

Industrial Dynamics: Patenting Perspectives

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Abstract

This article is based on the premise that the dynamics of an industry are not only driven by patenting activities at the levels of country, industry, and firm, but have also coevolved along with the various developmental stages of the industrial cycles in each country. Consequently, most merger and acquisition activity, manpower recruitment, patent licensing and lawsuits, and antitrust prosecutions take place in the Trilateral Patent Offices of the United States, Japan, and Europe. The most prolific and fastest-growing patentees (in the United States, Japan, Germany, Korea, Taiwan, and China) are those that are closely linked with information and communication technologies and the biotechnology industries. Emerging policy challenges and future research directions are also elaborated in order to better describe the role of patenting in the evolving industrial dynamics of the twenty-first century.

Introduction

The study of industrial dynamics goes beyond the traditional disciplines of industrial organization studies to encompass a wide range of characteristics of firms within a country or an industry, in terms of size, entry and exit, innovation performance, research and development (R&D) expenditure, and innovation strategies, and it deals with comparisons of one period or geographic region with another (Malerba and Orsenigo, 1996). Industrial dynamics is considered to be among the most interesting and rewarding fields of research, since its nature is knowledge- and strategy-centric, and it is constituted by a number of networks and driven by various types of industrial actors (including new entrants, incumbents, governments, academy, business associations, and regulatory agencies). The ultimate goal is promoting the growth of industrial companies and building stronger competitiveness for them, through the creation and diffusion of knowledge within and across the industry.

Given that knowledge diffusion is critical for building innovation capability in a dynamic industry, the development of knowledge sources, delivery processes, and interactions as dynamic elements has become essential, as has the contribution of technological and institutional actors. Knowledge creation and diffusion is effected through a range of channels, including foreign direct investment (FDI), joint ventures, international trade, technological licensing, imports of capital goods, cooperative research projects, researcher networks, movement of personnel, and the scientific literature. In this complex situation, codified knowledge such as patents can play a role as legal documents, since they contain reliable and traceable records of knowledge creation and diffusion. This makes patenting activity one of the best and most accessible proxies for exploring the evolution of industrial dynamics, especially in knowledge-intensive high-tech industries. This article, based on patent perspectives, is intended to summarize the state of current knowledge on industrial dynamics and to discuss the major challenges presented by current intellectual property systems, through which emerging policy implications and future research directions may be developed.

Worldwide International Patenting Activity

A patent is a temporary monopoly awarded for the commercial exploitation of a newly invented device. The grant of a patent implies that such a device would not appear obvious to a skilled practitioner of the relevant technology. While researchers usually use industrial production, value chain networks, and market share to evaluate an industry, the volume of patenting applied for and approved can be a further important indicator of industrial dynamics.

According to the cooperative Trilateral Patent Office, most patent applications are to the USPTO, the JPO, and the EPO, while worldwide patent demand rose from 2 586 045 in 2000 to 6 082 067 in 2009, which is more than a twofold increase in a decade, corresponding to an average annual increase of about 13%. Within this overall total, there has, however, been a marked difference in patenting propensity between the advanced countries and latecomer countries. First filings accomplished in the advanced countries over the period 2003–09 registered a rise of just 2.6% (USPTO) and 0.97% (EPO) and a fall of 3.8% (JPO). In comparison, patenting activity in the emerging latecomer countries, such as that to China's SIPO, Taiwanese IPO, and Indian IPO exhibit an approximately 20% increasing rate of first filings over the same decade, indicating the rapid diffusion and internationalization of patent knowledge spillovers in these emerging countries.

The patent document is considered to be one of the major indicators of cutting-edge technology, embedding as it does great commercial value (World Intellectual Property Organization (WIPO), 1999). WIPO reported that over 90% of R&D achievements were disclosed in the patent gazettes, while 80% of them were not revealed in academic journals or the technical literature. Moreover, the world's No. 1 patentee, IBM, earns over US\$1 billion in royalties per year. Patents and patenting information represent some of a company's most valuable assets and decisive factors in company strategy, protecting R&D achievements, raising research performance, creating profits and new business models, and maintaining competitive advantage in the market.

Patent Statistics as Indicators of Innovation and Industrial Dynamics

While technological innovation cannot be precisely measured, patenting rates have long been considered a well-grounded proxy for level of innovation. Though the sources of patents may introduce bias, the advantages associated with using international patents are described in many prior studies (e.g., Soete, 1987). In addition, a strong link between foreign patent grants and domestic R&D investments, as well as between foreign patents and FDIs demonstrates that patenting activity is an important factor in international trade. While some researchers have emphasized that involvement in global production networks is an important source of knowledge for advancing export performance in late industrializing countries, other studies have explored the importance of the different relationship between technology and international business trade performance (e.g., Dosi et al., 1990). To various degrees, all the literature supports the positive relationships between knowledge, innovation activity, and economic or industry performance in both advanced and latecomer countries.

