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研究報告

（MS Word）

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【研究題目】

Cross-national and cross-sectoral dynamics of innovation policies: The case of lithium-ion battery technology for electric vehicles in the U.S. and China

【研究の目的】（４００字程度）

Sustainable technology increasingly relies on highly complex basic science, and basic research policies play a dominant role in the long-term process of sustainable technology innovation. The formation of socio-technological systems around green technology is closely linked to both the sustainable and industrial targets of nations. However, there is currently no formal model that encompasses various technology and cross-national sectors, which is necessary for analysing collaboration in relation to new scientific knowledge and new sustainable technology. Nevertheless, empirical evidence suggests that such a dynamic is pervasive. Our study aims to resolve this issue by developing an analytical model that integrates scientific research policy and innovation policy. We demonstrate the effectiveness of this model by analysing the cross-sectoral and cross-national dynamics of U.S. and Chinese policies for high energy density lithium-ion battery technologies essential to electric vehicles. We apply our model to the case of how China was able to emerge as a frontrunner in commercialisation despite the U.S.' early head start by way of 'legitimate free-riding' and 'complex cross-sectional policy' mechanisms. This case study enables us to formalise novel methods of analysing technological innovation over time, which could be used by future researchers.

【研究の内容・方法】（８００字程度）

The process of forming an innovation system for green technology is connected to both the sustainable and industrial targets of nations. To design policies that achieve both, the cross-national competition in scientific green technology innovation poses the question: *Who enjoys the fruits of basic research supported by government policies?* By considering recent green technology innovation, which is increasingly connected to national sustainability and industrial targets, policies should be strategically designed to achieve both. Thus, a combined analysis of science policy and innovation system policy is necessary. This study proposes a conceptual model to simultaneously analyse the cross-national and cross-sectoral interactions and effects of policy mixes directed towards basic research and TIS formation (Fig. 1). There are two major research gaps in the existing literature on science policy and innovation system policy. First, most previous studies have failed to consider the impact of the first-mover advantage at the national level. Instead, they have been limited to firm-level analysis or macro-economic analysis from an economic welfare perspective, thereby overlooking the cross-national effects of the policies (x_k) that are implemented at each stage of TIS formation (v_z) on the socio-technological change in each nation (grey arrows in Fig. 1). Second, there is a dearth of prior research that explores the influence of regionally specific measures, implemented in innovation system policies (x^+), on different stages of the value chain (s_i, n_j) within each process of TIS formation (v_z). Furthermore, there is little understanding of how these policies impact the cross-national effects of policies on socio-technological change, and subsequently, shape the global value chain (orange arrows in Fig. 1).

Therefore, we examine these interactions with socio-technological systems throughout the process of knowledge creation, formation, and growth (Hoppman et al., 2014). The aim is to provide support for relevant decision-making, research policy, and strategic management (Zhang and Kajikawa, 2021) in the context of innovation diffusion and system transition (Kajikawa et al., 2022). Herein, we discuss how the policies in a latecomer nation provides different options for strategic policies in the early-mover nation. Additionally, we show how the latecomer and early-mover nations alter the consequences of technology transfer and socio-technological development in each other, which we refer to as a 'mutually determined socio-technological system'.

【結論・考察】（４００字程度）

Our study makes several contributions to the literature on innovation policy research. First, the results reveal the policy mechanism that resulted in the critical knowledge created under the early-mover nation's research policy being transferred to the latecomer nation. This illustrates the need for innovating nations to anticipate the policies of knowledge recipient countries that could impact the early-mover nations' socio-technological targets. Second, this study develops an analytical model for evaluating and investigating the dynamics of cross-sectoral and cross-national interactions of policies for forming a TIS. This has both scholarly and policy implications and can lead to better outcomes for future innovation systems. Third, we produce new, granular evidence from the development of LiBs for EVs, which has emerged as a critical case in science, technology, and innovation literature (Altenburg et al., 2022; Pohl and Yarime, 2012; Stephan et al., 2019). Thus, we contribute theoretically, methodologically, and empirically to extant scholarship.

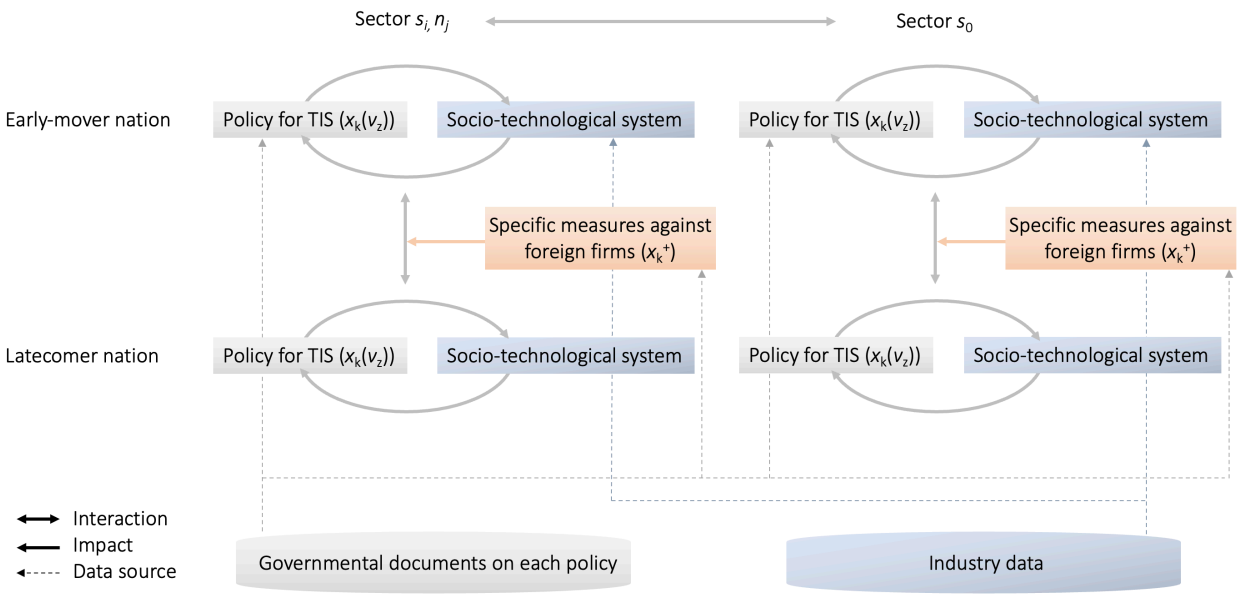

Figure 1. Schematic diagram of research design: Cross-national and cross-sectoral interaction of policies and socio-technological system, where x_k is the mode of a TIS policy, x_k^+ is a regionally specific measure implemented in each TIS policy, v_z is the process of TIS formation, and s_i and n_j are subsystems and components of the technological system, respectively. Subscripts k and z indicate the type of policy and the stage in the TIS formation process, respectively (each variable is defined in detail in Section 2).