c.MET 05

Centro Interuniversitario di Economia Applicata alle Politiche per l'Industria lo Sviluppo Locale e l'Internazionalizzazione

• Università degli Studi di Ferrara
• Università degli Studi di Firenze
• Università Politecnica delle Marche
• Università di Napoli - L'Orientale

c.MET Working papers

ISSN: 2281-5023

OPEN INNOVATION PRACTICES: MEASURING, ECONOMIC PERFORMANCE, AND INDUSTRIAL POLICY ISSUES. AN ANALYSIS OF THE ITALIAN MANUFACTURING SYSTEM.

Mattia TASSINARI Marco R. DI TOMMASO

ABSTRACT

The economic crisis has shown the weakness of some Italian industries, calling for an effective policy response for promoting innovation of the national system. In this context, the ability to evaluate the presence of cooperative forms of innovation and of open innovation practices becomes extremely important in order to define efficient and effective industrial policy strategies. The purpose of this paper is to assess the different degree of openness of innovation processes in Italian manufacturing industries, in order to get useful information for industrial policy decisions. The analysis is conducted through the construction of two different composite indicators. The first, the Open Innovation Index (OII), provides a ranking of the Italian manufacturing industries on the basis of the different degree of openness of innovation processes of enterprises. The second, the Economic Performance Index (EPI), aims to classify manufacturing industries considering the sectoral performance in term of innovative capacity, productivity and ability to promote economic growth. Some policy implications are derived from the comparison between the two rankings.

Keywords: Open Innovation, Industrial Policy, Manufacturing, Composite Indicator.

JEL Classifications: O32; L14

Mattia Tassinari
University of Ferrara, Italy
mattia.tassinari@unife.it

Marco R. Di Tommaso
University of Ferrara, Italy
ditommaso@economia.unife.it

c.MET Working paper 06/2014
December 2014

1 - Introduction

The economic crisis has put *innovation* at the center of the debate for boosting competitiveness of Italian industry. The difficulty of Italian enterprises to innovate is one of the main factors that exposes the Italian economy to an increasing competition with emerging economies, particularly in the traditional industries characterized by low value added (Hall *et al*., 2009; Gambardella, 2009; Bugamelli *et al*., 2014).

As argued by several authors, this framework raises the need to promote national industrial policy measures able to encourage structural changes and radical reorganizations of the production system (Onida, 2013; Viesti, 2013; Cersosimo and Viesti, 2013; CSC, 2014; Cappellin, 2014), with special attention to innovation in manufacturing industries (Tregenna, 2009, 2014; Chang *et al*., 2013; Andreoni and Scazzieri, 2014).[1] Clearly, the choice of policy tools that effectively promote science and technology in the economy has to take into account the peculiarities of the productive system. In particular, given the scarcity of resources available for R&D activities and the small size of Italian enterprises, evaluating the presence of cooperative forms of innovation and *open innovation* practices becomes extremely important in order to define efficient and effective industrial policy strategies (Breschi and Malerba, 2005; Cappellin, 2014).

Open innovation is based on the systemic nature of innovation. New products or processes are created through the ability of enterprises to establish cooperation agreements, share intellectual property rights, and participate in complex networks of relationships between different agents involved in production and use of *knowledge*, such as customers, suppliers, competitors, private research centers, and universities (Chesbrough, 2003).

Nevertheless, the adoption of open innovation practices, as it is shown below, is strongly influenced by several factors (Chesbrough, 2003, 2006) and the degree of "openness" varies considerably on the basis of the industries taken into account (Breschi and Malerba, 2005; Laursen and Salter, 2006). This heterogeneity has important implication for the implementation of national and regional industrial policy strategies. In fact, policy tools to effectively promote innovation could be significantly different if the productive context is "open" and the *knowledge* can circulate, rather than "closed".[2]

---

[1] In recent years there has been a general "resurgence" of industrial policy (Aghion *et al*., 2011; Wade, 2012; Chang *et al*., 2013; Ninni, 2013; O'Sullivan *et al*., 2013; Stiglitz and Lin, 2013; Warwick, 2013). At the international level interventions in supporting to specific industries or sectors, public procurement practices, bail-out, and general industrial policy measures have been implemented to respond to the crisis (Bianchi *et al*., 2011; Andreoni and Scazzieri, 2014; Di Tommaso and Schweitzer, 2013; Tassinari, 2014; Di Tommaso and Tassinari, 2014).

