

Exploring the operating mechanism of the open innovation system for China's 6G development

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Abstract

The continuous advancement of mobile communication technology has led to the emergence of 6G as a focal point for global scientific and technological innovation. Major countries around the world have outlined plans for the development of 6G. China has also been an active proponent of research into the requirements and key technologies associated with the 6G vision. 6G represents a much expansive category of convergence, integrating diverse fields and encompassing a multitude of technological breakthroughs, which places greater demands on open innovation and complex cross-border innovation. A variety of innovation entities engage in proactive practice and joint improvement of their innovation performance within open innovation systems. This paper explores the operating mechanism of the open innovation system for China's 6G development through a causal loop analysis. China Mobile, a leading operator in China, is selected as a case study to examine its coupled open innovation mode in collaboration with industry, academia, and research units by a three-tiered analytical framework. The established 6G innovation bases aim to develop a 6G innovation chain encompassing basic theories and product applications. Furthermore, the social network method was employed to evaluate the innovation performance of China Mobile's three main innovation bases.

The main contributions of this paper are reflected in the following aspects: First, we examine the interaction process and reveal the operating mechanism of the 6G's open innovation system through a systems thinking approach. The causal loop analysis identifies the main circuits that drive 6G innovation, as well as the constraints that may affect the development of innovation. By systematically analyzing the open innovation mechanisms for 6G technology development, we can identify the main circuits that drive innovation, as well as the mechanisms that may influence the development of innovation. Therefore, in the practical process of promoting the development of 6G technology, exploring the working mechanisms of the open innovation system is an effective way to analyze countermeasures.

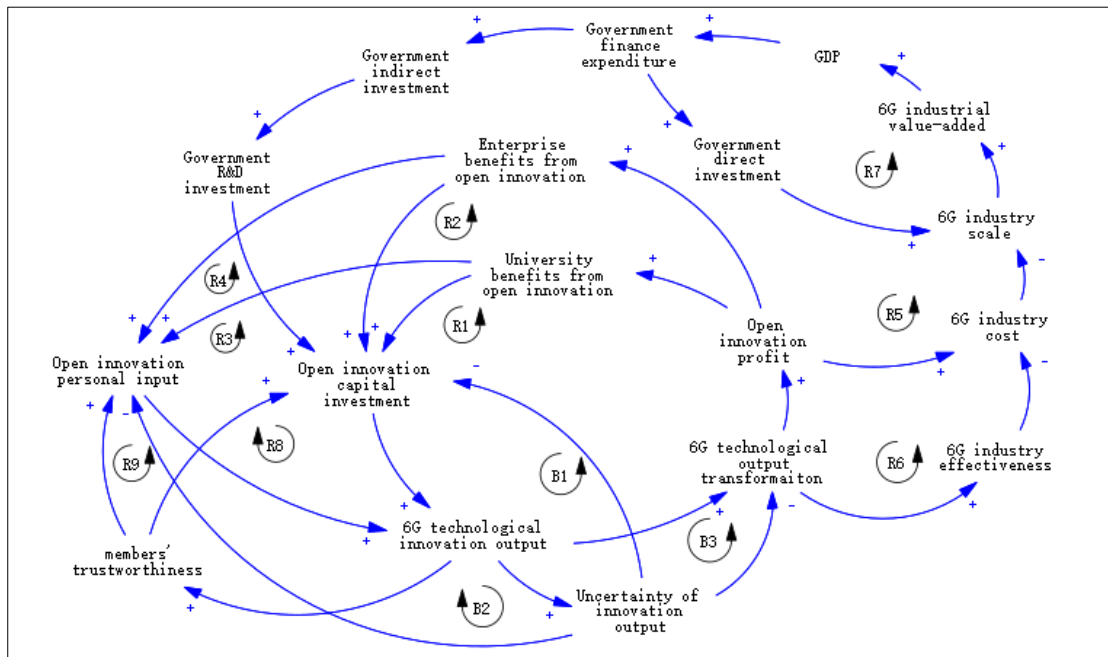


Figure 1 Causal loop diagram of the open innovation system for China's 6G development

Second, we identify the coupled open innovation mode of China's 6G development from a novel perspective. A three-tiered theoretical framework is used to illustrate the coupling of the outside-in and the inside-out processes in the 6G innovation ecosystem. Third, the real case analysis provides this paper of great practical significance. Drawing on social network theory and the literature on open innovation and innovation ecosystems, we use selected data from the 2018-2023 China Patent Network as a sample to establish a collaborative patent network, demonstrating that innovation bases between high-tech firms and universities can significantly improve technological innovation activity and innovation diffusion. By effectively capturing the practices of China Mobile's three innovation bases and evaluating the innovation performance, we advocate the need to widely promote 6G cooperation and open innovation at the international level. Furthermore, we suggest that efforts be made to jointly promote the quality development of the global 6G industry. This paper presents a decision-making basis for the government and enterprises by systematically studying the operating mechanism of open innovation system and the promotion mechanism of sustainable innovation for enterprises.

Despite its important implications, this research has several limitations that must be acknowledged. First of all, although we have collected patent data between China Mobile and all universities with cooperation in the time period of 2018-2023 from China Patent Network, the number of cooperation patents can only represent the active degree of technological innovation and innovation diffusion ability. The degree of innovation advantage, such as whether the patented technology is highly advanced and complex, has not been taken into account. Second, although the innovation bases between China Mobile and the three universities is very representative of China and has led the development of China's 6G technology, it has similar technological goals and the same focal company. Therefore, it is important to consider collecting data from more diverse high-tech firm-university innovation bases to further investigate the operation mechanism at the network level. In addition, future research may be able to take into more consideration on the impact of global environment to the operation of innovation bases and innovation ecosystem.

Key words: Open innovation; innovation ecosystem; 6G; systems thinking

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