

## Turning Concepts into Innovation Policies

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### Abstract

This paper discusses dilemmas that emerge when policy-makers are equally attracted to promoting concepts that are not based on evidence and to developing innovation policies that are evidence-based. It addresses six dilemmas of innovation policies by discussing the following questions: What is the capacity of theories and new policy concepts linked to innovation to provide useful policy prescriptions to foster innovation? To what extent are these theories and new policy concepts supported by solid evidence? The paper is based on a review of concepts and buzz words linked to innovation, and the types of data and diagnostics used by policy-makers to develop new national and regional innovation policies. The paper is also based on the consulting experience of the authors regarding the production of evidence-based diagnostics and derivation of policy measures at both the national and regional levels. The paper defines policy issues in terms of dilemmas, it provides concrete examples, and it discusses how policy-makers could resolve the tensions between equally attractive policy alternatives.

### Résumé

Cette communication discute des dilemmes qui émergent lorsque les décideurs sont tout aussi attirés par la promotion des concepts qui ne sont pas basés sur des données probantes que par l'élaboration de politiques d'innovation qui sont fondées sur des données probantes. Elle traite de six dilemmes des politiques d'innovation en abordant les questions suivantes : quelle est la capacité de théories et de nouveaux concepts de politiques liées à l'innovation à fournir des prescriptions utiles pour la formulation de politiques visant à stimuler l'innovation ? Dans quelle mesure sont les théories et les nouveaux concepts de politiques soutenus par des preuves solides ? La communication est fondée sur un examen de concepts et de « buzzwords » liés à l'innovation et des types de données et de diagnostics utilisés par les décideurs pour élaborer de nouvelles politiques d'innovation. La communication est également basée sur l'expérience de consultation des auteurs concernant la production de diagnostics fondés sur les données probantes et la dérivation des mesures de politiques d'innovation aux niveaux national et régional. La communication définit les questions de politiques d'innovation en termes de dilemmes, fournit des exemples concrets et examine comment les décideurs pourraient résoudre les tensions entre des politiques de rechange tout aussi attrayantes les unes que les autres.

### Resumo

Este artigo discute os dilemas que surgem quando os decisores políticos estão igualmente atraídos para promoção de conceitos que não são baseados em evidências e ao desenvolvimento de políticas de inovação que são baseadas em evidências. Ele aborda seis dilemas das políticas de inovação, discutindo as seguintes questões: qual é a capacidade de teorias e novos conceitos políticos relacionados com a inovação para fornecer receitas políticas úteis para promover a inovação? Em que medida são essas teorias e novos conceitos

de política apoiados por evidências sólidas? O livro é baseado em uma revisão de conceitos e buzz palavras ligadas à inovação e os tipos de dados e diagnósticos utilizados pelos decisores políticos para desenvolver novas políticas nacionais e regionais de inovação. O livro baseia-se também a experiência de consultoria dos autores sobre a produção de diagnóstico com base em provas e derivação das medidas de política nos níveis nacionais e regionais. O livro define aspectos de política em termos de dilemas, fornece exemplos concretos e discute como os decisores políticos poderiam resolver as tensões entre igualmente alternativas de política atraente.

**Key words:** innovation, concepts, dilemmas, evidence-based policies

## Introduction

Turning concepts into innovation policies raises many dilemmas. Hence, ideas of policy concepts emerge from multiple sources such as market failure theories, economic development theories, and cluster theories to name a few. Furthermore, ideas of policy concepts also emerge from various types of diagnostics as to how firms perform with respect to innovation. This paper discusses dilemmas that emerge when policy-makers are equally attracted to promoting concepts that are not based on evidence and to developing innovation policies that are evidence-based.

