Regional research and technology organization and some challenges in Korea

Sangwoo Shin*

Science and Policy Research Unit (SPRU), University of Sussex, Falmer, Brighton, UK

(Received 7 April 2015; accepted 24 June 2015)

This paper explores the development of the regional research and technology organization in Gyeonggi province, South Korea. It finds that rather than following a top-down approach, Gyeonggi policy-makers are taking a new bottom-up approach, which emphasizes the detailed analysis of local industry needs. The fresh idea presented by this paper is that it is necessary to understand the tensions between top-down traditions and bottom-up aspirations in regional innovation systems.

Keywords: research and technology organizations; bottom-up approach; Tensions; South Korea

Introduction

Research and technology organizations (RTOs) are public research institutions established to fulfil the research needs of public administration bodies (Sharif & Baark, 2011). They were created to fulfil a governmental mission, and therefore conditioned to promote national competitiveness (Cho, Lee, Sung, & Kim, 2011, p. 56). While national RTOs remain important, the socio-economic environment has undergone significant changes in recent years, with a growing trend of regionalism in innovation policy. Regional policies have become more separate from national policies than previously (Uyarra, 2011) and regional government RTOs have become emerging players in policy processes for science, technology and innovation at the regional level.

Regional RTOs’ contributions to building capacity for collective innovation offer a rationale for public policy in their activities, but such public policy must be accompanied by a bottom-up approach. Given that regions may have different cultures of collaboration and different phases of regional innovation systems (RIS), a region-specific policy design is required for them to attain a credible position. These pressures for increased regionalism have been felt by regional actors in both Western and East Asian developmental economies. However, for regional RTOs the emergence of such challenges has created dilemmas. The weak institutional framework of research and dirigiste forms of RIS (i.e. nation-state-oriented policies in regional development) remain endemic in catch-up economies (Cooke, Heidenreich, & Braczyk, 2004), and regional RTOs have had to adjust their approaches to these conditions. Therefore, it is worth examining the response of regional RTOs and regional policy actors to understand better how regional RTOs emerge and develop bottom-up processes toward a strategy of providing

*Email: sangwoo42.195@gmail.com

© 2015 The Author(s). Published by Taylor & Francis. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.
integrated services in collaboration with local actors, and what the major difficulties are in this process.

We will use the RIS approach to understand the current situation for RTOs at the regional level. In Gyeonggi province, South Korea, the focus of systemic innovation has been at the national level, although the regional government has begun to play a strong role in industrial development. This paper analyses the role played by the Gyeonggi Institute for Science and Technology Promotion (GSTEP) in the policy processes of industrial development, and the tensions emergent in these processes. The following sections examine the theoretical approach to RIS, and then how GSTEP has implemented its mission, in relation to national RTO and policies.

**RTOs in a RIS**

The RIS approach highlights systemic aspects of economic development (Autio, 1998; Cooke et al., 2004). Its fundamental focus is the interactions between different actors in the economy, particularly between users and producers, but also between business and the community.

RTOs are ‘intermediaries’ in the RIS: from a relatively impartial third-party position they purposefully catalyse innovation by bringing together actors and facilitating their interaction. In general, RTOs bring actors together mainly for national purposes (Roessl, Kessler, & Fink, 2010), being established by central government to enhance the competitiveness of national economic sectors in the industrialized economies (Hassink & Shin, 2005). They support the delivery of a shorter-term economic impacts economy, rather than more strategic long-term research, but RTO activities can extend throughout innovation processes that last several decades. They expand the role of knowledge extension from that of a one-to-one intermediary between knowledge creator and firms to that of an intermediary that creates and facilitates many-to-many relationships (Leijten, 2007; Miller, 2014). Their policies often include testing laboratories and as product and process developers for local firms, focusing on user- or problem-oriented research. Some well-known examples of RTOs include the Fraunhofer Gesellschaft (Germany), VTT (Valtion Teknillinen Tutkimuskeskus, State Technical Research Center) (Finland) and TNO (Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands Organisation for Applied Scientific Research) (Netherlands).

With growing regionalism, tensions and conflicts are inevitable in an RIS; innovation policy conducted in RTOs has been faced with increasing regional demands to contribute more concretely to the regional economy. Tensions between a nation-state and its regions, and the conflicts between neighbouring regions have been increasing rapidly over recent decades, which may lead to serious delays in the ability to take united action.

