



# Rethinking the city and innovation: A political economic view from China's biotech

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## ARTICLE INFO

### Keywords:

Innovation  
High-tech parks  
Biotech  
Shanghai  
China

## ABSTRACT

The city is arguably where innovations concentrate. Agglomeration and diversity are two major explanations for why innovations concentrate in the city. Existing studies tend to focus on knowledge dynamics, in particular interfirm networks, while paying insufficient attention to the process of urban development in which knowledge dynamics are materialized. We concur that the city itself does not possess such a power for innovation (Shearmur, 2012). Rather, it is an arena where various actors exert impacts on knowledge dynamics. In a view from China, we reveal why bio-tech innovations concentrate in particular places and what political economic processes contribute to such concentration. We highlight the need for a political economic analysis in economic geographical studies of innovation.

## 1. Introduction

The concentration of economic innovation in the city has almost 'become a research premise' as opposed to a research question (Shearmur, 2012). Numerous publications over the last few years have been written on the innovative traits of cities (Florida, 2002; Florida, Adler, & Mellander, 2017; Glaeser, 2011; Krätke, 2014; Simmie, 2001). The conceptualization of the 'nature of cities' as agglomeration (Scott & Storper, 2015) has triggered a debate largely outside economic geography. Given that there is a fruitful literature of relational economic geography (Bathelt, Malmberg, & Maskell, 2004; Martin & Sunley, 2006; Rutten, 2017; Yeung, 2005), it is therefore the right time to rethink the connection between innovation and cities (Shearmur, 2012). However, rather than rehearsing a well-established critique over clusters (e.g. Martin & Sunley, 2003, 2006), we critically review what is missing in the paradigms of agglomeration and diversity when they are applied to a different context. We tentatively provide a view from China, in particular biotech innovation.

The objective of this paper is to rethink the relation between the city and innovation. We try to explain why biotech innovation in China is heavily concentrated in major cities and particularly their high-tech parks. Through biotech in Shanghai, we explore how the city becomes an arena where multiple actors exert their influence over innovation capacities. This paper focuses on the connection between innovation and cities.

The Chinese case provides a good angle to see the concentration of

innovation. As an emerging market in the global South, China has recently experienced economic restructuring and is striving to develop innovation capacities (Fu, Pietrobelli, & Soete, 2011; Grimes & Du, 2013; Zhang & Wu, 2012). The medium- and long-term science and technology plan places strategic importance on the new biopharmaceutical sector. Combined with the policy of high-tech parks, large cities are regarded as the main places to realize the sector's innovation ambitions. Beijing's Zhongguancun, Wuhan's Donghu and Shanghai's Zhangjiang have been chosen as the first three 'demonstration zones for indigenous innovation' (Miao & Hall, 2014; Zhang & Wu, 2012; Zhou, 2008).

Besides the theoretical implications, attention to the role of the city in innovation is much needed for explaining Chinese innovation. The current literature on Chinese innovation attributes increasing innovation capacities to state policy (Fu et al., 2011; Prevezer & Tang, 2006; Su & Hung, 2009; Zhang, Cooke, & Wu, 2011). Studies on biopharmaceutical innovation in East Asian emerging markets pay extensive attention to the developmental state (Lee, Tee, & Kim, 2009; Wang, Chen, & Tsai, 2012; Wong, 2011). However, Yeung (2009: 325) suggests that 'the developmental state is a necessary but not sufficient condition for regional development to take place'. Scott and Storper (2015: 12) argue that resort to a peculiar institution may exaggerate the scope of variations and conceal the 'intrinsically urban phenomena'.

The paper is organized as follows. In the next section, we review the literature of two major paradigmatic explanations, agglomeration and diversity, in innovation. Section 3 proposes the perspective of seeing

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the city as an arena where biotech innovations occur. Section 4 examines agencies in the development of biotech innovation in Shanghai, China, to provide an example of our argument. Finally, we conclude with the importance of political economic analysis within economic geographic studies of innovation.

## 2. Agglomeration and diversity and their limitations

The purpose of this section is to review the prevailing paradigms that explain the emergence of innovations and the limitation of these explanations. While these two paradigmatic explanations of innovation help to explain the process in which knowledge and innovation are created, they are not oriented towards explaining the roles of agents, market power, and government. They tend to view the city through the perceived features and impacts on the interaction during knowledge processes. The intention of this paper is to take a brief step back to look at the process outside knowledge production, such as urban development, planning, and spatial policies, which lead to spatial changes and hence promote or constrain innovations. This means a political-economic view of innovation process is much needed.

