

The “FoMoFo” Project and “Technology Foresight at Lecco”: Some Cases of Regional Foresight

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Abstract

It is well recognised that innovation is a systemic process, which involves quite a number of actors with different capabilities, competencies and goals, operating at different levels: national, regional, local.

In particular, the local level is receiving a growing attention, due the fact that, on one hand, innovations tend to be concentrated in localized production systems (clusters) and, on the other hand, they tend to be specialised according the features of the local systems. Many studies have pointed out that in a local system innovation is the output of exchange of formalised and not-formalised knowledge among various actors, which interact and cooperate on the basis of mutual trust and acceptance of shared values. These actors are basically firms, universities and public and private research centres, banks, trade associations, governmental bodies.

Up to now in the scientific literature there is a substantial lack of analysis of Foresight in the context of industrial clusters. This paper aims at filling this gap by describing our recent Foresight exercises in the metalmechanic district of Lecco and by illustrating how Foresight can be a valuable tool for bringing in and developing new (technical) knowledge in an industrial cluster.

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1. Introduction

This paper focuses on the role that Foresight may play in order to foster the innovation capability at a regional level, with reference to the peculiar case of industrial clusters.

“Foresight” is now widely used to refer to a wide range of approaches and methodologies which aim at improving future-oriented decision-making, by the early detection and assessment of emerging trends and drivers of change (Martin, 1995; Technological Futures Analysis Working Group, 2004; Georghoiu, 2001). Foresight has become quite popular in the scientific literature and among policy and strategy decision makers, and many projects and exercises have been carried out both in the public sector, at national (Grupp and Linstone, 1999; Gavigan and Scapolo, 1999) and regional level (Roveda, Vecchiato and Vercesi, 2004; Roveda et al., 2007), and in the private sector (Schwartz, 1991; Ruff, 2004; Roveda and Vecchiato, 2006).

On one hand, the impact and role of industrial clusters for the global competitiveness of a whole national socio-economic system is well recognized (Porter, 1990; Pyke et al., 1990). On the other hand, up to now in the scientific literature there is a substantial lack of analysis of Foresight in the context of industrial clusters: the distinctive features of this specific business environment raise the need of a careful selection and tailoring of the foresight methodologies and processes if its outputs have to bring remarkable benefits to local firms.

This paper is structured as follows: firstly, on the basis of both scientific literature and our field experiences in some industrial districts of Italy, we examine how innovation, mostly technology driven, takes place in industrial clusters. Secondly, we illustrate how, given these distinctive features, Foresight can be a valuable tool for bringing and developing new (technical) knowledge in an industrial cluster. The analysis is based on the Foresight projects we carried out in the metal working and machinery district of Lecco, i.e.:

- the “FoMoFo” Project, 2004: it was sponsored and financed by the European Commission, it made use of the methods of Critical technology list and Interactive workshops and it involved both districts;
- the “Technology Foresight at Lecco” Project, 2005; it was sponsored and financed by the Regional Government of Lombardy, it made use of the methodology of Scenarios and it involved the metal working and machinery district of Lecco only.

2. Innovation in industrial clusters

The economic macro-fabric of an industrial cluster, namely its fragmentation in a large number of firms is, on one hand, the essential condition for the continuous enrichment and evolution of the knowledge underlying the *current* technologies of the district; on the other hand, it turns out to be the hardest obstacle to the diffusion and adoption of *new* technologies. The natural and systemic adaptive capability which works so well in relation to the *incremental* evolution of its *past and present* knowledge basis, struggles to grasp breakthroughs and paradigmatic shifts of emerging technologies and to generate and to make use of the different technical knowledge and skills required for radical product and process innovation. As in a cluster there is a uniform technological know-how, this sort of shared culture reinforces traditional patterns of behaviour and creates rigidities and inertia that may prevent the transfer and development of completely new technologies which can make obsolete and inadequate the existing and widespread pool of talents, information, infrastructures (Porter, 1998; Geels, 2005). More than this, in order a new technology to take off in an industrial cluster, it is not enough that a critical mass of the interconnected firms at the core of the district gets aware of the benefits the technology may bring in terms of cost savings or product differentiation. What it really matters, it is the need to convince these firms that the new technology will not force them to give up the position they have in the local socio-economic system and to which they are used to; what it really matters, is to convince these firms of the possibility of fully grasping the new technology, and therefore of shaping it, so being able to still play a relevant role in the continuous knowledge creation process, which underlies the future evolution of the technology. In particular, in order to be successfully transferred into an industrial cluster, it is required that the knowledge generated outside it is, at least partially, translated into some sort of a “local language”. Every district devotes to its products and processes not only its technical and organizational skills, but also its history, culture, social values: definitely, a combination of resources and circumstances that, all together, are something of unique and completely different

from the one of any other place. Therefore, if external scientific and technological experts want to give an effective contribution to local firms, they must be able to become themselves a part of the district, by speaking an understandable language and adapting their approach to problem setting and solving and to the usual way of thinking and doing of local entrepreneurs.

