

Chapter 2

The Theoretical Building Blocks for Technology and Industrial Parks

Abstract No single body of literature offers a fully encompassing framework for the use of technology and industrial parks. Instead, justification arises from the collection of a variety of theoretical building blocks from a broad set of intellectual traditions. At its foundation, park models are grounded in our contemporary understanding of the nature of knowledge for economic development and the ways in which it is both accumulated and diffused, a discourse most prominent in modern economic growth theories. Other complementary building blocks include literatures on agglomeration economies, absorptive capacities, regional systems of innovation, institutions, and the role of the triple helix institutions for development. By gathering a number of ideas and predictions in each of these theoretical traditions, parks can be introduced as viable instruments to achieve economic development. However, in addition to highlighting a range of policy opportunities, different scientific strands also draw attention to major challenges that park policies must come to terms with to accomplish their goals and to get the most from projects implemented in their territories.

Keywords Knowledge · Knowledge diffusion · Economic development · Agglomeration · Spillovers · Innovative environments · Innovation policies

Despite the growing popularity of technology and industrial parks, no single body of literature offers a fully developed and encompassing framework that justifies their use. Theoretical support for park models arises by combining several theoretical traditions. The constituent concepts are not only diverse, spanning economics, economic geography, regional science, innovation studies, industrial organisation, and international business, among others, but also feature at the cutting edge of our understanding of phenomena such as territorial innovation systems and the nature of local economic development. By extracting the complementary strands of theory, which form the basic building blocks of a supporting rationale for park creation, it is possible to envisage technology and industrial parks as important tools for achieving important development goals, such as technology-led growth and increased global trade.

2.1 Knowledge and Economic Development

Knowledge and innovation disproportionately emerge from specific places. The spiky nature of economic landscapes has made the study of knowledge and innovation, on the one hand, and economic development, on the other, a key preoccupation of many scholars (Audretsch and Feldman 2004). Successive intellectual breakthroughs in the economic growth literature have put the spotlight on the properties of knowledge, and more specifically, the ways in which ideas and technologies are diffused through space. No longer conceived as weightless and universally available—like ‘manna from heaven’ in neoclassical growth models—knowledge does not flow uniformly. Instead, it accumulates in specific places and is observed to be intricately linked to the types of economic activity that take place within a territory (Doring and Schnellenbach 2006). In addition, knowledge is diversified. Using the classic distinction made between tacit and codified knowledge, as popularised by Polanyi (1957), highly prized, tacit forms of knowledge tend to remain geographically localised and exhibit strong distance decay properties (Jaffe et al. 1993; Asheim and Gertler 2005). As put by Glaeser et al. (1992, p. 2) and Quah (2001, p. 90) respectively, “intellectual breakthroughs must cross hallways and streets more easily than oceans and continents” and spread “only incompletely and gradually, not fully and instantaneously”. This raises important questions about the distinctive features of regions that accumulate knowledge, particularly in the context of an increasingly globalised business environment. Although revolutions in ICT and travel have made firms increasingly footloose, this has not yet led to a more level playing field for innovation or the creation of a flatter economy, as predicted by some scholars (Cairncross 1997; Friedman 2007). Instead, the heightening of connectivity between places seems to have engendered ever more spiky and concentrated economic landscapes (Yeung 2004; McCann 2008; Rodríguez-Pose and Crescenzi 2008). The territories that have benefitted the most have been able to accumulate knowledge, a cumulative process based on the absorptive capacities of local actors, such as firms, to harness prior knowledge and competencies for the assimilation of new, external information (Cohen and Levinthal 1990). As such, it is now generally understood that knowledge, innovation and human capital are fundamental for achieving economic development, and represent key explanations for the significant and persistent divergences in economic growth and development between countries and their regions (Aghion and Howitt 1988; Romer 1990; Howells 2005). This has stimulated significant academic and political reverence and, consequently, knowledge-based initiatives have ascended to the top of the policy agenda (Storper 1997).

Knowledge spillovers denote the primary mechanism of knowledge diffusion. The notion itself is shorthand for the natural exchange process that takes place between individuals, research institutions, and firms as they interact, and can occur in formal or informal settings, deliberately or otherwise. Knowledge spillovers are, therefore, more local than global, and are difficult to quantify due to their inherently social nature. They are, nevertheless, considered to be a crucial prerequisite

for the effective functioning of knowledge-intensive environments. Yet, the natural, social processes of knowledge exchange, sharing and dissemination can prove to be serious impediments to private investment in knowledge generating activities, such as R&D. Understandably, if a firm is unable to fully control the dissemination of valuable knowledge generated internally—and is thereby unable to fully appropriate the returns to their investments—an underinvestment in knowledge generation is likely to take place. With this type of market failure in mind, government interventions can be justified in order to raise the levels of knowledge-based investments to more socially optimal levels, by means of incentives or subsidies to promote private R&D. For regions that lack an established base of knowledge-intensive firms, research institutions, and skilled workers, interventions may be all the more pertinent. The limited presence of potential competitors and collaborators creates an environment that not only provides few incentives to invest in R&D and innovation, but virtually discourages these activities, as few firms will either be willing or capable of conducting R&D. Consequently, policy interventions, such as the development of technology and industrial parks, can also be seen as instruments to provide local reference points or knowledge hubs to lagging, marginal areas, in hope that they can foster the development of a viable technological foundation over time.