[2] Considering, for example, *Research and Innovation Strategies for Smart Specialization* (RIS 3), launched by the European Commission within the *Europe 2020*, the smart specialization strategies are implemented through the promotion of "enabling" scientific and technological specializations (*smart* specializations) able to improve competitiveness across different traditional industries. In productive contexts characterized by a lack of ability to share information and knowledge

The purpose of this paper is to evaluate the different degree of openness of innovation processes in Italian manufacturing industries, in order to get useful information for industrial policy decisions. On the one hand, the work aims to identify the industries with the best opportunity to absorb new knowledge by the system, thanks to their high degree of "openness". On the other hand, the analysis aims to identify the sectors that are more "closed", for which public policies that stimulate collaborative activities, in order to share technology and know-how already existing in the system, could be particularly promising to foster the development of new products and new processes.

At the methodological level, the analysis is conducted through the construction of two different composite indicators. The first, the *Open Innovation Index* (OII), provides a ranking of the Italian manufacturing industries on the basis of the different degree of openness of innovation processes of enterprises. The second, the *Economic Performance Index* (EPI), aims to classify manufacturing industries considering the sectoral performance in term of innovative capacity, productivity and ability to promote economic growth.

The remainder of the paper is organized as follows. The next section briefly describes the literature on *open innovation*. In Section 3 the two composite indicators are developed and, in Section 4, they are employed to analyze the Italian manufacturing system. Section 5 presents some concluding remarks.

2 – Open Innovation

Innovation - as introduction of new or significantly improved products, or processes, or methods of marketing or of organization (OECD, 2005) - is traditionally interpreted as the result of a closed business process, in which the company invests in internal R&D with the aim to independently develop new ideas useful to compete in the markets.

However a different economic literature, going beyond this model, shows how innovation processes can be explained by analyzing the external environment where the organizations operate and interact among each other. The external environment plays a vital role in the contemporary innovative dynamics. On the one hand the changes that occur in the competitive environment, and the globalization processes of the recent decades, force the companies to continually adapt to the external environment, making the ability to innovate and acquire *knowledge* a central element of the enterprises competitiveness (see, for example, Malerba, 2002; Bianchi and Labory, 2006; Spender, 2012). Thus,

---

that are necessary for innovation, the diffusion of enabling technologies could require a more intense policy effort. On "smart specialization strategies" see "Guide to Research and Innovation Strategies for Smart Specialization (RIS 3)" on https://www.researchitaly.it/uploads/4692/RIS3%20Guide%20March%202012final_0204.pdf?v=048101c (last accessed December 2014)

innovation constantly accompanies the evolution of contemporary enterprises.[3] On the other hand, the speed with which technological progress takes place today, the brevity of the products life cycle, and the increasing technical complexity of the goods, make research and development more risky.

In this framework the ability of companies to exchange information and absorb *knowledge* from outside, rather than the single amount of R&D conducted within the enterprise, has become increasingly important. Innovation is increasingly becoming a *systemic* process, which engages a complex network of relationships between the agents involved in the production and use of knowledge, such as, for example, customers, suppliers, competitors, private research centers, and universities. *Knowledge* is seen as created and used within a *national system of innovation*,[4] where relations between the different actors of the economic system lead technological progress and innovation.