The criticalities and limits which concern the long term competitiveness and wealth of an industrial cluster, may be better understood through the comparison with the large Japanese corporations, that Nonaka and Takeuchi propose as a paradigm of the “knowledge creating company” (Nonaka and Takeuchi, 1995). In Japanese corporations one of the fundamental principles of organizational design and of the key drivers of the knowledge creating process, is the “redundancy”, namely the conscious overlapping of information, resources and business activities within the company. “Redundancy” plays a key role since it encourages dialogue and communication, and therefore the development and transfer of knowledge. In an industrial cluster “redundancy” is naturally built in case of the incremental development of the technologies that are already available in the cluster. However, the small size of most firms is an obstacle to the transfer of new technologies from outside into the district and to the development of radical innovations. The small amount of available resources (financial, managerial, human) forces these firms to focus on day by day operations: the entrepreneur himself is usually a factotum, who makes all relevant decisions and is involved in all the activities, from the strategic to the operational ones. That’s the reason why the firms of a district struggle to monitor and to acquire the emerging technical and scientific know-how which is generated outside the district, mostly through formal occasions when they can meet and think about the enabling factors behind the success (or the failure) in the adoption of a new technology.

Nonaka and Takeuchi identify another key enabling feature of the knowledge creating company in the interactions among “senior managers”, “middle managers” and “frontline employees”. Each of them can and must bring their own very specialized, but synergistic contribution. Frontline employees are responsible of daily operations: they control today’s technologies, products, markets. On the other hand, as being deeply involved in current operations, they haven’t enough time to translate the information they own into knowledge that can be used by the organization. On the opposite side, “senior managers”, who sit at the top of the organizational structure, design the future of the company and express its mission by means of metaphors and strategic guidelines, which steer the activities of their employees. As Nonaka and Takeuchi point out, if the task of frontline employees is to generate the knowledge of “what the firm is”, the task of senior managers is to define “what the firm should be” and the path to follow towards it. “Middle managers” are the link between the vision of senior managers and the reality of operators, i.e. between the future and the present of the firm. They achieve this result by developing new products and searching for new markets.

These roles, that Nonaka and Takeuchi identify in their “knowledge generating company” can be found, at a meta-firm level, in an industrial district. Small entrepreneurs play the same role as front line employees; senior managers can be identified in the main stakeholders of the district: government, trade associations, universities and research centres, technology transfer organizations, banks. Leading entrepreneurs, namely the managers of the largest and most innovative companies of the district, play the role of middle managers, serving as a bridge between the policies of the stakeholders and the daily activities of small entrepreneurs, by means of the influence they have on the firms with which they cooperate within the value chain.

This intrinsic pattern of roles and activities works well in the case of incremental development of the common basis of the technologies which are already available in the district. But when discontinuities in the knowledge which is needed for technology innovation happen and this knowledge has either to be acquired from outside or to be developed within the district, this harmonic synergy and integration of roles and activities fails to take place adequately: the many district stakeholders and firms find difficult to share visions, strategies and actions and to work together in order to select common research priorities, on which to concentrate and to optimize their efforts.

3. Foresight in industrial clusters: our experience in some Lombardy districts

The features of industrial clusters, namely the intrinsic strengths, but also the limitations, in the capacity of developing and disseminating innovative knowledge, pose some relevant implications for designing and carrying out Foresight.

In the following we describe the Foresight exercises we carried out in the district of Lecco. These exercises focussed on the main challenges coming from the new competitors in the global markets, mainly from Asian countries, so they looked at the possible role of new technologies for keeping the districts competitive, by:

- transferring existing technologies from other sectors;
- developing radical innovations, that is completely new advanced technologies.

3.1 *The industrial districts of Lombardy*

In the industrial structure of Lombardy there are twenty-one clusters; altogether, they account for a population of almost three million inhabitants, against more than nine millions of inhabitants of Lombardy.