To analyse these tensions, the development of the GSTEP and the provincial government was followed between September 2010 and February 2011. Forty-two interviews were conducted with chief officers and experts in regional government, agencies, policy-makers, firms and academics. Participatory observation was undertaken to understand regional agendas and issues, and the way strategic action is promoted.

**A wider regional context**

Gyeonggi is the most developed South Korean province, located in the north-west, surrounding the capital Seoul (Figure 1), with ready access to the huge consumer market in the metropolitan area. More than half of South Korea’s 50 million population lives in this area, with 11 million in Gyeonggi itself. Despite extensive urbanization, substantial
areas of countryside remain under-populated, notably in the east and north around the North Korean border area. Gyeonggi is thus strategically important in both international relations and business markets. Mechanical engineering and electronics, textiles, and information and communication technology (ICT) have historically been important; traditional industries with low growth rates remain over-represented.

However, the region’s growth is relatively strong: gross domestic product (GDP) grew by 9.8% in 2011 compared with 6.6% nationally. Furthermore, Gyeonggi has recorded consistently good innovation performance innovation. In 1997, it already had the highest provincial proportion of research and development (R&D) expenditure (34.1% of national R&D expenditure); this had grown to 45.4% in 2012, more than double the region’s share of GDP (19.6%).

Gyeonggi can thus be characterized as the economic heart of South Korea, with a diverse industrial base and high levels of innovation. However, in common with other
provinces, most RTOs tended to emerge from national initiatives by central government, such as the Technopark programme and regional research centre (RRCs) (Hassink & Shin, 2005).

The Technopark initiative aimed to promote regional development through relatively homogeneous hubs, providing advice and support, established in each region from 1997. They aimed to create both collaborative networks linking industry, academia and the government, and additional new technology-based firms (NTBFs). In parallel, central government established RRCs at universities, aiming to foster collaboration between universities and firms (Lee, 2003); Gyeonggi has three RRCs. Start-ups and mature small and medium-sized enterprises (SMEs) could access (1) technological and management advice; (2) signposting to finance; (3) joint projects; (4) training; and (5) the use of scientific equipment.

These activities are ‘top down’ in devised from outside the region, but also in failing to provide a strategic framework for regional innovation policy, as opposed to mainly promoting national priorities. For example, programmes in Gyeonggi prioritized regional high-technology industries, such as ICT and biotechnology. As there was no analysis of regional demands for innovation, these policies tended to use ‘generic’ programmes and favour hardware-focused initiatives (e.g. infrastructure investment), which are easier to manage than software-focused initiatives (e.g. helping firms to develop technology strategies).

Since 2006, Gyeonggi provincial government has adopted a more bottom-up approach to industrial support, endorsed by the Gyeonggi Research Institute (GRI) in 2008. The plan identified four fundamental challenges underlying Gyeonggi’s innovation system: (1) fragmentation of services and funding; (2) lack of coordination and knowledge about technology support services; (3) a desire to focus on regional SMEs in general rather than high-technology sectors; and (4) a desire to improve the efficiency of public innovation expenditure (Lee et al., 2008). This analysis led to the creation of GSTEP.

GSTEP’s mission was to develop a strategic understanding of the regional fundamentals of innovation – a regional RTO was reasoned to have greater information than national RTOs to tailor measures to specific regional needs, thereby promoting endogenous technology development. However, this inherent information asymmetry between national and regional levels creates scope for opportunistic behaviour by the regional RTO. This may lead to tensions between the national and regional levels, as the regional RTO pursues its own priorities at the expense of national priorities.

**GSTEP and bottom-up policy development**

GSTEP attempted to create a distinctive ‘regional’ flavour though two complementary programmes based on a ‘single point of entry’ (or ‘no wrong door’): the Gyeonggi technology development programmes (GTDP) and the industrial innovation cluster committees (IICC). GTDP provides a shared vision for regional SME technology development. From 2008, four GTDP sub-programmes (Table 1) funded projects where SMEs have either already proven successful or are seeking to improve innovation performance. SMEs submit a proposal for innovation-related funding, judged competitively on the basis of technical and regional merits. GDTP is thus a hybrid of top-down decision-making and bottom-up competition.