The concept of *open innovation*, introduced by Chesbrough (2003), is based on the ability of enterprises to participate in the network of relationships that composes the system of creation and use of knowledge, increasing and exploiting the capacity of the system to produce innovation. In this way costs, risks and benefits of innovative activities are distributed among different economic actors, through the enterprises' *absorptive capacity* of new specific and cross-cutting technologies (Cohen and Levinthal, 1990; Gambardella, 2009).

In order to absorb from outside know-how and knowledge useful to innovative activity, the ability of enterprises to create linkages, cooperation agreements and relationships with external partners is crucial. In this context, the resources within the enterprise are not the unique source of innovation; the knowledge is also acquired from external organizations. In addition to the technologies that can be acquired or created in collaboration with competitors, customers or suppliers, a central role in the system's ability to innovate can be played by research centers or universities (e.g. through the creation of spin-offs).

In a context of *open innovation*, the different forms of collaboration between the actors of the economic system, may allow the exploitation of new ways for the development of new technology (through, for example, the creation of new organizations), and for the acquisition of knowledge from external environment (Chesbrough, 2006). The organizations that operate in the system can expand learning opportunities, share the risks to invest in innovation, and achieve economies of scale in the development of an innovative product (Powell *et al*., 1999; DeBresson and Amesse, 1991).

A central theme in this area is the defense of *intellectual property*, as a mechanism that allows to create new knowledge and, at the same time, to exploit benefits of its circulation. Therefore, the *intellectual property rights* can be an important tool in an open context, to capture the value produced by innovative activities and to create platforms that make possible the exchange of knowledge through,

[3] The economic literature on these topics starts from the contributions of Schumpeter (1911, 1942), until the more recent *evolutionary theory*. See Nelson and Winter (1982), Dosi (1988), Magnusson (1994), Dosi and Malerba (1996).
[4] About the model of the *National System of Innovation*, see Lundvall (1992), Nelson (1993), Freeman (1995), Metcalfe (1995).

for example, licensing, purchase of patents, or the creation of strategic alliances (Teece, 2007; Sandulli and Chesbrough, 2009).

However, the development of open innovation practices is strongly influenced by several factors, such as the availability and the level of turnover among enterprises of skilled workers, the amount of investment in research specifically aimed at the commercialization of the results, the presence of services for the commercialization of knowledge produced by the enterprises, and the presence of companies with business models able to absorb knowledge from external environment (Chesbrough, 2003, 2006).

Consequently, the degree of openness of innovation processes varies considerably on the basis of the economic systems and of the industries taken into account. Cooperation seems to grow more in those industries where the need for companies to innovate is structural and technological progress is faster (Laursen and Salter, 2006).

In the following pages an analysis for evaluating the degree of openness in innovation processes in the different Italian manufacturing industries is proposed.

3 – Composite indicators for measuring *open innovation* and economic performance of manufacturing industries.

The construction of a composite indicator is useful when it is necessary to study a complex phenomenon, in order to "synthesize" the information provided by different variables in a single value. Thus, composite indicators are used, for example, to inform policy-makers, investors or citizens on trends and changes in countries' performance over time (in terms of market opening, development, security, education, health, human rights, environment, corruption, etc.) (OECD, 2008).

Innovation and processes that generate it are complex phenomena, depending on many factors and difficult to measure. Several indicators have been constructed to evaluate the innovation performance of countries.[5] In this section two different composite indicators are developed in order to classify 13 Italian manufacturing industries on the basis of (a) the degree of openness of innovation processes of enterprises, (b) the economic performance in term of innovative capacity, productivity and ability to promote economic growth.

The first indicator, the *Open Innovation Index* (OII), is composed by 5 variables, specified as follows.

[5] General guidelines for measuring innovation are provided in the Frascati Manual and in the OSLO Manual. See OECD (2002, 2005). The most common performance indicators of innovation at the international level are the *National Innovation Index*, the *Global Innovation Index*, and, at European level, the *Innovation Union Scoreboard* (IUS).