These clusters are all specialised in traditional (or mature technology) sectors, such as furniture, shoes, textiles, clothing, pottery, etc. , and they share the same factors of competitiveness: efficiency, productivity, flexibility, product customization and differentiation, quick response. However, competitors from newly industrialised countries, mostly in Asia (Korea and China) proved to be able to imitate quickly and accurately the traditional products made in Lecco, at least for the low and medium quality segments of the market, so undermining their international competitiveness and eroding partially their share of the global market. Hence there came the need for the firms of this district of substantially fostering product differentiation, through the enlargement (by acquiring new technologies) and the renewal (by developing new technologies) of their traditional technical skills and assets. However this need was not felt by most firms of this district and, more than this, it was not clearly understood which new technologies had to be adopted, how they should be developed or acquired and with whom to cooperate to this aim. The foresight exercises helped to provide an answer to these questions and to overcome the widespread uncertainties about the future of the districts and to set up some guidelines for action.

3.2 *Bringing new technologies into an industrial cluster: the FoMoFo project*

The FoMoFo (Four Motors Foresight) project was carried out in the metal product and machinery district of Lecco (Roveda, Vecchiato and Vercesi, 2004). According to the policy guidelines of the European Commission –DG Research, which sponsored and financed the project, we aimed at exploring the ways of expanding the technological basis of the district, by means of the “lateral” transfer of technologies from other sectors. The technological knowledge was rather new to most local firms, but it had been previously applied in other industrial sectors and business areas with success.

The FoMoFo project was structured in these main steps.

At the beginning we defined for each district, together with several experts from the main universities of Lombardy, first of all Politecnico di Milano, and with representatives of the local Chamber of Commerce and of the trade associations, a preliminary set of technologies likely to make a relevant impact on the structure of the local industry. Following the methodology of the critical technology list (Gavigan et al, 2001), we afterwards defined a set of “criticality/priority” criteria. These criteria took into account features of both the *attractiveness* and *feasibility* of a technology. Attractiveness referred to the capability of a technology to enhance the competitiveness of the district; feasibility referred to the capability of the local system to acquire the technology and to use it in order to develop new industrial applications. The notions of attractiveness and feasibility were translated into both qualitative and quantitative indicators, concerning:

a) Attractiveness

- the potential capability of the technology to give rise to relevant product and process innovations;
- the pervasiveness of the technology;
- the potential capability of the technology to give rise to new firms.

b) Feasibility

- the level of knowledge, regarding the technology, in the academia and public research centres of the area and in the local industrial system;
- the availability in the academia and public research centres of the whole Lombardy of experts and researchers able to transfer the technology to the local firms of the districts.

Afterwards the experts and the representatives of the local Chamber of Commerce and the trade associations were asked to make use of the criteria to assess the technologies. Out of the preliminary list, the following families of technologies were finally selected as critical (both attractive and feasible):

a) in the metal product and machinery district of Lecco:

- Advanced polymers
- Non-ferrous metallic materials
- Mechanical technologies
- ICT for advanced logistics and supply chain e-management and for e-commerce

Afterwards, for each technology a few interactive workshops were organized, with the participation of both technologists and researchers and some local entrepreneurs. The technologists and researchers involved were chosen not only on the basis of their technical competence, but also of their previous experience of cooperation with industrial firms.

Through these workshops technologists and researchers described the new technical knowledge to the entrepreneurs and discussed the benefits these technologies could bring, and the critical factors of success in their adoption. In this way the conditions for starting to collaborate with the entrepreneurs were set up. In fact, after the workshops many contacts between the technologists/researchers and the entrepreneurs were established and, through some cooperative innovation projects, the new technologies could be successfully experimented in the district throughout all the main phases of the knowledge creation process

3.3 Developing radical technologies: Scenarios for the district of Lecco

Interactive workshops and critical technologies list turned out to be quite effective in bringing into the district new technologies developed elsewhere, that are usually at a growing or mature stage of their life cycle. These technologies allow the innovation of products very fast, with a low risk and at a relatively low cost, since the technologies have been already tested and applied successfully in other industrial sectors. On the other hand, the same technologies are available also to foreign competitors, who can, sooner or later, imitate the new products of the district.

In order to achieve a strong and long lasting competitive advantage, it is necessary that the firms of the district develop radically innovative technologies, which are difficult to be imitated. In order to promote and to support this innovation process a second foresight exercise was launched in 2005 for the industrial district of Lecco, with the aim of identifying the emerging technologies that might have a disruptive impact on the local products and manufacturing system and of designing appropriate R&D initiatives.

The methodology used in this exercise was scenarios, with a much wider participation of the district stakeholders from industry, finance, government, trade associations, university and research centres (Gavigan et al., 2001).

