a clear-cut alternative to sectoral policies. In fact very few interventions are truly horizontal. They almost necessarily favour some activities, even if the main goal was not to create such discrimination. This is consistent with Foray (2009) and Foray *et al.* (2012) arguing that much of the discourse of economic policy making has been radically out of step with reality. They support something (neutral R&D policies that address market failures and do not favour one sector or technology over others) that does not really exist.
6. See in *The Economist*: Economic Focus/Tinker, tailor: economists reconsider the merits of industrial policy, but some flaws are hard to fix, 1 October 2011; industrial design: can governments help revive innovation and trade?, 3 October 2009; work to be done: how the

government can help things along, 3 April 2010; picking winners, saving losers: industrial policy is back in fashion. Have governments learned from past failures? 7 August 2010; and last but not least Josh Lerner and Dani Rodrik discussion in Industrial policy: statements, 12 July 2010.

References

Aghion, P. (2012), "Innovation process and policy: what do we learn from new growth theory?", in Lerner, J. and Stern, S. (Eds), *The Rate and Direction of Inventive Activity Revisited*, The University of Chicago Press, NBER, Chicago, IL.

Aghion, P., Boulanger, J. and Cohen, E. (2011), *Rethinking Industrial Policy*, Bruegel, Policy Brief, No. 4.

Agrawal, A. and Cockburn, I. (2003), "University research, industrial R&D and the anchor tenant hypothesis", *International Journal of Industrial Organization*, Vol. 21 No. 9, pp. 1417-1433.

Agrawal, A., Cockburn, I. and Oettl, A. (2010), "Why are some regions more innovative than others? The role of firm size diversity?", NBER Working Paper No. 17793.

Arrow, K. (1962), "Economic welfare and the allocation of resources for invention", in Nelson, R. (Ed.), *The Rate and Direction of Inventive Activity: Economic and Social Factors*, Princeton University Press, Princeton, NJ.

Bailey, D. and MacNeil, S. (2009), "The rover task force: a case study in proactive and reactive policy intervention?", *Draft*.

Berger, S. (2013), *Making in America – from Innovation to Market*, MIT Press, Cambridge, MA.

Boschma, R. and Frenken, K. (2009), "Technological relatedness and regional branching", in Bathelt, H., Feldman, M. and Kogler, D. (Eds), *Dynamic Geographies of Knowledge Creation and Innovation*, Routledge (forthcoming).

Bresnahan, T. (2012), "Generality, recombination and reuse", in Lerner, J. and Stern, S. (Eds), *The Rate and Direction of Inventive Activity Revisited*, The University of Chicago Press, NBER, Chicago, IL.

Dasgupta, P. (1988), "The welfare economics of knowledge production", *Oxford Review of Economic Policy*, Vol. 4 No. 4, pp. 1-12.

Foray, D. (2004), *The Economics of Knowledge*, MIT Press, Cambridge, MA.

Foray, D. (2009), "Structuring a policy response to a 'grand challenge' ", *Knowledge for Growth: Prospects for Science, Technology and Innovation*, Report, EUR 24047, European Union.

Foray, D., David, P.A. and Hall, B. (2009), "Smart specialisation: the concept", *Knowledge for Growth: Prospects for Science, Technology and Innovation*, Report, EUR 24047, European Union.

Foray, D., Mowery, D.C. and Nelson, R.R. (2012), "Public R&D and social challenges: what lessons from mission R&D programs?", *Research Policy*, Vol. 41 No. 10, pp. 1697-1702.

Frenken, K., Van Oort, F. and Verburg, T. (2007), "Related variety, unrelated variety and regional economic growth", *Regional Studies*, Vol. 41 No. 5, pp. 685-697.

Hall, B. and Lerner, J. (2010), "Financing R&D and innovation", in Hall, B. and Rosenberg, N. (Eds), *Handbook in Economics of Innovation*, North-Holland, Amsterdam, Vol. 1.

Hausmann, R. and Rodrik, D. (2003), "Economic development as self-discovery", *Journal of Development Economics*, Vol. 72, December, pp. 603-633.

Hirshleifer, J. (1971), "The private and social value of information and the reward to inventive activity", *American Economic Review*, September, pp. 561-574.

Houssel, A. and Houssel, J.P. (1992), "L'évolution de la fabrique lyonnaise de soieries", *Revue de Géographie de Lyon*, Vol. 67 No. 3, pp. 187-198.

Krueger, A. (2012), "Comments", in Yifu Lin, J. (Ed.), *New Structural Economics*, The World Bank, Washington, DC.

Landabaso, M. (2013), "Time for the real economy: innovative strategies for smart specialisation and the need for new forms of public enterprise", *Draft*.

Machlup, F. (1984), *Knowledge, its Creation, Distribution and Economic Significance*, Vol. III, Princeton University Press, Princeton, NJ.

Minkler, A. (1993), "The problem with dispersed knowledge: firms in theory and practice", *KYKLOS*, Vol. 46, pp. 569-587.