1. *Enterprises with innovations developed through collaborations, as percentage of the total number of enterprises (2010-2012)*: it is the percentage value of the enterprises of the industry that have successfully introduced at least one product or process innovation developed through collaborations with other organizations in the three years 2010-2012.

2. *Expenditure for acquisition of R&D services (R&D extramural), as percentage of total R&D expenditure (2012)*: it is the percentage value of R&D of the industry commissioned to other companies (also in the same group) or other research institutions (public or private) in 2012.

3. *Enterprises with cooperation agreements for innovation, as a percentage of enterprises with product or process innovative activities (2010-2012)*: it is the percentage value of the enterprises of the industry with formal cooperation agreements for innovation in the three years 2010-2012 (in relation to the total number of enterprises that have performed activities oriented to introduce product or process innovations).

4. *Enterprises with cooperation agreements for innovation with competitors, as a percentage of the number of enterprises with product or process innovative activities (2010-2012)*: it is the percentage value of the enterprises of the industry with formal cooperation agreements for innovation *with competitors* in the three years 2010-2012 (in relation to the total number of enterprises that have performed activities oriented to introduce product or process innovations).

5. *Enterprises with cooperation agreements for innovation abroad, as a percentage of enterprises with product or process innovative activities (2010-2012)*: it is the percentage value of the enterprises of the industry with formal cooperation agreements for innovation *with foreign organizations* in the three years 2010-2012 (in relation to the total number of enterprises that have performed activities oriented to introduce product or process innovations).

The second indicator, the *Economic Performance Index* (EPI), aims to classify manufacturing industries considering the sectoral performance in term of innovative capacity, productivity and ability to promote economic growth. As the previous, also this index is composed by 5 variables:

1. *Enterprises with product or process innovations, as percentage of the total number of enterprises (2010-2012)*: it is the percentage value of the enterprises of the industry that have successfully introduced at least one product or process innovation in the three years 2010-2012.

2. *Growth rate VA (2012-2009)*: it is the growth rate of sector value added (VA) from 2009 to 2012. It describes how the total VA of the sector has evolved over time.

3. *Growth rate VA/Employment (2012-2009)*: it is the growth rate of sector *productivity of labor* from 2009 to 2012. It shows how the intrinsic capacities of a sector to produce economic wealth, regardless of the total volume of sector production, is varied.

4. *Growth rate wages and salaries/Employees (2012-2009)*: it is the growth rate of the sector wages per employee from 2009 to 2012.

5. *Employment/Total manufacturing employment (2012)*: it is the sector employment as percentage of the total manufacturing employment in 2012. This variable aims to consider the weight of the industry in total manufacturing.

Considering both the proposed indicators - OII and EPI - the application to the Italian case allows a comparison between the industries with the highest degree of *open innovation* and those who have achieved the best economic performance.

Once chosen the variables that compose the two indexes, the method for calculating a composite indicator is divided in two steps: 1) transformation of the original variables (in order to allow comparability between them); 2) combination of variables to obtain a synthetic measure of the phenomenon that is object of interest.[6]

In the first step, each of the original variables is normalized in the interval (0,1) so that a transformed value tending to 1 is assigned to the best of the sectors, and the worst of them corresponds to a transformed value tending to 0. For all other sectors the transformed value is a number between 0 and 1.

Formally, indicating with X_{jk} the value of the k-th variable for the sector j, with Y_{jk} the corresponding normalized value, and $T_k(\square)$ the function for normalizing the k-th variable:

$$Y_{jk} = T_k(X_{jk}) = \frac{X_{jk} - min(X_{1k}, \dots, X_{Jk}) + \frac{1}{J}}{max(X_{1k}, \dots, X_{Jk}) - min(X_{1k}, \dots, X_{Jk}) + \frac{2}{J}}$$

where $\frac{1}{J}$ and $\frac{2}{J}$, respectively added to the numerator and to the denominator, allow to obtain normalized values strictly included between *0* and *1*, to avoid infinite values or impossible forms of indeterminacy in the aggregation phase.

