

# **Technology Dynamics in Korea: The Paradox of National R&D Investment Decision**

Hun-Joon Park(Yonsei U.)

Sei-Hong Oh(STEPI)

Sang-Joon Kim(Yonsei U.)

## **Abstract**

Dilemmas surrounding investment decisions for national research and development projects include difficulties of determining the total funding amount (the strategic loop), R&D systems (the structural loop), and the process of realizing initial investment objectives and priorities by assigned researchers (the efficacy loop). This study purports to arrive at a feasible policy alternative to these decisional dilemmas by providing a simulation model that can detect inherent problems within the unobtrusive dynamic structure of the Korean national R&D investment institution.

The simulation model we introduce in this study maps out the cyclical causal nodes of the Korean R&D investment institution that has produced sub-optimal investment decisions. We noticed that over the years the Korean R&D investment institution has made substantial commitments to the expansion of total funding packages awarded to selected national R&D projects. Increases in the dollar amounts of these targeted projects resulted in the stage-by-stage evolution of Korean technologies. It was possible for us to observe that the said technological evolution resembled paradigmatic changes similar to the ones we can identify in the evolution of a scientific body of knowledge. However, our simulation results show that enormous side effects and unnecessarily long inter-stage temporal gaps also surfaced as technological innovations progressed from one stage to another. This affirms our initial premise that the Korean national R&D investment institution, like its counterparts in other industrial countries, is mired by decisional dilemmas of setting investment priorities and R&D amount. What demarcates the Korean national R&D investment institution from its international competitors is the unusually high discrepancy between the total investment stock and consequential research results that have the benefit of international recognition.

Previous studies have failed to address these structural issues inherent in the Korean national R&D institution, especially on the dynamic structure of making funding decisions. Although some extant studies noticed the ongoing decisional problems within the Korean national R&D institution, empirical simulation models that could detect underlying structural anomalies rampant in the institution have not yet been fully developed or tested. In this study, however, we identify three cyclical loops of strategy, structure, and efficacy that are continuously interacting with each other to produce both intended and unintended outcomes of national R&D projects. We then built up simulation models of each loop to unravel its complex web of causal nodes by using a computer software program STELLA 5.1.1.

Three simulation models produced various results for different scenarios. In sum, we found that emphases on application and “add-on” or developmental technologies resulted in long inter-stage temporal gaps, although their short-term economic benefits were obvious. In a similar vein, myopic investments in specifically targeted technologies in strategically designed R&D projects led to decreasing levels of absorptive capabilities, whereas far-sighted investments brought in adversary results. Finally, we found that an initial investment package did not have significant impact on the level of researcher efficacy, which augurs a more complex dynamics of researcher motivation structures than is usually assumed. Therefore, in the Korean case, it is imperative that the national R&D institution concentrates resources in long-term and far-sighted projects to enhance strategic technologies, while it is necessary for it to increase funding for fundamental research projects to beef up its R&D capabilities.