Exploration of China's technological innovation capacity from knowledge flow

Keywords: Knowledge flow; Technology integration; Technology diffusion; Self-citation; Other-citation

Innovation through the knowledge flows, use and creation has become a major driver for economic growth. The measure of technological innovation capacity has gained more and more attention of researchers (Archibugi, D., & Archibugi, D, 1988; Yue R, Xia Z, Wei Z, 2008; Filipescu D A et al, 2013). With the rapid development of science and technology in China, the extent of China's technological innovation capability has become a matter of public concern (Zhang H.S, 2006; Jiang X, Jiang X, Yu X.H, Luo J, Luo J, 2010).A variety of measurement methods emerge as the times require.

The role of knowledge exchange is especially important in a knowledge and technology driven economy because it allows better penetration and diffusion of innovation and stimulates cooperation in R&D(A.G. Hu, A.B. Jaffe,2001;R. Lukach, J.E. Plasmans,2002).There have been extensive studies emphasizing the importance of knowledge flow/spillover.

Although it is not difficult to conceptualize a phenomenon of knowledge flow, it is a real headache to measure the degree of knowledge flow. We use patent citations as a measure of knowledge flow due to the following considerations: the correlation between patent citations and reported knowledge flows is high, which justifies the use of citation, at least in large samples (Jaffe, A., Trajtenberg, M., 2002; Duguet, E., MacGarvie, M, 2007); Roach and Cohen (2013) provided strong evidence for the validity of patents citations as a measure of knowledge flows from public research.

In this paper, we propose a method to explore China's technological innovation capacity by measuring technology knowledge flow of patents at two levels: macroscopic and microscopic analysis. Macroscopic analysis mainly focus on the main regions and countries of technology inflow/outflow. Two indicators, that is self-citation ratio and other-citation ratio, are proposed. Microscopic analysis

emphasize the technology integration and technology diffusion among IPC codes of patents and citation. We propose the indicators of technology integration(I) and technology diffusion(D) based on the literatures(Porter, A. L. et al., 2007; Porter, A. L. et al., 2008; Wang, X et al., 2017) in order to revealing absorption, integration and re-innovation of knowledge and diffusion and influence of knowledge .We compare the changes of the main regions and countries of technology inflow/outflow, technology integration and technology diffusion in three time periods to find the change characteristics of China's technological innovation capability in different technical fields. The framework for this paper is shown in Fig.1