[6] For further details on methodological aspects related to composite indicators see, for example, Arboretti *et al*. (2007), Bonnini *et al.* (2009), Marozzi (2009), Fayers e Hand (2012).

In the second step, the normalized variables are aggregated by applying an appropriate combination function. This phase implies the choice of the combination function and the weight to assign to each variable, in order to incorporate their different degree of importance in the indicator.

In this case, for both indicators, the variables have the same weight and are combined by applying the *Fisher* function[7], obtaining for each sector *j* the values (1) of the OII and (2) of the EPI:

1. $OII_j = -\sum_{k=1}^{K} w_k \ \ln(1 - Y_{jk})$

2. $EPI_j = -\sum_{k=1}^{K} w_k \ \ln(1 - Y_{jk})$

where, separately for each of the two indicators, K is equal to 5 (number of variables); Y_{jk} is the normalized value of the *k*-th variable for the *j*-th sector; and W_k is the weight given to the *k*-th variable.

The final values of the two indicators are normalized in the interval *(0,1)*: industries with values of the OII and of the EPI tending to *1* have respectively a high degree of *openness* in innovation and a high *economic performance*, while those with values tending to *0* have low *openness* and low *economic performance*.

4 – Application to Italian manufacturing industries.

This section presents the results obtained by calculating the *Open Innovation Index* (OII) and the *Economic Performance Index* (EPI) in the case of Italian manufacturing.

The analysis has been conducted processing data provided by *Istat*.[8]

The indicators are calculated for 13 manufacturing sectors of the Italian economy, in order to rank the productive activities on the basis of the degree of openness in innovation processes and of the economic performance achieved.

Table 1 shows the results, where position 1 corresponds to the industry with the highest degree of openness and economic performance.

Table 1. Ranking *OII* and *EPI* related to the Italian manufacturing industries.

Ranking *OII*		**Ranking *EPI***	
1. Basic pharmaceutical products and	0,98	1. Computer, electronic and optical products	0,96

[7] On properties of Fisher function see Arboretti *et al*. (2007), Bonnini *et al.* (2009).

[8] The Istat survey on enterprises innovation - coordinated at European level with the Community Innovation Survey (CIS) - collects information on innovation activities of firms with at least 10 employees. The results of the CIS survey are widely used by the European Commission to monitor the level of innovation and competitiveness and for the development of indicators on science and technology used, for example, in the European Innovation Scoreboard. The published data are related to the years 2010-2012, except those on innovation expenditures and output resulting from product innovations that are related only to 2012. See: http://dati.istat.it/

pharmaceutical preparations			
2. Chemical products	0,85	2. Chemical products	0,33
3. Computer, electronic and optical products	0,63	3. Coke and refined petroleum products	0,31
4. Transportation equipment	0,22	4. Machinery and equipment n.e.c	0,30
5. Coke and refined petroleum products	0,18	5. Electrical equipment	0,29
6. Electrical equipment	0,17	6. Basic metals and fabricated metal products, except machinery and equipment	0,26
7. Furniture; other manufacturing; repair and installation of machinery and equipment	0,10	7. Basic pharmaceutical products and pharmaceutical preparations	0,15
8. Machinery and equipment n.e.c	0,09	8. Textiles, wearing apparel and leather products	0,15
9. Rubber and plastic products, and other non-metallic mineral products	0,07	9. Transportation equipment	0,14
10. Textiles, wearing apparel and leather products	0,07	10. Furniture; other manufacturing; repair and installation of machinery and equipment	0,11
11. Basic metals and fabricated metal products, except machinery and equipment	0,05	11. Food products, beverages and tobacco products	0,11
12. Food products, beverages and tobacco products	0,05	12. Rubber and plastic products, and other non-metallic mineral products	0,10
13. Wood and paper products, and printing	0,02	13. Wood and paper products, and printing	0,04