There are two perspectives on evidence-based policymaking. There is a narrow perspective that promotes the use of systematic reviews and meta-analyses to generate evidence on the effectiveness of policy interventions. In this narrow perspective, the evidence is translated into evidence-based policy interventions that should be imposed to policy-makers and practitioners. In this chapter, we endorse a broader perspective to consider evidence-based policy-making as an approach that aims to help policy-makers and practitioners base the development of their policy interventions on the best available evidence (Nutley et al. 2009; Bogenschneider and Corbett 2010). Without evidence, policy-makers and practitioners must rely on intuition, ideology, conventional wisdom, policy buzz words, and untested theories. We claim that many innovation policies are made this way because the intensity of competition has induced policy-makers at both national and regional levels to continually adapt their innovation policies in order to take into account new policy concepts and diagnostics that pinpoint deficiencies and failures in existing policies. The review of the innovation policy literature suggests major difficulties regarding the capacity of theories to provide useful policy prescriptions. Furthermore, the existing policy diagnostics tend to provide data at levels of aggregation that do not take into account the diversity of the situations and needs of firms, industries and regions. In this paper, policy diagnostics have to do with ascertaining the nature of unsatisfactory innovation performances by looking at symptoms and signs of shortcomings and failures in innovation policies. As for evidence-based policy diagnostics, they refer to the type of evidence used to prepare diagnostics. In such a context, practice-based innovation policy-making refers to the idea that the making of policies is more or less based either on the best available evidence concerning the innovation performances of companies or on untested intuitions, concepts and buzz words related to innovation performances. Hence, dilemmas of practice-based innovation policy-making arise because policy-makers are equally attracted to the reliance on the best available evidence and on untested concepts, intuitions, and buzz words.

This paper addresses dilemmas of innovation policies by discussing the following questions: 1) What is the capacity of theories and new policy concepts linked to innovation to

provide useful policy prescriptions to foster innovation? To what extent are these theories and new policy concepts supported by solid evidence?

The paper is based on a review of concepts and buzz words linked to innovation, and the types of data and diagnostics used by policy-makers to develop new national and regional innovation policies. The paper is also based on the consulting experience of the authors regarding the production of evidence-based diagnostics and derivation of policy measures at both the national and regional levels. The paper defines policy issues in terms of dilemmas, it provides concrete examples, and it discusses how policy-makers could resolve the tensions between equally attractive policy alternatives.

The discussion of practice-based innovation policy-making is organized around six policy dilemmas: 1. Theory vs practice-based innovation; 2) The magic ingredient concept vs the multiple ingredients practice; 3) Open vs closed innovation; 4) Inward vs outward view of innovation; 5) Innovations that are first on the world market vs incremental innovations 6) Policy imitation vs customized solutions.

### **Dilemma 1: theory vs practice-based innovation**

**The dilemma:** policy-makers are equally attracted by the idea of implementing innovation policies based on concepts derived from policy theories and theories of innovation than by its opposite alternative which is to implement innovation policies based on the diversity of situations and needs of firms, industries and regions.

#### **1.1 The theoretical argument in four parts**

How are innovation policies justified by the market theory? In theory, there are market deficiencies when private firms invest less in R&D and innovation than is socially beneficial (Lerner 2009). Experts classify the economic justifications following four series of factors. First, market deficiencies pertaining to R&D are related to three factors (Lerner 2009; Reback 2009; Caracostas 2007; Usher 1992): the first factor, which is related to the concept of indivisibility of the innovation process, supports that the interdependence of the different phases of the innovation process entails an indivisibility of fixed costs to the different phases of the innovation process that makes difficult the efficient exploitation of scale costs. The second factor is related to the concept of imperfect appropriability of the innovation results. It claims that firms cannot appropriate the total profits of their investments in R&D and innovation activities because these investments generate intangible and immaterial public benefits that cannot be commercialized. Furthermore, it is argued that in some cases, the public benefits can be more important than the private benefits. The third factor is related to the concept of uncertainty of innovation. In theory, R&D and innovation processes involve scientific, technical and commercial uncertainties that render difficult the forecast of results and the calculation of profits of private investments. The intangible character of R&D and innovation investments complicates the life of suppliers of capital by rendering the R&D and innovation investments irrecoverable.

Second, markets may also fail due to deficiencies pertaining to diffusion (MacVaugh and Schiavone 2010). First, it is argued that the indivisibility of the diffusion process entails the same type of indivisibility than the R&D process. Second, the diffusion of new technologies and of innovation can be impeded because of three deficiencies of the absorption capacity of firms: deficiencies in the mastering of techniques required to adopt new technologies; organizational deficiencies of the firm that prevent the best exploitation possible of new technologies; deficiencies in the abilities of the infrastructure that the firm depends on (commercialization structures, banks, local institutions, etc.) which impede the best exploitation possible of new technologies.

Third, the diffusion of new technologies and of innovation can be impeded because of two deficiencies of information: inadequate availability of the information concerning opportunities for entrepreneurs to be familiar with new technologies and innovation; presentation of the required information in a way that is useless and non-credible for the potential user firm.