The second element aimed to increase SMEs’ technological capacity through networks promoting collaboration within the fragmented regional economy (Yim, Lee, & Kim, 2010). The IICC, working in tandem with GTDP and GSTEP, established
Table 1. Gyeonggi Technology Development Programmes (GTDP).

| Aim | Strategic industry technology development | Enterprise-based technology development |
|-----|------------------------------------------|-----------------------------------------|
|     | Enhancing industrial structure and high value added | Developing public technology sector | Open technology development in the short-term |
| Targets | Fourteen sectors\(^a\) responding to regional government needs | Technology responding to publicity needs | Applied technology in the short-term |
| Clients | Firms, universities, public research institutes | Firms | More than two co-work firms |
| Period (years) | 3 | 2 | 1 |
| Annual funding per project (US$) | 284,000 | 284,000 | 189,000 | 95,000 |
| Number of projects, 2008–12 | 56 | 9 | 129 | 116 |
| Example | Solar battery | Develop foot and mouth disease antibody check-kit | Voice–user interface navigation | Environmental stretch film |
| Funding, 2008–12 (US $ millions) | 26.5 | 4.8 | 10.9 | 28.7 |
| Process | Top down | | | |

Note: \(^a\)LED parts/display, system semiconductor, mechatronics, digital convergence, contents/software, bio, agriculture, environmental systems, renewable energy, marine leisure, knowledge-based services, automobile, textile and furniture. Currency conversions are based on 2013 values.
partnerships between SMEs, research institutes and GSTEP itself, deriving benefits through the creation of networks between firms in connected industries based on related diversity (Asheim, Boschma, & Cooke, 2011). By 2012, more than 1300 firms and research institutes had joined cluster committees in 13 sectoral networks.

There are three notable features to these programmes. First, it is difficult to replicate them in other regions (as other bottom-up approaches have been criticized for doing), as GSTEP rejected generic policy initiatives (e.g. from Technopark) in favour of more focused and specific approaches, designed on the basis of regional characteristics and particularities. Second, GSTEP promoted a commitment to collaborative working; firms themselves had a large role in the programmes. This contrasts sharply with the national approach, where research was channelled through Technopark, via top-down processes, with firms themselves playing a minor and less active role. Third, the nature of interventions, and the role of the regional authority in that intervention, was tailored according to the entrepreneurial and technological capabilities of firms in Gyeonggi. The programmes were either primarily a facilitator, where particular capabilities existed, or took a more proactive, developmental role where capabilities were non-existent or only potential. Accordingly, innovation programmes moved away from the traditional policy of ‘picking winners’ (i.e. NTBF focused), in favour of prioritizing support for knowledge-creation amongst lower technology firms.

GSTEP’s policies were thus hybrids, combining the technological explicitness of a bottom-up approach with the economic richness of top-down. It was planned to integrate these programmes with pre-existing initiatives, notably Technopark. However, this has not proceeded smoothly. Whilst GSTEP programmes were welcomed by firms, they faced considerable resistance to the implementation and integration from other initiatives. For instance, even from the start, Technopark was reluctant to become involved with the new regional initiatives, going so far as not to refer companies to GSTEP. Instead, Technopark set up the ‘Techno Doctor’: expert groups providing scientific advice to high-technology firms facing problems in innovation processes.

Emerging tensions between RTOs

The source of these challenges is, fundamentally, the tension between top-down and bottom-up perspectives in regional innovation policy. In the top-down approach, Technopark held prime responsibility for targets and instruments of innovation policies, in turn influenced by central government’s regional policy aims. The state aimed to promote balanced territorial development and regional specializations in strategic industries. Innovation policy became an increasingly attractive instrument towards harmonizing regional economic development.

However, GSTEP’s bottom-up approach was different. Although Technopark was highly important, its top-down processes failed to provide a strategic lead tailored to Gyeonggi’s situation. GSTEP’s priority, by contrast, was that regional policy be forward looking, so that it could contribute to technological innovation in a strategic, developmental manner.

Thus, there were different priorities for Gyeonggi viewed from the top (the national perspective) and the bottom (the regional perspective). This created the potential for tensions to emerge, which proved to be the case: divergent policies were pursued simultaneously, with differing mandates and accountability structures due to unclear lines of policy authority. Relevant legislation (e.g. the Local Autonomy Act) does not provide clear guidance on the resolution of conflict caused by separate but overlapping powers.
Although there was some interaction between GSTEP and Technopark, there were tensions and a lack of communication in managing resources at different scales. Each concentrated on its initial methodology without showing interest in the other’s policies.

Although GSTEP has access to devolved funding, and has been able to reorganize and make better use of its own resources in pursuing identified regional priorities, it has not been able to align these priorities fully with nationally funded activities that are important to the RIS. The inherent tensions remain acute and regional knowledge sharing is heavily constrained. While it has been common historically for countries to experience regional frictions in devolution, the introduction of bottom-up industrial policy, in the manner it has been implemented in South Korea, has aggravated pre-existing tensions between central government and the regional authorities, with no clear resolution in sight.