In operational terms, this new foresight exercise at Lecco was tackled in the following macro-stages :

Stage I. Operational programming of the exercise (Pre-Foresight)

- a) Identification of the stakeholders to involve
- b) Specification of the crucial factors and processes on which to concentrate the perspective analysis
- c) Selection of the Foresight methodologies to use

- d) Identification of the experts to involve
- e) Collection of basic documentation

Stage II. Performance of the perspective analysis (Main-Foresight)

- f) Building of (alternative) scenarios for the future of business in the Lecco area

Stage III. Formulation of policy lines (Post-Foresight)

- g) Formulation of policy indications for the Lecco Provincial Council on the basis of the alternative scenarios.

First of all, a preliminary systematic analysis was carried out of existing literature on the subject including scientific publications, economic magazines, daily papers, other texts and reports. This made it possible on one hand to create a picture of the current structure of the manufacturing industry in the Lecco area and its level of internationalisation. Secondly, it was possible to identify an initial group of drivers capable of influencing, at least potentially, the process of internationalisation of manufacturing SMEs in the province of Lecco, in terms of geographical outlets, goals pursued, and means and forms of realisation. We must point out here that these macro-factors depend to a certain extent on the actions of public and private parties, and on the socio-economic system in Lecco, while in other ways they are the result of decisions and actions taken outside the province, at a national, European and international level.

The preliminary list of drivers was discussed at an interactive workshop with the experts, and it was supplemented and modified on the basis of their suggestions.

In this way, the workshop led to the identification of a bundle of factors (drivers), which are considered relevant in determining the evolution of the manufacturing industry in the province of Lecco, with a particular focus to its internationalisation and a specific attention to SMEs. Afterwards, such drivers have been aggregated in clusters, with reference to the macro-areas described above.

The drivers on which the scenarios for the internationalisation of the SMEs in the Lecco area were based, were identified by their relevance and uncertainty, in the sense that they are both highly relevant and uncertain.

The following were selected as basic drivers:

- The industrial system of the Lecco area, in relation to its composition and the share of Large enterprises and of emerging sectors
- The infrastructure system, in relation in particular to road and railways, linking the local area with the other Italian regions and foreign Countries

By combining the extreme configurations outlined for these basic drivers, we obtain four scenarios for the socio-economic system of the province of Lecco, within which it is possible to define articulated, consistent pictures of the other drivers for the macro-areas of Science & Technology, the Structure of the industrial system in Lecco, Individual and social values, Population and the labour market, and therefore to identify the main characteristics of the internationalisation of manufacturing SMEs in the Lecco area.

Afterwards, the various aspects of the development of the industrial system of Lecco SMEs in the scenarios were outlined, considering in particular its competitiveness at an international level. As an example, we give a brief description of the results achieved for the first scenario, under the hypothesis of the high development of the local infrastructure system and the persistence of the current composition of the local industrial system, largely based on SMEs in traditional sectors.

In the area of Lecco, the coordination of local authorities takes the shape of effective support to businesses accessing international European and non-European markets, in terms of economic diplomacy, development of infrastructural transport and communications networks (in cooperation

with the national and European government and in the context of the construction of the trans-European networks), support to innovation and R&D, and protection of Italian products. Territorial marketing and effective promotion of the “Italy System” lay the bases for greater visibility and greater acceptance of Italian products in high tech sectors.

However, in many cases, these market opportunities and support policies are not grasped or suitably exploited by Lecco businesses (at least not in the short term) to expand on the international market. Exploiting these opportunities means expanding their direct presence in outlet markets, with a local presence and direct control of the final activities in the value chain, in other words, distribution and service to customers in the pre-sale, sale and after-sale stages. For example, in the field of instrumental goods and in “business to business” sectors generally, the direct control of the end markets sustains both assistance during the design stage and therefore the customisation of products, and the delivery of after-sales service. An alternative to opening company sales branches could be to integrate with foreign businesses. First of all, this would require the identification of reliable partners, capable of offering a suitable level of service to maintain the integrity of the offer, particularly in the higher market brackets. However, this often implies forgoing high profit margins, and in the absence of direct relations with the end customer, the Lecco-based company risks losing expertise in terms of the capacity to grasp the customer’s requirements and to customise the offer, as well as possible integration upstream by foreign partners, which could emerge as new competitors.

Therefore the companies that successfully achieve dimensional growth and complementary integration in a network organisation, create the conditions necessary to pursue international strategies that are more sensible and more sustainable in the long term, repositioning themselves strategically in higher market brackets, and differentiating their offer from the low quality, low cost output of competitors in newly industrialised countries, and China in particular. To this end, the modernisation of the info-telematic and transport infrastructure within the territory of the province, and the creation of large trans-European networks paves the way for more effective, efficient coordination of the various business activities, particularly logistics and distribution.

