Science parks as local innovation systems: old wine in a new bottle?

Three waves of science park constructions have been identified by the International Association of Science Parks: the late 1960s and early 1970s witnessed the slow diffusion of science parks from North America; the 1980s experienced a much wider enthusiasm for science park construction, concentrated mainly in Europe; the new century welcomed the latest momentum on science park development, especially in Asian Pacific Region. Different aims of these science parks could be identified in different regional contexts. Nevertheless, stimulating high-tech industries and economic growth in less-developed regions are perhaps one of the main justifications for these real estate developments. In the context of China, the original target of science parks to accelerate industrialization and modernization has gradually shifted to one of achieving more balanced regional development. This shift of concern to 'regional harmony' in turn has stimulated the passion of the less-favoured regions in China to construct science parks, despite the lack of research evidence on the effectiveness of science parks. It is this gap in the research that I have attempted to fill in my own research on science parks in China.

Criticisms of science parks' cost-benefit balance dominate in academia. Most of these negative conclusions, in turn, were achieved on the theoretical foundation of a linear innovation model, which assumes one-way knowledge diffusion from the research institutions, to private sectors, and then the market. However, this theoretical assumption itself is problematic, as it overlooks the interaction loops of learning and the sundry actors involved in the innovation process. Therefore, based on this unrealistic theoretical foundation, analysis on science parks will unavoidably yield biased and sometimes misleading conclusions. Moreover, these overwhelmingly negative results are arguably not well-received by the (potential) shareholders of the science parks, as their daily operation of science parks have by now already passed from being concerned solely on the relationship between research and industry to engaging broader networks of relations in support of innovation. So it is my first argument that this linear innovation model underpinning science parks should be updated to reflect the progresses made both in academic research and in management practices.

The emerging innovation system theory (IS), especially its later marriage with economic geography, is a promising place to begin to replace the linear model. Set in the junction of

evolutionary and institutional economics, IS pays attention to the interactions and learning between public and private sectors, with due attention given to the institutional factors. These foci of IS make it particularly powerful in analysing public-stimulated construction such as the science park initiatives in the Asia Pacific Region, where the institutional environment is influential historically. However, the weakness of IS in explaining the micro-level activities of companies needs to be improved in order to fulfil its explanatory power on the potential value of science parks. Therefore it is my second argument that micro-level analysis of business behaviour needs to be incorporated in IS theory. For this purpose, the resource-based view of companies was incorporated into IS in this study, which extended IS into a four-quadrant dynamic model.

Departing from this four-quadrant model, the author digs into one science park practice in less-favoured central China – the so-called 'Optics Valley of China' (OVC) in Wuhan, Hubei Province. Three interesting findings emerged after a painstaking face-to-face questionnaire survey of companies and interviews with the main stakeholders. First of all, it was found that the contributions of science parks on companies' performance were not definite. Previous studies on the 'added-value' of science parks tend to focus on the economic contributions either to the tenants or the host regions. This study, on the other hand, found that there was indeed limited value of OVC to companies' revenue growth; but the institutional actors of OVC and a series of purposely constructed 'themed parks' were significantly adding to companies' innovation performance, as measured by companies' innovation counts. Therefore the influence of the 'soft' institutional environment on the efficiency of science parks should be paid attention to both in academic research and in management and planning practice.

Secondly, the author's study showed that companies' entrepreneurship was a systematic phenomenon. Earlier studies on entrepreneurship were either biased towards new start-ups, or else treated this phenomenon as a 'black box'. This study, in comparison, defined entrepreneurship as a crucial chain in the four-quadrant model, linking micro-level activities of companies and the macro-level IS. Since both micro and macro domains are multi-dimensioned, it is therefore a safe argument to say that companies' entrepreneurship is by no means a single dimensioned phenomenon. 19 indicators were included in the questionnaire to reflect entrepreneurship, and factor analysis identified at least three dimensions of companies' entrepreneurship; entrepreneurship oriented towards the market, towards technology, and towards institutional opportunities. Although it is out of the scope of this study to compare companies' entrepreneurship between different science parks, it is to be expected that

different regions would exhibit different entrepreneurial patterns, which in turn would affect the contributions of the science parks to which they are host.

The third finding of this study was concerned with the systematic synergy of science parks. Systematic synergy is widely regarded as both consequence and catalyst of learning and interactions, the latter of which were also the interfaces in the four-quadrat model. From a static viewpoint, as most studies on science parks have adopted, the synergy of OVC was still weak even after around three decades of development. However, tracing the four growth stages of OVC and seeking to answer the question of whether this science park was functioning effectively, what the author got was not simply a 'yes' or 'no' answer, but a picture of (a) the power struggles between the multiple tiers of government in China, (b) the evolution of China's reform policies, and more importantly, (c) the importance of specific social and industrial assets of the region. In terms of the latter, local citizens' preference for independence explained the dominance of SMEs. A historical separation between research-education-industry shed light on the missing trust between companies and research institutions. The region's heavy-industry tradition impeded the formation of a complete optoelectronic industry chain in OVC to a great extent. Finally, a concurrent process of decentralization and interregional competition underpinned the accelerating growth of OVC since 2000, even without the usual synergies of cooperation between private and public sectors that have come to be expected in the literature.

In conclusion, my study shows how rich and colourful a picture on science parks would be obtained if we substitute a suitably enhanced IS interpretation for the linear model of innovation. Management and planning practice for science parks would also benefit significantly by adopting a systematic viewpoint. This would necessarily entail the particular goals of individual science parks to be identified and differentiated and supplementary motivations to tenants to be provided in light of the multi-dimensions of companies' entrepreneurship. What is more, it is important for policy makers to avoid the 'high-tech fantasy' disaster, is a deeper understanding of the social and industrial assets of their regions in which a science park is embedded, as no science park is ever constructed 'out of thin air'. All in all, my study suggests that treating science parks as innovation systems is by no means a case of 'old wine in a new bottle'.

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