**Conclusions: challenges to the regional RTOs**

The findings highlight systemic aspects of regional development, especially the transformation of RISs by the emergence of regions with competing political agendas. In Gyeonggi, the GSTEP is now perceived as a new RTO in this process through the introduction of bottom-up and strategic place-based programmes with a strong territorial impact. Despite central government’s strong push it has been unable to address specific needs, with the result that further bottom-up policies appear likely, leading to priorities and resources being focused on programmes designed to meet the real needs of firms being more clearly directed to these needs. This could result in improved innovation outcomes.

The clearest conclusion of this study is that regional government RTOs have the potential to provide support through strategic programmes for regional innovation. On closer examination, however, barriers to bottom-up policies remain in place. Limited coordination between national and regional RTOs has reduced the effectiveness of innovation system to influence resource allocation in the region.

It is necessary to understand the tensions between top-down traditions and bottom-up aspirations. At the general level, tensions provide much of the political context for unfolding debates about the meaning of regional innovation; in the Korean case the tensions are fundamental to its dynamics. More specifically, there is the key question of balancing top-down and bottom-up policies: ideally, both must be harnessed to serve the needs of regional actors, but implementation presents a challenge.

Regional policy should be designed so the firms have a single entry point for all support programmes, which improves collaboration. The region’s policy-makers thus have to be able to manage tensions between national agencies, which requires a clear statement about the link in socio-economic development between national interest and regional innovation, to enable integration of national and regional objectives.

Finally, the findings inform the debate on institutional reform. The reason for the ongoing tension is that the constitutional order does not provide clear guidance about how responsibility and accountability over separate but overlapping powers should be resolved. In general, devolution has not been a considered response to the specific problems, but is more the consequence of wider national reforms.

**Disclosure statement**

No potential conflict of interest was reported by the author.
References

Asheim, B., Boschma, R., & Cooke, P. (2011). Constructing regional advantage: Platform policies based on related variety and differentiated knowledge bases. *Regional Studies, 45*, 893–904.

Autio, E. (1998). Evaluation of RTD in regional systems of innovation. *European Planning Studies, 6*, 131–140.

Cho, H., Lee, B., Sung, T., & Kim, S. (2011). Assessing the institutional legitimacy of research and technology organizations in South Korea: A content analysis approach. *Science Technology & Society, 16*, 53–73.

Cooke, P., Heidenreich, M., & Braczyk, H. J. (Eds.). (2004). *Regional Innovation systems*. (2nd ed.). London: Routledge.

Hassink, R., & Shin, D. (2005). The restructuring of old industrial areas in Europe and Asia. *Environment and Planning A, 37*, 571–580.

Lee, K. (2003). Promoting innovative clusters through the Regional Research Centre (RRC) policy programme in Korea. *European Planning Studies, 11*, 25–39.

Lee, W., Moon, M., Yim, D., Sung, Y., Lee, D., & Shin, S. (2008). *Designing a new management system for the new R&D programs of Gyeonggi-do and suggestions for the future development of Gyeonggi-do’s R&D programs*. Policy report 2007–58, Gyeonggi Research Institute.

Leijten, J. (2007). The future of RTOs: A few likely scenarios. Working Papers, European Commission, 119–138.

Miller, S. (2014). The Strathclyde Technology and Innovation Centre (TIC) in Scotland’s innovation system. *Regional Studies, Regional Science, 1*, 145–151.

Roessl, D., Kessler, A., & Fink, M. (2010). The role or research and technology organizations in innovation processes or small and medium-sized enterprises. *The International Journal of Entrepreneurship and Innovation, 11*, 199–207.

Sharif, N., & Baark, E. (2011). The transformation of Research Technology Organisations (RTOs) in Asia and Europe. *Science Technology Society, 16*, 1–10.

Uyarra, E. (2011). Regional innovation systems revisited: Networks, institutions, policy and complexity. In T. Herrschel, and P. Tallberg (Eds.), *The role of the regions, networks, scale, territory* (pp. 169–194). Gothenburg: Region Skane.

Yim, D. S., Lee, S., & Kim, S. J. (2010). Creating and managing regional innovation networks in Korea. Technology Management for Global Economic Growth (PICMET), 2010 Proceedings of PICMET, Retrieved from http://ieeexplore.ieee.org/xpl/articleDetails.jsp?reload=true&arnumber=5603294