Fourth, the innovation process can also be impeded by deficiencies pertaining to the infrastructure that the firm depends on. In this matter, experts tend very often to highlight the following shortages (Peters 2006; Schmoch et al., eds. 2006; Lundvall, ed. 1992): lack and inadequacy of technical and professional training; lack of collaboration between public research institutions and firms; lack of institutions of economic intermediation involved in innovation promotion; lack of intermediation institutions dedicated to the promotion of creation and consolidation of networks, partnerships and horizontal collaborations between actors; lack of social values like trust and reciprocity that raises the costs of knowledge exchange.

## **1.2 Implications for practice-based innovation policy-making**

Four implications derive from the above theoretical arguments (Lerner 2009; Reback 2009; Caracostas 2007; MacVaugh and Schiavone 2010): first, state intervention is justified by the idea of compensation of the difference between private benefit and social benefit. Second, certain R&D and innovation projects imply fixed costs and investment levels so important that they cannot be financed by private firms without governmental grants or fiscal incentives. Third, the imperfect appropriability of innovation results renders the intervention of the state necessary to compensate the gap between the benefits for the community as a whole and those pertaining exclusively to the firms. Fourth, the importance of these uncertainties pushes firms to reduce their risks. This propensity justifies state intervention to share the risk with firms in different ways, notably by creating or facilitating the creation of new financing mechanisms, particularly in the field of venture capital.

At first sight, these theoretical arguments are attractive but, upon further examination, they neither provide specific theoretical diagnostics, nor clarify policy implications regarding innovation. The market failure arguments are formulated at a very high level of aggregation that prevent policy-makers from deriving policy prescriptions that would take into account the diversity of situations and needs of firms, industries, regions and countries in the matter of innovation. Furthermore, the market failure arguments do not diagnose the innovation process in a way that is disaggregated enough to be able to derive specific policy implications that would contribute to foster innovation in firms.

As a consequence, in its current formulation, the theory of market failures does not help significantly to turn conceptual diagnostics into innovation policies based on the diversity of situations and needs of firms, industries, regions and countries.

### **Dilemma 2: the magic ingredient causal concept vs the multiple ingredients practice**

**The dilemma:** policy-makers are equally attracted by concepts suggesting the implementation of innovation policies based primarily on one or two ingredients, such as R&D and patents, than by its opposite alternative which is to implement innovation policies based on evidence showing that, in practice, innovation depends on multiple factors (ingredients) used in a complementary manner by firms.

## 2.1 The theoretical argument

In spite of all the criticisms addressed to the linear science push theory of innovation, policy-makers of many countries, including Canada and many of its provincial governments, tend to actually assume that the innovative performance of firms might be improved by developing innovation policies that rely primarily on increasing R&D and patenting activities. The rationale for such an argument is that increases in R&D activities will increase the development of product and process innovations and, in turn, increasingly relying on patents will increase protection against imitation by competitors of the newly developed innovations. A variation of this rationale argues that increases in industry-university research and increases in the commercialization of the intellectual property rights derived from the discoveries and inventions of university research will foster the transfer of university inventions and discoveries to industry and, in turn, foster innovation in industry. Such a rationale induces policy-makers to rely on one or two factors of innovation theories upon which to base their policies.

## 2.2 What is the evidence on the determinants of innovation?

The strong lesson learned from the empirical literature on innovation tells us that multiple ingredients or determinants are required to ensure the development and commercialization of technological innovations. Hence, Becheikh et al. (2006) have documented in a detailed manner the determinants (explanatory factors) of innovation in a systematic review of the empirical literature on innovation. There now exist many systematic literature reviews on innovation at the national level (Becheikh et al. 2006). The development of product and process innovations is explained by the use of firms' internal and external resources. No firm, even the biggest, has at its disposal all the necessary internal resources to develop or improve, on its own, its products, processes and practices. The empirical literature on innovation shows that it is possible to increase the innovation performance of firms by improving the external factors and resources that contribute to increase innovation. Innovation depends in fact on internal and external determinants or resources, as well as hybrid determinants. The internal determinants refer to the internal capacities of the firms to create and use the necessary knowledge to develop and improve products and processes. The external determinants refer, for their part, to the capacities of the firms to identify, obtain and use the knowledge coming from external sources, and to the capacities of the firms to adapt themselves to the competitive environment. The development of product and process innovations requires the combination of a large number of ingredients as illustrated in the following summary list of determinants that explain innovation in a statistically significant manner.

The determinants linked to the internal resources of firms relate to (Becheikh et al. 2006):

- Size of the firm;
- Strategies (including commercialization strategies);
- Investments in strategic assets, that is:
- Knowledge creation: R-D;
- The use of knowledge embodied in advanced technologies;
- The use of knowledge embodied in manufacturing practices linked to added value production;
- The use of knowledge embodied in manpower.