The existing paradigms seek to identify the factors that are believed to be conducive to knowledge generation and innovation. Agglomeration and diversity are identified as the major factors. First, the neo-Marshallian cluster stresses agglomeration. Porter's (1998) cluster theory emphasizes the effect of self-reinforced agglomeration. More recently, Scott and Storper (2015) argue that the nature of the city comes from agglomeration. The original cluster theory focused on the sameness of firms and the agglomeration effect associated with the sameness. The prescription, based on an understanding of agglomeration for regional development, can be seen in 'new regionalism', which has been criticized for its confusion of policy advocacy and underlying political economy (Lovering, 1999). Cluster theory is criticized for its excessive attention to spatial proximity (Martin & Sunley, 2003, 2006). The relational turn of economic geography (Sunley, 2008; Yeung, 2005) requires more attention to extra-regional connections and an external environment outside clusters (Phelps, 2004). To overcome the limitation of spatial proximity, Boschma (2005) extends the notion to include and distinguish different types of proximity, for example, cognitive and institutional proximities.

The concept of the regional innovation system (RIS), however, emphasizes a wider range of attributes of the environment besides the available associated firms. These attributes include, for example, the institutions and culture of localities (Cooke & Morgan, 1998). RIS expands not only the geographical scope but also the nature of networks beyond firms to include the conditions of a region. For example, social capital and trust are deemed important features of RIS (Cooke & Morgan, 1998). Further, local conditions can include the interactive roles between university, industry and government in the 'triple helix model' (Etzkowitz & Leydesdorff, 2000). The extension of the cluster to RIS or the triple helix model opens up the possibility of interrogating the process of urban development, which may include wider concerns than the cluster. However, confining discussion to concerns over the region of innovation, they tend to focus more on localities.

Moving away from the territorial view of innovation to a relational view, greater attention has been paid to the network. The model of 'local buzz and global pipelines' proposed by Bathelt et al. (2004) combines local interactions and translocal linkages. The 'local buzz' refers to 'a complex multilayered information and communication ecology' (Bathelt et al., 2004: 45), while these local clusters are connected through pipelines to the rest of the world. The model, however, is largely concerned with knowledge flows and dynamics. Focusing on translocal connections, the global production network (GPN) approach explains how these translocal activities are related to each other. The perspective of the GPN explains the relation between globalization and regional changes (Coe, Dicken, & Hess, 2008).

Further, the GPN theory is further enriched by the notion of

'strategic coupling' (Coe et al., 2008; MacKinnon, 2012), which emphasizes that local firms are strategically coupled with leading firms in the GPN for effective innovation. The perspective has been usefully applied to understand the development of the liquid crystal display (LCD) industry in Shenzhen through the coupling of designated domestic firms and lead firms in the GPNs (Yang, 2014). A more recent development is a dynamic view of GPN which may endure decoupling and recoupling (MacKinnon, 2012). These theories are very close. The pipeline theory focuses on knowledge linkage while GPN stresses production connection.

The relational and evolutionary economic geographies are rich both in their concepts and in attention to the specific process of development, as Asheim et al. (2011: 899–900) suggest, arguing that 'it would be wrong to apply a "one-size-fits-all" policy, such as copying best practices like Silicon Valley' and that policies 'should be based on the institutional history of a region and which type of intervention fits better a region's situation, rather than abstract theoretical or ideological accounts'.

The second major paradigm is the perspective of diversity which stresses heterogeneity and urban externality as an essential feature of the urban environment. The chance of unexpected encounters and face-to-face contact associated with 'buzz' enhances innovation (Storper & Venables, 2004). Combining Jacobs's (1969) insights on diversity and Joseph Schumpeter's theory of entrepreneurship and innovation, Florida et al. (2017) explicitly argue for 'the city as innovation machine'. Similarly, at the industrial sector and firm level, Boschma and Frenken (2006) propose the notion of 'related variety', suggesting that rather than the homogeneity of clustered functions, heterogeneity facilitates innovation and the creation of new knowledge. Applying 'relatedness' to knowledge dynamics in biotech at the city level, Boschma, Heimeriks, and Balland (2014) found that new scientific topics emerge in the cities where the related topics already exist. Focusing on knowledge dynamics and the differentiation of knowledge bases, a prescriptive 'platform policy' is proposed by Asheim et al. (2011), which, instead of pursuing clustering, promotes knowledge spill-overs across sectors. The notion of related variety points to the co-location of a variety of economic sectors to help cross-fertilize knowledge. For example, Cooke (2008) emphasizes the Jacobian externality of diversity in green innovation research and explains that the emergence of clean technology (as part of green innovation) is due to the co-existence of diverse firms from different economic sectors, for example, biotech, ICT and agri-food. Related variety tends to focus on the knowledge dynamic and pays less attention to the question of how diverse firms in different sectors come to co-locate in the same locality.