2.2 The Concentration of Economic Activities in Space

In addition to knowledge spillovers, other knowledge-based externalities are noted features of knowledge-intensive clusters. Agglomeration and increasing returns foster a range of beneficial locational externalities that are associated with heightened productivity, localised learning, and employment growth, among other things (Marshall 1920; Ellison and Glaeser 1999). It is often observed that places where economic activities begin to concentrate—frequently the result of chance events, but sometimes by design—tend to gather momentum and continue to grow, and develop a resilience or adaptability to changeable economic and technological landscapes. As predicted by the new economic geography and endogenous growth models, areas that gain an advantage over neighbouring or competitor regions are able to further profit from the forces of agglomeration, widen the gap between them, and cumulatively increase their innovative performance (Fujita et al. 1999). However, whilst agglomeration is closely associated with phenomena like innovation (Saxenian 1994), the underlying mechanisms remain largely implicit and tend to take centre stage on the research agenda as scholars continue to unravel the intricacies of innovation.

Innovation is generally understood as the implementation of new or improved products and services, organisational methods, and business practices (OECD 2005). Breakthroughs can be radical or incremental and can evolve from existing knowledge, acquired knowledge from external sources, or from new ideas generated locally. Put simply, innovation is predicated on the learning capacities of

the people and organisations within each region (Howells 2002). Correspondingly, proximity—associated with more frequent social interactions, closer observation, and increased communication—diminishes the marginal cost of transmitting technical knowledge (Audretsch and Feldman 2004). In this sense, proximity affects knowledge spillovers insofar as it exerts an influence upon the intangible aspects of communication. As outlined by Boschma (2005), proximity can be elaborated into five key dimensions, comprised of social, institutional, organisational, cognitive, and geographical, which together shape how knowledge is diffused and innovation is affected. Boschma's five proximities echo longstanding insights into the knowledge transfer and learning processes, such as socially embedded histories of interaction, cooperation and trust-based relationships (Granovetter 1985; Uzzi 1997), untraded interdependencies—the rules, conventions, and habits that coordinate actors under conditions of uncertainty (Dosi 1984; Storper 1997)—and the significance of face-to-face interactions which facilitate the creation of a 'local buzz' (Storper and Venables 2004). Moreover, knowledge exchange is predicated on some degree of cognitive crossover, or shared knowledge, which forms the basis for identifying and understanding new knowledge. Cohen and Levinthal's (1990) notion of 'absorptive capacity' articulates this process, which is considered essential for a firm's—and by extension, its region's—economic development and progress.

In order to create an environment conducive to innovation, it is important for policymakers to incorporate this more sophisticated conception of proximity and distance into development strategies. In other words, policies need to be tailored to reflect the strengths and weakness of a particular business environment. Too much or too little distance in any of the outlined dimensions can yield local environments that foster innovation with greater difficulty. Geographical proximity alone is insufficient to generate innovation and engender economic development. Proximity only facilitates learning, cooperation, and the development of a truly dynamic and innovative environment where the local socio-economic, institutional, and political conditions are appropriate.

In line with this more encompassing, inclusive approach, many different actors and organisations can and should feature in the creation of innovative places. In this respect, Schumpeterian entrepreneurs, talented, mobile workers, and research institutions, can all play significant roles. First, opportunistic entrepreneurs have the capacity to surmount barriers to technology transfer by commercialising ideas identified in the regional environment, and in doing so provide the missing link between research outputs and economic activities, which tend to be overlooked in formal economic growth models (Acs et al. 2004). Second, skilled, mobile workers, including engineers, scientists, and academics, can transfer embodied knowledge as they relocate to join new firms in different countries and regions (Breschi and Lissoni 2003). Third, universities increasingly assume a so-called 'third mission' within their local context, becoming participants in the transfer and commercialisation of knowledge, characterised by closer and overlapping collaboration with government and industry (Giuliani and Arza 2009), a relationship formalised in Etzkowitz's (2003) 'triple helix' model.

This condensed summary serves to highlight that clustering in space and economic performance are intertwined in complex but significant ways. Growth policies perceived as likely to be successful need to influence appropriate forms of agglomeration and harness other vital actors, such as universities, entrepreneurs, and skilled migrants to propagate the dynamic economic gains available.