The determinants linked to the external resources of firms relate to:

- The use of external sources of knowledge (ideas and information, technical support) to complete and improve internal resources, that is:

- Market sources: clients, suppliers, competitors, consultants;
- Research sources: universities, public centres of research, centres of technology transfer, patent documentation;
- Formal and informal collaborations with other business and research organizations;
- Services of economic development agencies and intermediary organizations helping firms to innovate;
- Variables linked to the firm's competitive environment.

The hybrid determinants of innovation that are partly linked to the firm's internal factors and partly linked to external factors mainly refer to the obstacles to innovation such as lack of information on technology relevant to the development or introduction of new or significantly improved products or processes, lack of financing for the development of development or introduction of new or significantly improved products or processes, lack of skilled personnel to develop or introduce new or significantly improved products or processes, inability to qualify for government assistance programs or R&D tax credits (Amara and Landry 2005; Amara et al. 2008).

The evidence shows that around 15% of SMEs rely on the use of patents to protect their innovations against imitation from rival firms. By comparison, 40% of SMEs rely on secrecy to protect their innovations from imitation, and other informal strategic mechanisms such as lead time over competitors (51% of cases) and complexity of production processes (25% of cases) (Landry and Amara 2004). Furthermore, recent data on the commercialization of inventions and discoveries developed in Canadian universities show that investments of 10.9 billion dollars in university research (Statistics Canada 2010a) generated 53 million dollars of economic returns in 2008 (Statistics Canada 2010b), thus confirming in a complementary manner that the patenting and commercialization of university intellectual property rights is not really a winning strategy when used in isolation from other explanatory factors of innovation. The available evidence shows similar trends in European countries.

### **2.3 Implications for practice-based innovation policy-making**

Hence, the quantitative evidence on innovation also shows that patenting is used by a small percentage of firms as a tool to protect technological innovations, and that the linkage between university research and economic return is much more indirect than assumed by many policy-makers. The empirical literature on innovation shows that many ingredients are required and combined in a complementary manner in order to ensure the successful commercialization of technological innovations. Following the concept of evidence-based policy-making, we argue that practice-based innovation policy-making should rely only on variables that influence innovation in a statistically significant way. Variables that do not explain innovation in a statistically significant manner have no impact on innovation and, therefore, should not be considered as innovation policy levers. In practice-based innovation policy-making, a statistical analysis thus allows to identify strengths and weaknesses of firms, and to generate ideas to improve innovation policies.

However, the evidence provided in a statistical analysis entails three main limits that prevent their efficient use in practice-based innovation policy-making: first, available evidence usually does not link the determinants of innovation to specific policy instruments supporting innovation; then, when they tackle the question of policy instruments of innovation support, these studies usually do not tackle systematically the transferability conditions of these instruments; finally, another important limit of empirical studies on the determinants of innovation is to implicitly postulate that countries and regions are homogeneous. Practice-based innovation policy-making should assume, following Asheim et

al. (2003), that in order to achieve their goal, innovation policies must take into account the variety of regional contexts, the diversity of firms' capabilities and attitudes, and the diversity of factors facilitating or impeding innovation. Nauwelaers and Wintjes' (2003, in Asheim et al. 2003) thesis asserts that these elements of diversity render impossible the establishment of policies that could be valid and efficient for each of the encountered regional situations. They however add that this does not mean that nothing can be done to develop general policies which could contribute to improve the efficiency and effectiveness of the policy instruments used to support innovation in firms, particularly in SMEs. Hence, based on their empirical studies, they suggest that general policies should embody three characteristics: first, matching the context and companies' needs with the policy instruments in each region; second, confronting the policy tools with the lessons of theory; third, comparing results achieved with a range of policy instruments in different environments (Nauwelaers and Wintjes 2003: 219).

### **Dilemma 3: open vs closed innovation**

**The dilemma:** policy-makers are equally attracted by the idea of implementing innovation policies based on the concept of open innovation than by its opposite alternative which is to implement innovation policies based on the protection of innovation (closed innovation).

#### **3.1 The argument supporting the concept of open innovation**

The concept of open innovation has caught the attention of policy-makers and business leaders who have transformed this buzz word into a new policy paradigm for the management of innovation. The starting point for the argument supporting this concept is that no firm, even the largest ones, can develop product innovations in isolation by relying only on its internal resources. Therefore, firms have to forge relations with external partners to acquire external ideas, information, knowledge and resources in order to improve their innovation capabilities and performances. The literature on open innovation stresses the benefits of openness in innovation, leaving aside the examination of the costs and disadvantages of openness (Dahlander and Gann 2010). In some policy circles, open innovation is understood to be extremely open, and treats openness as a dichotomous variable: completely open vs completely closed (Balca et al. 2010).