From agglomeration to diversity, although these theories have different emphases, they are largely concerned with the knowledge process of innovation. The local-buzz and global-pipeline theory and the strategic coupling of GPN goes beyond the locality and examine local and global interactions, paying less attention to the actual and material processes through which innovation spaces are constructed. All these approaches highlight the importance of knowledge processes. These processes are most evident in the city and hence innovation 'emerge' from the city. However, the knowledge process cannot 'play a role' unlike agents or actors. We aim to show that the city is where a variety of actors exert their impact on the development and further alter the processes related to innovation. The process of knowledge exchange is one of these processes.

## 3. The city as an arena of innovation

In this section, we propose a perspective in which to think of the relation between the city and innovation. We consider the city as an arena of innovation. Multiple actors and agencies assemble during the course of urban development, which affect innovation. As an arena, the city is not an actor in itself but a space or 'assemblage' which brings together various actors to pursue their own objectives. These objectives

may or may not be directly related to innovation or cluster formation. For example, policies that intervene in the labour market and regulate land-use planning may have an effect on urban development, which may further enhance or hamper innovation capacities. Some policies are directly related to innovation, while others stem more from operational requirements, which may not necessarily bear the aim of innovation. While these actors may be dependent upon broad institutions of development, for example land regulation, and create path-dependent effects, the result can be emergent and path-breaking. For example, a pharmaceutical valley has been created in Shanghai, although the industry has not been a key economic sector of the city in the past. The development of biotech innovation in Shanghai is thus more strategic and serves national interests rather than being created by knowledge dynamics, although without the latter the strategy cannot be realized.

From the perspective of seeing the city as an arena where multiple agencies act or exert their agencies, agglomeration is a necessary but not sufficient condition for regional development and innovation. As seen in Shanghai, agglomeration dynamics are important, because collaboration within the science park helps to generate knowledge. However, agglomeration alone cannot fully explain the emergence of biotech innovation in the park. That is, the emergence of biotech innovation in Shanghai could not be *simply* attributed to cluster and agglomeration dynamics or a diverse knowledge base in Shanghai. Co-locating in the park may not necessarily lead to collaboration (Prevezer, 2008), although the government strives to foster such dynamics by setting up a common pool of resources and platforms for sharing equipment and conducting experiments. The intervention of urban planning and innovation policies has been critical to the creation of conditions for innovation, for example developing a new land use and attracting overseas returnees. The emergence of biotech innovation hinges upon these conditions being met, particularly in Zhangjiang as a new suburban place. The growth of Zhangjiang did not start from earlier agglomeration dynamics. They present a path-breaking trajectory, not because firms co-locate in the city, but rather because multiple forces act at the same time to drive the concentration of biotech innovation.

Thinking of the city as an arena of development which eventually affects innovation goes beyond the notion of ‘innovative cities’ (Simmie, 2001), which regards the city as an innovative milieu. Shanghai has seen the development of multinational research centres, which is related to but not limited to its global city status. In another context, it is argued that global cities serve as ‘locational anchoring points’ for global pharmaceutical and biotech firms; that is, biotech firms are more likely to be associated with or located in global cities (Krtáke 2014). In many cases the city indeed presents an innovative environment that is conducive to innovation. The city is what Shearmur (2012) noted as a ‘key geographical locus’ for innovation, because ‘factors other than interactions and learning factors such as the social position of agents and their market power’ may also explain why innovations are developed in cities (Shearmur, 2012: 515, emphasis added).

Thinking of the city as an arena also means that the policy of fostering local interaction might not be appropriate in all circumstances, as Moodysson (2008) finds in the case of the Swedish Medicon Valley, where local buzz is largely absent and more meaningful interactions are along globally configured professional knowledge communities. According to Shearmur (2012), the city is not necessarily the ‘font of innovation’, which means that the political economic forces beyond the agglomerative and diversity features of the city are acting to produce an innovation outcome. In many cases, these forces are most forceful and salient in the city.