On the country and industry levels, researchers associated with the National Bureau of Economic Research have developed methodologies for studying the flow of knowledge from one country or industry to another, using patent statistics. In particular, data from patents taken out in the USPTO by both American and foreign firms have enabled researchers to trace the influence of knowledge spillovers and degrees of specialization associated with industrial clustering (Jaffe and Trajtenberg, 1999). Studies have used this USPTO patenting activity to examine the experiences of specific institutions, such as biological resource centers (Furman and Stern, 2004), individual industries, such as solar photovoltaic (Wu and Mathews, 2012), and international knowledge flow, such as that between Taiwan and South Korea (Hu and Jaffe, 2003). Many have argued that only certain types of innovation can be measured, and that many important innovations are not patented, for instance in food and tobacco; some patents are awarded for very modest discoveries (e.g., in basic metals and automotive techniques). Nevertheless, patent activities are still widely recognized as an appropriate indicator in the context of high-tech industries.

On the level of the firm, patent data are a valuable information source allowing decision makers to assess their own technology

portfolio in comparison with their competitors within and across the industry, including the ability to assess the attractiveness of technologies, especially those posing a threat, or new opportunities for the existing business; to recognize strategic changes in the firm's competitive environment; to identify and assess external sources for knowledge generation (e.g., merger and acquisitions (M&A) and R&D alliances); to assess the status of patent appropriation in new business areas; to evaluate important market partners, especially customers and suppliers to determine whether the firm's R&D strategy is in alignment with that of its major customers and competent suppliers; and to improve human resource management pertaining to leading inventors in specific technological fields. In summary, integrated patent information can act as a quick and efficient monitoring system for capturing the industrial dynamics through timely review and update of competitive portfolio analysis, technology trends, market segmentations, and business opportunities within and across industries, as shown in Figure 1.

Worldwide Industrial Dynamics: Patenting Perspectives

The US industrial market is widely recognized as the largest and the most technologically advanced in the world and the US patent statistics are reliable indicators because of the general screening procedures imposed by the USPTO. With all their deficiencies, then, patenting rates, and particularly data on what the USPTO calls 'utility patents' (which represent real inventiveness, rather than minor improvements or other 'noise' in the overall data), represent a uniform and time-robust measure of innovative output with an immediate economic significance, since the time and trouble involved in seeking patents in the USPTO system has the effect of filtering out trivial or idiosyncratic innovations. Accordingly, worldwide industrial dynamics will be explored in terms of patenting activity at the levels of country, industry, and firm, as follows.

Country-Level Patenting Comparisons

Many studies examine the extent of innovation by using patent data for advanced countries (mainly in the Organization for

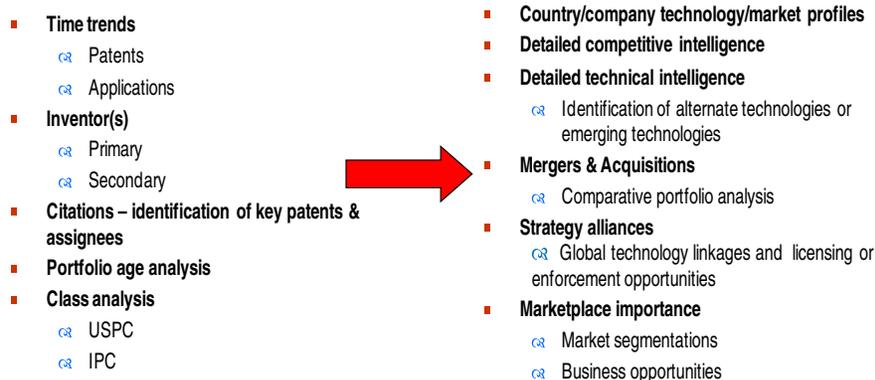
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- **Time trends**
 - ☞ Patents
 - ☞ Applications
 - **Inventor(s)**
 - ☞ Primary
 - ☞ Secondary
 - **Citations – identification of key patents & assignees**
 - **Portfolio age analysis**
 - **Class analysis**
 - ☞ USPC
 - ☞ IPC
 - **Country/company technology/market profiles**
 - **Detailed competitive intelligence**
 - **Detailed technical intelligence**
 - ☞ Identification of alternate technologies or emerging technologies
 - **Mergers & Acquisitions**
 - ☞ Comparative portfolio analysis
 - **Strategy alliances**
 - ☞ Global technology linkages and licensing or enforcement opportunities
 - **Marketplace importance**
 - ☞ Market segmentations
 - ☞ Business opportunities

Figure 1 Patent information as monitoring systems for industrial dynamics.