From the standpoint of firms, the innovation process has always been an open process. The degree of openness of the innovation process might have increased due to the rising specialization of R&D, advanced technologies, and patents whose exploitation requires access to codified knowledge in combination with tacit knowledge. In such a context, open innovation refers to various types of inflows and outflows of knowledge. According to Chesbrough et al. (2006, page 1), open innovation is «the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively.». In their systematic review of literature on open innovation, Dalhander and Gann (2010) have further divided the literature on inbound and outbound flows into interactions that are pecuniary from those that are non-pecuniary, and proposed four emblematic forms of openness:

**Sourcing:** non-pecuniary inbound flows of resources refer to the exploration and use of external sources of ideas, information, knowledge, R&D and technologies to enhance internal innovation capabilities.

**Acquiring:** pecuniary inbound flows of resources refer to the acquisition of expertise and technologies (license-in of patents, acquisition of advanced technologies) on the market in order to enhance internal innovation capabilities.

**Revealing:** non-pecuniary outbound flows of resources refer to how internal ideas, information, knowledge and technologies are revealed to external organizations without any

short term financial rewards, thus leveraging the innovative capabilities of external organizations outside the boundaries of the firm.

**Selling:** pecuniary outbound flows of resources refer to how firms sell or license out their inventions and technological innovations, thus contributing to improve the internal innovation capabilities of other organizations.

The argument for open innovation supports that the internal innovation capabilities of firms are maximized by increasing, in combination, inflows and outflows of resources.

### 3.2 What is the evidence on openness of innovation?

Despite the attention paid to open innovation, empirical studies on its different forms are still scanty. Hence, most empirical studies have examined non-pecuniary (sourcing) and pecuniary (acquiring) inbound flows of resources.

There is an abundant quantitative literature on the external sources of ideas and information used by firms in the development of product and process innovations (non-pecuniary inbound flows of knowledge) (Amara and Landry 2005; Laursen and Salter 2006). Hence, a study of Canadian SMEs about the frequency of use of external sources of ideas and information used for the development of product and process innovations indicates that traditional market sources of ideas and information dominate in the development of technological innovations (Landry and Amara 2004):

1. Clients (used by 80,3% of SMEs);
2. Exchange of ideas and information with other business leaders (64,3%);
3. Suppliers (62,3%);
4. Industrial and tradefairs (61,7%);
5. Internet (60,0%);
6. Local economic development agencies (34,0%);
7. Patent documentation (21,0%);
8. National Research Council (NRC/IRAP) (19,9%);
9. Community colleges (18,6%);
10. Community college tech transfer offices (18,2%);
11. Universities (18,2%).

Other studies arrive at similar levels of use of non-pecuniary inbound flows of ideas and information in the development of product and process innovations (Amara and Landry 2005; Vega-Jurado et al. 2009). Such data suggest that ideas, information and knowledge are voluntarily exchanged without any pecuniary immediate rewards in order to foster the development of product and process innovations. To the extent of our knowledge, the pattern of use of external sources of ideas and information in the development of innovations has not changed drastically over the last decades, with the exception of the increasing use of the Internet. Landry et al. (2002) showed that firms developing innovations that carry higher degrees of innovativeness are more likely to use research sources of ideas and information, whereas the use of market sources such as clients and suppliers plays a more important role in the development of incremental innovations.

There is also a quantitative literature on the acquisition of advanced technologies that firms use for the development of process innovations (pecuniary inbound flows of technologies) (Roulet et al. 2010).

The evidence on pecuniary outbound flows of resources regarding how 615 innovative SMEs sell or license out their inventions and technological innovations to other firms shows that (Landry and Amara 2004):

- 2.2% of SMEs have licensed out;
- 16.7% have conducted R&D projects for other firms;

- 26.2% have sold equipment to other firms;
- 16.7% have had technicians or engineers lent to other firms.

There are few studies on open sources (Henkel 2006), and case studies on firms like Apple, IBM and Sun (West 2003) on inbound flows, revealing ideas, information, knowledge and technologies to other organizations. However, data on how internal ideas, information, knowledge and technologies are revealed by SMEs to external organizations without any short term financial rewards are almost nonexistent.