2.3 The Nature of Innovative Environments

The study of the places that generate, incubate, and attract innovative, highly productive firms has yielded a fruitful discussion of their nature and evolution. By examining a variety of places as diverse as nineteenth century industrial towns in Britain, the prosperous light industrial estates on the outskirts of provincial towns in the so called 'Third Italy', and the modern, archetypal centres of innovation typified by Silicon Valley, these studies have unravelled some of the complexities involved in cultivating and sustaining thriving, productive, and innovative environments. Moulaert and Sekia (2003) provide a review of a number of theoretical models and conceptions collectively referred to under the umbrella term 'territorial innovation models'. The variety of models, such as industrial districts, innovative milieus, learning regions, and regional systems of innovation, hint towards the diversity exhibited by various agglomerations across the globe in terms of their characteristics and key success factors. Social, cultural, and institutional factors together shape the innovative performance, evolution, and path-dependency of regions, and the firms they host, in highly differentiated ways. As such, blueprint approaches will often prove unsuccessful, and achieve highly diverse outcomes in different contexts. This suggests that policies need to not only be sufficiently adaptable, but also specifically tailored to the characteristics of the regional environment. Accordingly, scholars and policymakers alike have begun to develop a wider appreciation of the highly interactive and accumulative nature of learning, with closer scrutiny to the cultural and institutional factors that are conducive to fostering innovative activities.

The classic *industrial district* model describes the experiences of places characterised by many small, interconnected firms belonging to the same industry. Firms are, however, organised according to their specialisation in various stages of the production process, or for a particular set of goods or services (Bagnasco 1977). Relationships between firms are based on a mixture of trust, cooperation, and competition over time. As these relationships evolve they establish the foundations for the dynamics of innovation to thrive (Moulaert and Sekia 2003). The *innovative milieu* model is defined by the important linkages between the idiosyncratic history of a region—particularly the factors that shape the organisational and collective behaviours exhibited in the local environment—and its learning capacity (Aydalot 1986). Morgan (1997) stresses how the nexus of social conventions and institutional routines is a major influence of the interactive nature of the local innovation process in the *learning region* model. Finally, the *regional*

systems of innovation literature is distinctive for its focussed attention on the specific organisational and institutional aspects of innovation, particularly with respect to the collective learning process that takes place within the departments of a company as it collaborates with external partners (Cooke et al. 2000).

Taken together, this set of distinctive yet overlapping models highlights that ‘knowledge ecosystems’ are far from standardised (Mian and Hulsink 2009). Patterns of development are often unique and path dependent. Yet, certain commonalities do emerge from the different innovation models that serve as vital pointers for policymakers looking to boost—or even create from scratch—their own local territorial innovation systems. Accordingly, there is increasing policy recognition that local conditions and competencies are of fundamental importance for the competitive advantage of firms, and consequently greatly influence where they decide to locate. The time-period over which such conditions emerge is also of considerable significance. A regions, institutions, social conventions, and capacities to learn are developed slowly and have long memories. For regional decision-makers, the key message is to factor an appropriate time dimension into investments and adjust their expectations according to the—often unpredictable and complex—difficulties associated with creating appropriate (and addressing deficient) socio-economic conditions for innovation, growth and technological development.

2.4 From Knowledge and Agglomeration to Policy Intervention

The combination of intellectual breakthroughs related to knowledge, geography, and the nature of innovation, so far discussed, highlights a range of potentially fruitful policy opportunities. Equally, the discussion draws attention to a number of inherent limitations. The specificities of knowledge mean that public investments and incentives to promote R&D cannot only be beneficial for growth, but are often necessary to ameliorate market failures and achieve a more balanced and socially optimal distribution of economic activity. The role of agglomeration externalities and the challenges associated with the various dimensions of proximity have similarly diverse policy implications. In the context of globalisation, strengthening cores of activity that compete at the frontier of their respective industries may be justified to maintain national competitiveness, maximise efficiency, and compete globally. However, the concentration of economic activity engenders issues of territorial equity. In other words, interventions can also be justified to redress uneven distributions of economic activity by investing in lagging regions with a view to boost local employment, upgrade local human and technological capabilities, and catch-up with leading regions. However, these decisions need to be taken with care, and not only factor in the particular strengths and weaknesses of a given territory, but also evaluate wider considerations, such as

what are the strengths of neighbouring regions and why the intervention is justified in one particular location and not elsewhere. Ultimately, the nature of regional innovation systems underlines the sensitivity of firms and places to the social, cognitive, organisational, and institutional aspects that facilitate technology transfer and collective learning. Where these are missing or inadequate, appropriate policy actions may be championed to reduce their negative impacts and loosen constraints holding back the development of a territorial innovation system. In other words, policies need to factor location and geography into strategies, with consideration for the where interventions are needed, the method of intervention, and the potential implications for the territory itself and neighbouring regions in order to get the most from development initiatives.

Policymakers have exercised a mixture of direct interventions and indirect approaches to address a number of the identified issues. Examples include subsidies and tax breaks for R&D, the commissioning of public research centres, support for the formation of technology transfer networks, and programmes to promote entrepreneurship. However, technology and industrial park models come to the fore as one of the most widely applied policy interventions to date and have become extremely popular in recent years. The opportunities they present to address the entirety of issues discussed finds some support in the theoretical literature, but their success in emerging contexts remains to be seen.



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