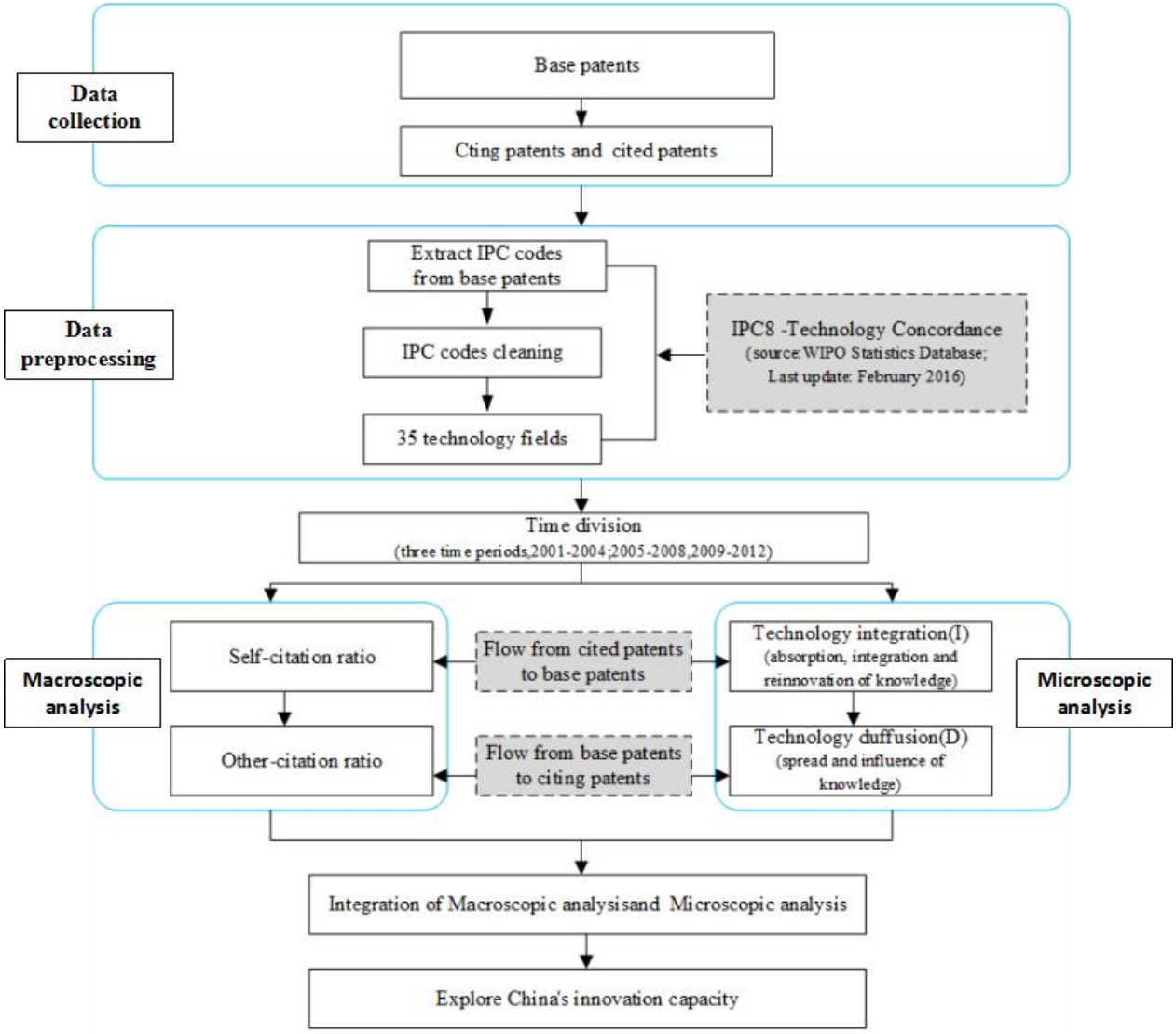

Fig.1 The framework of research

In the paper, the subject of analysis is base patents whose assignees/applicants include Chinese in the USPTO database from 2001 to 2012.Based on the data set, we

collected 33,805 patents. Subsequently, 385,276 cited patents and 75,083 citing patents are collected from Thomson Innovation database. The result shows that some technical fields, such as Materials, metallurgy and Surface technology, coating, increasingly rely on foreign technical knowledge inflow, meanwhile the technology integration and technology diffusion reveal steady downward trend. In technology integration and technology diffusion. Though the two technical fields-Digital communication and Pharmaceuticals, have poor performance between 2001 and 2004, the patents get more and more foreign patents cited and have a greater degree of ascension in technology integration and technology diffusion between 2009 and 2012.More and more technical fields are inclined to cite Chinese patents and have strong ability in technology absorption and diffusion.In general, China's technological innovation capability has been significantly improved.

References:

Archibugi D. (1988). In search of a useful measure of technological innovation (to make economists happy without) discontenting technologists). Technological Forecasting & Social Change, 34(3), 253-277.

Duguet E., MacGarvie M.(2007). How well do patent citations measure flows of technology? evidence from french innovation surveys. Economics of Innovation & New Technology, 14(5), 375-393.

Filipescu D.A., Prashantham S., Rialp A., et al (2013). Technological innovation and exports: unpacking their reciprocal causality. Journal of International Marketing, 21(1), 23-38.

Hu A.G.Z., Jaffe A.B. (2001). Patent citations and international knowledge flow: the cases of korea and taiwan. International Journal of Industrial Organization, 21(6), 849-880.

Jaffe A., Trajtenberg M. (2002). Patent, citations and innovations: Awindow on the knowledge economy.Cambridge: MIT.

Jiang X., Yu X.H., Luo J. (2010).Evaluation of China's Scientific and Technological Innovation Capability. Technoeconomics & Management Research.

Lukatch R., Plasmans J. (2002). Measuring knowledge spillovers using patent citations: evidence from belgian firms' data. Social Science Electronic Publishing, 6(7), 1-26.

Porter A. L., Cohen A. S., Roessner J. D., et al (2007). Measuring researcher interdisciplinarity. Scientometrics, 72(1), 117-147.

Porter A. L., Roessner D. J., Heberger A. E. (2008). How interdisciplinary is a given body of

research? Research Evaluation, 17(4), 273-282.

Roach M., Cohen W. M. (2013). Lens or prism? patent citations as a measure of knowledge flows from public research. Management Science, 59(2), 504-525.

Yue R., Xia Z., Wei Z. (2008). The Research on Evaluation Model of Enterprise's Technological Innovation Capacity Based on Entropy Theory and Osculating Value Method. International Conference on Management Science and Engineering. IEEE, 2011-2015.

Zhang H.S. (2006).The analyses of technological innovation capability of china's manufacturing industries. (4), 15-23.

Wang X., Wang Z., Huang Y., et al. (2017). Measuring interdisciplinarity of a research system: detecting distinction between publication categories and citation categories. Scientometrics, doi:10.1007/s11192-017-2348-4.