The available data on SMEs suggest that they devise open strategies of innovation in a complementary manner with closed strategies to protect their inventions and innovations from imitation by rival firms. Hence, the survey of 615 Canadian SMEs, conducted by Landry and Amara (2004), shows the extent of use of these different mechanisms:

- Patents: 14.5%
- Design registration: 8.9%
- Trademark: 20.3%
- Secrecy: 39.2%
- Complexity of production processes: 24.5%
- Lead-time advantages over competitors: 51.3%

The same study also provides evidence of use of combinations of non-pecuniary inbound and outbound flows of knowledge in the development of product and process innovations (Landry and Amara 2004). Hence,

- 21.0% of innovative SMEs collaborated with other firms in projects regarding product and process innovations;
- 8.7% of SMEs collaborated with universities in projects regarding product and process innovations;
- 15.8% of SMEs collaborated with public research organizations in projects regarding product and process innovations.

### **3.3 Implications for practice-based innovation policy-making**

The existing evidence convincingly shows that firms which increase sourcing (non-pecuniary inbound flows of knowledge) and acquiring (pecuniary inbound of technologies and expertise) contribute to improve their innovation performances. However, there is as yet no convincing quantitative evidence regarding the causal linkage between innovation and revealing (non-pecuniary outbound flows of knowledge), and between innovation and selling (pecuniary outbound flows of technologies and expertise). Furthermore, we suggest that in practice, it is very difficult to figure out how firms can avoid revealing ideas and information while sourcing (non-pecuniary outbound flows of knowledge), and vice-versa. Overall, the practical implementation of open innovation strategies is costly and depends in large part on absorptive capacities linked to the current use of advanced technologies, and the current level of skills and expertise of employees.

The available evidence suggests that, in practice, firms devise complex strategies combining elements of openness and closeness. In practice, complete openness is a strategy that would make value capture and exploitation of inventions by innovators difficult, especially when ideas and information are revealed to rival firms which can rely on better complementary assets and production facilities to make use of the revealed information in the development of product or process innovations.

Hence, the implications of the above evidence for the implementation of practice-based innovation policy-making are that policy-makers should develop measures helping firms to

progressively increase their degree of openness, in particular sourcing and acquiring, because there is solid evidence of the positive influence of such forms of openness on innovation. However, the lack of convincing evidence regarding the correlation between revealing and innovation calls for policy caution. We have learned in our consulting mandates that SMEs selectively reveal, to other parties, information regarding their expertise, inventions and innovations. Practice-based innovation policy-making should be based on the practice of firms and should aim to help them gradually evolve with respect to sourcing and acquiring rather than transforming a buzz word into policies.

#### **Dilemma 4: inward vs outward view of innovation**

**The dilemma:** policy-makers are equally attracted by the idea of implementing outward-looking approaches to innovation policies fostering niches of excellence than by its opposite alternative which is to implement inward-looking innovation policies that primarily focus on internal factors of regions while neglecting the forging of linkages with the rest of the world.

##### **4.1 The argument supporting the outward concept of innovation**

Policy-makers and business leaders aim to foster innovation and competitiveness by developing niches of excellence and clusters competing in global markets. Hence, innovation policies based on cluster approaches emphasize the impact of the following external factors of firms to explain their success in innovation (Cooke et al. 2000; Morgan and Nauwelaers 2003; Asheim et al. 2003):

- Presence of sophisticated local clients;
- Presence of local clients who anticipate needs that will emerge elsewhere;
- Presence of sophisticated local suppliers;
- Presence of sophisticated local knowledge-intensive business service firms;
- High quality local research infrastructure;
- Strong density of highly qualified human resources in the region;
- Abundant supply of venture capital in the region;
- A local context that encourages investment in innovation;
- A tradition of cooperation between actors;
- The existence of intermediary organizations that support the interaction between firms, and between firms and other actors;
- Close relationships between clients and suppliers that favor trust;
- A regional culture of knowledge sharing.

These factors concern the proximity of firms to their partners, and experts such as Weterings and Boschma (2009), and Boschma (2005) tackle them more and more often by distinguishing between three types of proximity that could contribute to increase the propensity to innovate at the cluster level:

- The cognitive proximity defined by the similarities with which actors perceive, interpret, understand and evaluate their context of action;
- The organizational proximity defined by the extent to which actors share the same relationship space in an organizational system;
- The geographical proximity defined in terms of spatial or physical distance between the economic actors.