Muscio, A., Rivera Leon, L. and Reid, A. (2013), "Can smart specialisation help overcome the regional innovation paradox?", *Conference on the New Structural Economics, UCL-SSEES, London, June*.

Navarro, M., Aranguren, M.J. and Magro Montero, E. (2011), "Smart specialisation strategies: the case of Basque country", *Orkestra WPseries*, R07.

Neffke, F., Henning, M. and Boschma, R. (2009), "How do regions diversify over time? Industry relatedness and the development of new growth paths in regions", *Papers in Evolutionary Economic Geography*, 9-16, Utrecht University.

Nelson, R.R. (1959), "The simple economics of basic scientific research", *Journal of Political Economy*, Vol. 49, pp. 279-306.

Nikulainen, T. (2008), "Open innovation and nanotechnology: an opportunity for traditional industries", *VISION Era.net*, April.

Percoco, M. (2013), "Strategies of regional development in European regions: are they efficient?", *Cambridge Journal of Regions, Economy and Society*, Vol. 6, pp. 303-318.

Phelps, E.S. (2013), *Mass Flourishing*, Princeton University Press, Princeton, NJ.

Rodrik, D. (2004), "Industrial policy for the twenty-first century", Discussion Paper Series, No. 4767, CEPR, November.

Rodrik, D. (2007), *Normalizing Industrial Policy*, paper prepared for the Commission on Growth and Development, September.

Rodrik, D. (2013), *Green Industrial Policy*, School of Social Science, IAS, Princeton, NJ.

Romer, P. (1993), "Implementing a national technology strategy with self-organizing industry investment boards", *Brookings Papers: Microeconomics*, Vol. 2, pp. 345-399.

Sabel, C. (2004), *Beyond Principal-Agent Governance: Experimentalist Organizations, Learning and Accountability*, WRR – Wetenschappelijke Raad Voor Het Regeringsbeleid, Amsterdam, July.

Sopas, L. (2001), *The Portuguese Mould Industry and Plastic Clusters*, 1st meeting of the Portuguese session of the Society of Plastic Engineers, Marinha Grande.

Trajtenberg, M. (2002), "Government support for commercial R&D: lessons from the Israeli experience", *Innovation Policy and the Economy*, Vol. 2, pp. 79-134.

Trajtenberg, M. (2012), "Can the Nelson-arrow paradigm still be the beacon of innovation policy?", in Lerner, J. and Stern, S. (Eds), *The Rate and Direction of Inventive Activity Revisited*, The University of Chicago Press, NBER, Chicago, IL.

Veugelers, R. and Mrak, M. (2009), "Catching-up member states and the knowledge economy of the European Union", *Knowledge for Growth: Prospects for Science, Technology and Innovation*, Report, EUR 24047, European Union.

Appendix. Market and coordination failures in a smart specialisation process

The potential presence of strong market and coordination failures as characterising the economic environment of a smart specialisation process is likely to result both in systemic under-investment in entrepreneurial discoveries, lower than socially desirable rates of discoveries, and in obstacles and difficulties of development and early growth of the new activities, once the discovery has been made.

Entrepreneurial knowledge division and dispersion: the division of knowledge stems from division of labour and increasing specialisation in the field of knowledge production. Its dispersion is related to local situations in which knowledge is produced. The result is an extremely fragmented knowledge base (Foray, 2004, p. 18; Machlup, 1984; Minkler, 1993). The integration of dispersed and divided knowledge creates an externality that is a source of market failure (see the weak appropriability case below).

Weak appropriability of entrepreneurial discovery: the discovery of new domains of opportunities entails significant information externalities that are virtually impossible to appropriate, thus causing a wide gap between social and private returns to discoveries (Nelson, 1959; Arrow, 1962; Trajtenberg, 2012). Note that the usual solution involving the use of intellectual property rights is not appropriate here since the information spillovers need to be maximised (see Hirshleifer argument, above). Thus, the appropriability problem is even more severe in the case of discovery than in the case of "simple" innovation (for which the use of a patent is a plausible (although second-best) solution).

Uncertainty: the value of a discovery is more conjectural than that of most types of innovation and is therefore more likely to be undervalued by firms (the variance of distribution of expected returns from discoveries is much higher; Arrow, 1962; Dasgupta, 1988).

Access to finance: an additional gap exists between the private rate of return required by an entrepreneur and the cost of capital when the entrepreneur and financier are different entities (Hall and Lerner, 2010).

Increasing returns in the form of agglomeration economies (including large firms' spin-off externalities, anchor tenant externalities and small firms' externalities, see Agrawal and Cockburn, 2003; Agrawal *et al.*, 2010) are a generic source of market failures.

Coordination failures at an early growth stage: a lot of coordination problems may arise from the early growth stage of the new activity (needs for simultaneous investments in various segments of the activity) (Rodrik, 2004) as well as the provision of new industry-specific public goods (Romer, 1993).

I hope that I have made it clear that smart specialisation as a process of evolution is not at all new. However, a policy aiming at promoting smart specialisation does have some new elements. I will discuss these new elements now as well as in the next section.

Corresponding author
Professor Dominique Foray can be contacted at: dominique.foray@epfl.ch