The two rankings provide a synthetic overview of the industries with the highest degree of openness in innovation processes and those that have achieved the best economic performance. In general, industries with higher degree of *openness* tend to achieve better economic performance in terms of innovation, productivity, and ability to promote economic growth. It is the case for example of industries such as *Chemical products*; *Computer, electronic and optical products*; *Coke and refined petroleum products*. On the contrary, a low level of *openness* corresponds usually to a low economic performance, as in the case of *Wood and paper products, and printing*; *Food products, beverages and tobacco products*; *Rubber and plastic products, and other non-metallic mineral products*; *Textiles, wearing apparel and leather products*. In other words, the industries where technological progress is faster, with high technology content, high productivity, and high added value, tend to be most involved in *open innovation* practices, to share knowledge, and absorb technology from the system.

However, the correspondence between industries positions in the two indexes is not always confirmed. A preliminary analysis of the correlation between the values of the OII and the EPI can be performed through the Pearson coefficient of correlation (R). In this case $R=0,41$ reveals a positive correlation between the indexes; however it is not particularly robust and, especially, it does not suggest what is the "independent variable".

This preliminary picture provides some indications about the choice of the industrial policy targets and tools.

In fact, a low degree of cooperation for innovation - especially if it is followed by low productivity and if the enterprises are not operating on "technological frontier" - can reveal an

"unexploited potential" for technological upgrading. For the industries that operate under these conditions, to increase the sharing of technology and know-how already existing in the productive system, could encourage the development of new products or processes.

An industrial policy for stimulating collaborative activities, *open innovation* practices, and exchange of information between organizations - selecting the industries where the "openness" is generally lower - could be a promising way for increasing innovative capacities of the system.

5 – Concluding remarks.

This work has presented an analysis to evaluate the different degree of *openness* of innovation processes in Italian *manufacturing* industries, as important information for effective industrial policy decisions.

After a brief review of the literature on *open innovation*, we have developed two different composite indicators. The first, the *Open Innovation Index* (OII), has provided a ranking of the Italian manufacturing industries on the basis of the different degree of openness of innovation processes of enterprises. The second, the *Economic Performance Index* (EPI), has aimed to classify manufacturing industries considering the sectoral performance in term of innovative capacity, productivity, and ability to promote economic growth.

The application of the composite indicators to the Italian case has highlighted the industries where the innovation process is more *open*, corresponding generally to the industries with the better economic performance.

On the other side, the analysis has identified the industries where the innovative processes are more closed to the external environment.

This latter group of identified industries could be a potential interesting *target* of the industrial policy strategies. In fact, in a condition of scarcity of resources, as that raised by the contemporary crisis, it becomes central to improve the ability of the governments to select and promote activities that maximize the development opportunities. Policies to stimulate *open innovation* practices and collaborative activities in the industries where the "openness" is generally lower, could be promising for increasing the innovative capacities of the system.

References

Aghion P., Boulanger J., Cohen E. (2011), "Rethinking Industrial Policy", *Bruegel Policy Brief*, 4/2011

Andreoni A., Scazzieri R. (2014), "Triggers of Change: Structural Trajectories and Production Dynamics", *Cambridge Journal of Economics*, vol. 38, pp. 1391-1408

Arboretti G. R., Bonnini S., Salmaso L. (2007), "A performance indicator for multivariate data", *Quaderni di Statistica*, vol. 9, pp. 1-29

Bianchi P., Labory S. (2006), *International Handbook on Industrial Policy*, E. Elgar, Cheltenham.

Bianchi P., Labory S. (2011), *Industrial Policies after the Crisis. Seizing the Future*, E. Elgar, Cheltenham.