#### 4.2 Limits of the cluster concept

More and more experts (Boschma 2005; Bathelt et al. 2004) are underlying the limits of these diverse forms of proximity by emphasizing the necessity for firms of having access to sources of ideas that are different and complementary to those available by cognitive proximity, the necessity for firms of having at their disposal organizational flexibility and training possibilities complementary to those offered by organizational proximity, and finally, the necessity of opening oneself to the outside world and establishing non-local links to avoid a lock-in in geographical local links that prevents innovation.

#### 4.3 Implications for practice-based innovation policy-making

In practice, innovation policies such as cluster policies/strategies tend to focus their attention on internal factors of countries, industries or regions and to neglect the linkages with the rest of the world. Hence, regional policy-makers are induced to develop their own independent clusters in plastics products, clusters in marine products,... by stressing the importance of internal factors at the expense of external sources of knowledge, technologies and markets.

In such a context, provincial and national policy-makers have the obligation to force regional policy-makers to recognize that the benefits on innovation emerging from the effects of proximity must be counterbalanced by the benefits resulting from the openness to the outside world and the establishment of non-regional links to prevent the effects of lock-in.

#### Dilemma 5: innovations that are first on the world market vs incremental innovations

**The dilemma:** policy-makers are equally attracted by the idea of implementing innovation policies based on concepts of radical/disruptive innovations than by its opposite alternative which is to implement innovation policies that primarily support incremental innovations in existing firms.

#### 5.1 The argument supporting the concept of innovations that are first on the world market

Policy-makers and business leaders are attracted by the concept of radical/disruptive innovations. Radical innovations are innovations that are the first on the world market. As for disruptive innovations, they refer to new products for which there is as yet no market and for which there are no standards. The supporters of these concepts (Christensen et al. 2008) claim that such innovations generate astronomical returns by creating new markets for which there is initially no competition.

#### 5.2 What is the evidence on innovations that are first on the world market?

The compilation of data of innovation surveys conducted in Canada and Europe reveals that (Becheikh et al. 2006; Amara and Landry 2005):

- Between two-thirds and three-quarters of the manufacturing firms develop product and process innovations.
- Large variations exist from one region to the next and from one country to the next.
- The propensity to develop product innovations varies greatly and in a non-linear manner with the number of employees.
- The development of product innovations also varies greatly depending on the sectors of activity, and also from one region to the next for the same sector of activities.
- The data of the Statistics Canada innovation survey of 2005 show that 10% of the innovative firms introduced, onto the market, at least one product innovation that was

a first in the world. However, our own survey data on innovation in manufacturing firms indicate that the propensity to claim the development of innovations that are the first on the world market increases as the number of employees of firms decreases. Such bias is due to the fact that smaller manufacturing firms have less information regarding the state of their competitive environment.

### 5.3 Implications for practice-based innovation policy-making

The existing data on innovation in manufacturing industries show that companies usually commercialize incremental innovations. The quantitative evidence on firms that launch innovations that are first in the world, especially on disruptive innovations, is still scanty. The available evidence on spin-offs derived from university research and from venture capital investments suggests that only a small proportion of such firms survive and that a small proportion of this small proportion becomes large firms creating a large number of jobs and large amounts of wealth. In practice, innovations that are the first on the world market make headlines, but not profits.

Rather than focusing all their attention on policy interventions aimed at companies developing innovations that are first on the world market or disruptive innovations, policy-makers should also take into account two more common categories of innovative firms:

- 1) firms that do not develop innovations;
- 2) firms that develop incremental innovations.

The positioning of policy support measures regarding these three groups of firms represents a good way of improving the efficiency and effectiveness of innovation policy measures that aim to improve the innovative performance of firms. Besides, as we have already mentioned, such a positioning of innovation policies and of their measures would incite to conceive measures around a gradation concept where one would attempt to progressively graduate firms from the non-innovating category towards the incremental innovation category and then, towards the innovation category where firms introduce innovations that are first on the world market.

Hence, we suggest that practice-based innovation policy-making must take into account the degree of novelty that firms bring to their innovations, mostly to product innovations, to have them progressively graduate into innovations that entail higher and higher degrees of novelty in their innovations.

### Dilemma 6: policy imitations vs customized solutions

**The dilemma:** in the absence of good theories and solid evidence, policy-makers and firms are equally attracted by the idea of implementing innovation policies based on the replication of « models that work » than by its opposite alternative which is to implement innovation policies based on customized solutions that take into account differences in their national contexts (history, institutions, values, R&D intensity,...).