However, few small businesses in the Lecco area pursue such strategies of internationalisation, particularly if they are not part of a network organisation, because they are severely hindered by their short-term approach, the lack of resources available to take advantage of new market branches and the limited control of the distribution channels. Internationalisation initiatives of these businesses are of limited significance, because of the numbers involved and the nature of the strategies adopted, with a sporadic, fluctuating approach. These initiatives are directed above all at the option of relocating activities with the greatest environmental impact and/or the largest manpower requirements to Eastern Europe or Asia, in order to reduce the cost of manufacturing factors and processes, producing goods in these countries that are then resold in the traditional markets.

But containing the cost of manufacturing factors, although fundamental for the medium-high market brackets, is not sufficient on its own to overcome the fierce competition of international competitors, particularly those in emerging countries, which enjoy unequalled advantages in terms of cost. So companies that focus only on reducing costs will come across huge difficulties, all the more so in the case of standardised products that are therefore easily imitated and replaced.

Companies which, on

the other hand, forgo opportunities for growth and expansion on the international market, but implement more advanced strategies to upgrade and innovate their products, still manage to defend and consolidate their position and to maintain their share of the traditional markets. Customer loyalty is also made possible by the spread and application of ICT, which is all the more important for companies that do not have branches outside their territory of origin and are not therefore able to operate in direct contact with their foreign customers.

The scenario based on the hypothesis of the high prevalence of small and medium enterprises operating in traditional sectors and the lack of development of road and railways infrastructure represents an extremism of current situation; vice versa, the scenario based on the hypothesis of deep restructuring of the Lecco industrial system, in terms of both composition of businesses and basic sectors, can be considered the best context in which it can evolve in the long run.

On this regard, instead of outlining for each of these scenarios the most effective policies and strategies for the main local stakeholders, we considered more useful to determine what are the strategies and plans these stakeholders have to pursue to avoid declining in the first extreme scenario, thus in order to move near the other one, instead.

Therefore, this basic policy was designed, and presented and spread within the main local stakeholders as the main output of the project.

4. Concluding remarks

The cases presented here, even if very few, show that Foresight may be a valuable tool for promoting innovation in an industrial district, as it supports the development and the dissemination of new technologies among the local firms through all the different steps of socialization, articulation, combination, internalization of both tacit and explicit knowledge.

Different methodologies can be used: rather simple and flexible methods, like list of critical technologies, are suited to transfer technologies that have been already applied in other sectors, and are in the intermediate stages of the life cycle. These methods can bring positive benefits even in the short term.

If radically innovative technologies are concerned, other methodologies like scenarios are to be used. These methodologies are definitely more complex, expansive and time consuming, since they require the wide participation and the active role of many stakeholders. Anyway these methodologies allow an organic and comprehensive investigation of the long term evolution of the economic, social and cultural structure of a district in the global competitive arena.

Whatever the objective to be pursued and the methodology to be used, two essential conditions must be fulfilled. First of all, a large number of firms should be involved, so reaching the critical mass needed for the new technology to take off in the industrial fabric of the cluster. Secondly, entrepreneurs must be enabled to master the new technology, and therefore to give their own contribution to its further development. This requires a follow-up of the foresight exercise, which must not end with the delivery of formal outputs (list of critical technologies; scenarios): what it matters most is the collaboration to be established afterwards between entrepreneurs and knowledge providers.

In this way, foresight can really be an effective tool for achieving in a district the organizational practice of “redundancy” and the dynamic cooperation between “senior managers”, “middle managers” and “frontline employees” of Nonaka and Takeuchi’s “knowledge creating company”. On one hand, the interactive workshops were the formal occasions when entrepreneurs could meet and share their experience of the use of new technologies, and the cases of success and failure: the factors behind these cases were analysed and the experts provided suggestions on how mistakes could be avoided.

On the other hand, building the scenarios allowed the district stakeholders, leading firms and small entrepreneurs to align their strategies and action plans towards a shared path of evolution. When small entrepreneurs pointed out the difficulties and problems they were facing in their daily business, they painted a picture of “what the district is”. When the representatives of local governments, trade associations, universities, research centers and technology transfer organizations expressed their views about the future of the districts, they articulated “what the district ought to be”. Leading firms, through their R&D activities and industrial exploitation of new technologies, mediated between the vision of the stakeholders and the current concerns of the small entrepreneurs.

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