Bonnini S., Corain L., Cordellina A., Crestana A., Musci R., Salmaso L. (2009), "A Novel Global Performance Score with Application to the Evaluation of New Detergents", pp. 161–179 in Bini M., Monari P., Piccolo D., Salmaso L. (ed.), *Statistical methods for the evaluation of educational services and quality of products*, Contribution to Statistics, Heidelberg, Physica-Verlag

Breschi S., Malerba F. (2005) (ed.), *Clusters, Networks and Innovation*, Oxford University Press

Bugamelli M., Cannari L., Lotti F., Magri S. (2014), "Il gap innovativo del sistema produttivo italiano: Radici e possibili rimedi", in Arrighetti A., Ninni A. (ed.), *La trasformazione 'silenziosa'. Cambiamento strutturale e strategie d'impresa nell'industria italiana*, Dipartimento di Economia Università di Parma, Collana di Economia Industriale e Applicata.

Cappellin R. (2014), "Strategie di crescita e reti di innovazione nel territorio", in Cappellin R., Marelli E., Rullani E., Sterlacchini A. (ed.), *Crescita, investimenti e territorio: il ruolo delle politiche industriali e regionali*, Website "Scienze Regionali", eBook 2014.1.

Cersosimo D., Viesti G. (2013), "Poli tecnologici meridionali, sviluppo e politiche industriali", *Economia e Politica Industriale*, 40(2).

Chang H.-J., Andreoni A., Kuan M. L. (2013), *International Industrial Policy Experiences and the Lessons for the UK*, Center for Business Research, University of Cambridge, Working Paper no. 450

Chesbrough H. W. (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business Press, Boston

Chesbrough H. (2006), *Open Business Models: How to Thrive in the New Innovation Landscape*, Harvard Business Press, Boston

Cohen W. M., Levinthal D. A. (1990), "Absorptive Capacity: A New Perspective on Learning and Innovation", *Administrative Science Quarterly*, Vol. 35, no. 1, pp. 128-152

CSC - Centro Studi Confindustria (2014), *Italia meno competitiva senza politica industriale*, no. 14-5/2014.

DeBresson C., Amesse F. (1991), "Networks of innovators: a reviewed and introduction to the issue", *Research Policy*, 20, pp. 363-379.

Di Tommaso M.R., Schweitzer S.O. (2013), *Industrial Policy in America: Breaking the Taboo*, Edward Elgar Publishers, Cheltenham

Di Tommaso M.R., Tassinari M. (2014), "Governo e Industria negli Stati Uniti. Le «pratiche» del passato e il dibattito sulle politiche del presente", *L'Industria*, 3/2014

Dosi G. (1988), "Sources, Procedures, and Microeconomic Effects of Innovation", *Journal of Economic Literature*, 26(3), pp. 1120-1171.

Dosi G., Malerba F. (1996), *Organization and Strategy in the Evolution of Enterprise*, Macmillan, Londra.

Fayers P.M., Hand D.J. (2002), "Causal variables, composite indicators and measurement scales: an example from quality of life", *Journal of the Royal Statistical Society Series A*, 165, pp. 233-261.

Freeman C. (1995), "The National System of Innovation in Historical Perspective", *Cambridge Journal of Economics*, 19(1), pp. 5-24

Gambardella A. (2009), *Innovazione e Sviluppo: Miti da Sfatare, Realtà da Costruire*, Egea Editore, Milano

Hall B. H., Lotti F., Mairesse J. (2009), "Innovation and productivity in SMEs: empirical evidences for Italy", *Small business Economics*, v.33, 1, pp. 13-33

Laursen K., Salter A. (2006), "Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms", *Strategic Management Journal* Vol. 27(2), pp. 131-150.

Lundvall B. Å. (1992), *National System of Innovation: Towards a Theory of Innovation and Interactive Learing*, Pinter Publishers, London

Magnusson L. (1994), *Evolutionary and Neo-Schumpeterian Approaches to Economics*, Kluwer Academic Publishers, Boston, Dordrecht and London.