#### 6.1 The argument supporting the concept

The lack of useful theories incites policy-makers to be inspired by «models that work», models of successful regions, models of successful firms, models of successful clusters, as sources of orientation for the formulation of practice-based innovation policy support measures. Hence, policy-makers are led to invest resources in attempts to replicate regions like Silicon Valley, the Science Triangle Park, clusters like the Rochester photonic cluster, the Boston biotech cluster, and firms like Nokia and Research in Motion (RIM).

## 6.2 What is the evidence on the concept of policy imitation?

The absence of diagnoses based on micro-data that could be appropriate to describe the variety of situations and of firms' needs at the disaggregated level, and the incapacity of theories on innovation to generate precise ideas of innovation support measures at the regional and industry levels, have incited policy-makers to look for ideas of innovation support measures in guidelines and policy papers of exemplary measures of innovation support. There now exist a very large number of these guidelines and policy papers. To illustrate this, here are a few examples:

- European Union Regional Policy, (2007). Examples of regional innovation projects.
- Economic Development Administration, (2008). A resource guide for technology-based economic development. US Department of Commerce.
- National Governors Association, (2008). Innovation America: A final report. National Governors Association.
- OECD, (2008). Globalization and regional economies: OECD reviews of regional innovation. Paris, OECD.
- Steineke, J.E. and Hedin, S., (2008). Management by objectives and results: structures and practices in the regional policy field in the Scandinavian countries and Iceland. Nordregio.

## 6.3 Implications for practice-based innovation policy-making

Such policy guidelines and policy papers of exemplary measures of innovation support in firms are part of the policy-makers' tool kit. They contribute to provide practical ideas on «how» to foster innovation. However, the major shortcoming of these policy guidelines and policy papers is that they do not provide indications on the contextual factors that ensure the success of the introduction of the listed policy measures. Hence, with the lack of similar conditions on the level of resources (research, human, network capital), of institutions and of history, this tendency to replicate policy measures and approaches of models that work elsewhere incites to copy policy measures that are not adapted to the situations and needs of the imitators.

In practice, however, differences in contexts (history, institutions, values, R&D intensity,...) make replication of successful models difficult. Many localized assets are difficult to reproduce in other local contexts. Replication of successful models must be guided by the attributes of the local context of actions and decisions. Practice-based innovation policy-making must be based on history and take into account factors linked to path dependency. Practice-based innovation policy-makers should remember that history is more than the end point of evolution in the matter of innovation performances. Hence, instead of replicating the end point (for instance, supporting the construction of new buildings, new R&D research institutes,...), they should pay attention to the take-off process, to the history of the take-off process that was instrumental in generating successful models of innovation. Such a perspective would induce them to develop customized solutions rather than replicating models likely to fail, due to their lack of replicability in different contexts.

## Summary and conclusion

This paper discusses the dilemmas that emerge when policy-makers are equally attracted to promoting concepts that are not based on evidence and to developing innovation policies that are evidence-based. It addresses eight dilemmas of innovation policies by discussing the following questions: What is the capacity of theories and new policy concepts linked to innovation to provide useful policy prescriptions to foster innovation? To what extent are these theories and new policy concepts supported by solid evidence? The paper is

based on a review of concepts and buzz words linked to innovation, and the types of data and diagnostics used by policy-makers to develop new national and regional innovation policies. The paper defines policy issues in terms of dilemmas, it provides concrete examples, and it discusses how policy-makers could resolve the tensions between equally attractive policy alternatives.

The discussion of practice-based innovation policy-making was organized around nine policy dilemmas: 1) Theory vs practice-based innovation; 2) The magic ingredient concept vs the multiple ingredients practice; 3) Open vs closed innovation; 4) Inward vs outward view of innovation; 5) Innovations that are first on the world market vs incremental innovations; 6) Policy imitation vs customized solutions.

The results of this paper contribute to show that many policy concepts that appear attractive are not supported by robust evidence. Hence, the results of this paper show that turning policy concepts into evidence-based policy is difficult. The professionals of innovation are very often submitted to tensions where they have to choose between equally attractive but opposite alternative innovation policy measures. The results of this paper show that policy ideas that appear to provide new policy prescriptions have to be confronted to evidence and diagnostics that take into account the diversity of the situations and needs of firms, industries and regions.

There are questions about the future of practice-based innovation policy-making. Contrary to what has happened in health policies, drug policies and medical professions, there has not been an institutionalization of an evidence-based approach in the field of innovation policy-making. As a consequence, there are as yet no organizations which provide leadership and guidance that promote the evidence-based approach in the field of innovation policies. The science and technology councils that exist or existed in many countries were expected to play such a role, but we assume that a lack of appropriate resources prevented them from playing such a role.

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