Malerba F. (2002), "Sectoral System of Innovation and Production", *Research Policy*, vol. 31, no. 2, pp. 247-264

Marozzi M. (2009), "A composite indicator dimension reduction procedure with application to university student satisfaction", *Statistica Neerlandica*, vol. 63, pp. 258-268

Metcalfe S. (1995), "The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives", in Stoneman P. (ed.), *Handbook of the Economics of Innovation and Technological Change*, Blackwell Publishers, Oxford, pp. 513- 557.

Nelson R. R., Winter S. G. (1982), *An evolutionary theory of economic change*, Belknap press, Cambridge and London

Nelson R. R. (1993), *National Innovation Systems. A Comparative Analysis*, Oxford University Press, New York

Ninni A. (2013), "La Cassa Depositi e Prestiti: il ritorno dello stato-guida (e oltre) in politica industriale", *Economia e Politica Industriale*, 3/2013, pp. 141-155

OECD (2002), *Frascati Manual. Proposed Standard Practice for Surveys on Research and Experimental Development*, OECD Publishing, Paris

OECD (2005), *Oslo Manual 3rd edition Guidelines for Collecting and Interpreting Innovation Data*, OECD Publishing, Paris

Onida F. (2013), "Politica industriale: parliamone ancora", *Il Mulino*, 2/2013

O'Sullivan E., Andreoni A., López-Gómez C., Gregory M. (2013), "What is new in the new industrial policy? A manufacturing systems perspective", *Oxford Economic Review of economic Policy*, 29(2), pp. 232-462

Powell W., Koput K., Smith-Doerr L., Owen-Smith J. (1999), "Network Position and Firm Performance: Organizational Returns to Collaboration in the Biotechnology Industry", *Research in the Sociology of Organizations*, 16, pp. 129-159.

Sandulli F., Chesbrough H. (2009), "The Two Sides of Open Business Models", *Universia Business Review*, 22, pp. 12-39

Schumpeter J. A. (1911), *Theorie der wirtschaftlichen Entwicklung*, Duncker&Humblodt, Berlin. English version (1934), *The Theory of Economic Development*, Harvard University Press, Cambridge, Mass.

Schumpeter J. A. (1942), *Capitalism, Socialism and Democracy*, Harper, New York and London.

Spender J. C. (2012), "Strategizing", in Wright J. D. (ed.), *International Encyclopedia Social and Behavioral Sciences*, Elsevier, 2nd Edition

Stiglitz J. E., Lin J. Y. (2013), *The Industrial Policy Revolution I: The Role of Government Beyond Ideology*, Palgrave Macmillan, New York

Tassinari M. (2014), "La politica industriale negli Stati Uniti. Il dibattito teorico, la retorica e le pratiche nell'era del Washington Consensus", *L'Industria*, 1/2014, pp. 69-100

Teece D. (2007), "Explicating dynamic capabilities: the nature and microfoundations of sustainable enterprise performance", *Strategic Management Journal*, 28(13), pp. 1319-1330

Tregenna F. (2009), "Characterising deindustrialisation: An analysis of changes in manufacturing employment and output internationally", *Cambridge Journal of Economics*, 33, pp. 433-466

Tregenna F. (2014), "A new theoretical analysis of Deindustrialisation", *Cambridge Journal of Economics*, 38, pp. 1373–1390

Viesti G. (2013), "La riscoperta della politica industriale: per tornare a crescere", *Economia Italiana*, no 3

Warwick K. (2013), "Beyond Industrial Policy. Emerging Issues and New Trends", *OCED Science Technology and Industrial Policy Papers*, n.2, OECD, Paris, Doi: 10.1787/ 5k4869clw0xp-en

Wade R. H. (2012), "Return of industrial policy?", *International Review of Applied Economics*, vol. 26, no. 2, pp. 223-239