There might be some objection that the notion of the arena is quite similar to the regional innovation system (RIS), a platform or knowledge base (Asheim et al., 2011). How is this understanding different from existing theories such as RIS and platform policies? Understanding

the city as an arena of innovation is not a normative policy prescription. It does not guarantee that the city is conducive to innovation. Therefore, a deliberate policy that pursues the territorially concentrated form of innovation governance does not ensure a positive outcome. The outcome may not be all positive and contribute to the development of innovation capacities. For example, the high-tech park policy has long been recognised as ‘high-tech fantasies’ (Massey, Quintas, & Wield, 1992). The model of ‘Silicon Valley’ has been applied worldwide (Castells & Hall, 1994; Wong, 2011), but without much success (Miao & Hall, 2014; Phillips & Yeung, 2003). The notion of the innovation arena downplays intervention policies that pursue knowledge spill-overs. We appeal for more critical and context-dependent analysis through studying the geographies of innovation through comparative governance studies (Robinson, 2016). This also requires attention to the process of development to ask how various agencies are actually assembled. In short, the notion of ‘arena’ is broader than the scope of innovation components; it is not predefined and not limited to the factors which are related to innovation. The arena may include opposition to innovation or speculators who might not be conducive to innovation. The understanding of the city as an innovation arena also differs from thinking that innovation concentrates in the city because of some trait of the city itself, for example that diversity or richness of urbanism that can lead to creativity or innovation in general. Peck (2005) made an extensive critique of associating creativity with mysterious ‘creative-city strategies’.

To rethink the connection between cities and innovation, we need to identify the real actors and their agencies in the city rather than resorting to a general notion of agglomeration, diversity, or relatedness (between economic sectors). Hence, we need a more political economic analysis of innovation which has so far been explained extensively through economic factors. The recent cultural and institutional turn does significantly expand the scope of the new economic geography beyond economic analysis. But attention to the dynamics of local urban development and its political economic dynamics is insufficient.

In sum, we argue that the city is an arena where multiple agencies affect innovation capacities and that the concentration of innovations in the city is an outcome of the political economic process of the development of innovation capacities. The intrinsic dynamics of knowledge generation, which are extensively studied under agglomeration and diversity paradigms, underpin the manipulation and politics of development, and are necessary but insufficient to understand such a spatial pattern.

#### 4. A view from China's biotech innovation

In this section, we provide the example of the Zhangjiang High-tech Park to illustrate the perspective of seeing the city as an arena for concentrated innovation. The research is based on our previous extensive empirical studies of the Park since 2008. We have conducted multiple fieldworks and interviews with biotech firm CEOs, local planners in Pudong and in the Shanghai Institute of Planning and Design, business consultants on park finance, and biotech lab technicians. We collected extensive documents including a research report by Shanghai Jiaotong University, government policies related to Zhangjiang High-tech Park and pharmaceutical industries in Shanghai.

Zhangjiang is a good case to understand the concentration of biotech in high-tech parks in China. It is located in the Pudong new district of Shanghai. Although it was established in 1992, its development was slow until 1999 when the Shanghai government developed a policy of ‘Focusing on Zhangjiang’. Still, Zhangjiang is located more in a suburban setting than in an urban environment. The lack of inter-firm interaction and the lack of an urban atmosphere have been observed. The park also has a problem of an imbalance between industry and residential housing.

In the case of Chinese innovation, understanding the post-reform political economy, especially the multi-scalar governance of the

Chinese state and its interaction with globalization, helps to explain why it is the city (rather than a larger subnational region) that has become the scale for innovation. China offers a remarkable case for understanding why innovations are concentrated in high-tech parks, as Chinese cities play an important role in organizing economic development through a highly decentralized administrative system. Within the administrative boundaries of cities, innovation space is clearly defined into economic and technological development zones (ETDZs) and high-tech development zones (Cao, 2004), with different ranks endorsed by different hierarchies of the state. For example, national high-tech parks are approved by the central government. These development zones and industrial parks are substantial operational units, managed by development corporations and quasi-government organizations. As a result, their operation becomes more ‘entrepreneurial’ with a streamlined governance system.

The current literature on China's innovation rightly pays attention to the role of the state and its policies in innovation. However, it does not adequately address how these multiple forces come together in the city. In this regard, this paper examines the city as an arena where various forces and agencies interact and co-produce biotech innovation capacities. This requires some understanding of the entrepreneurial local state in managing its space (Wu, 2018), for example the high-tech park (Zhang & Wu, 2012), and in drawing revenue from land to support infrastructure related to innovation (Zhang, 2015). The local government strives to capture mobile resources made available by the central government and global R&D. In the remainder of this section, we will analyse the agencies above, within and outside the city.

#### 4.1. The central state: building an innovation nation

The central government has supported Shanghai to become a Chinese globalizing city. The emergence of biopharmaceuticals has to be placed within the context of a national strategy to foster ‘indigenous innovation capacities’. Biopharmaceutical innovation was identified as one of eight frontier technologies in the ‘Medium and Long-term Science and Technology Development Plan’ in 2006 (Zhang et al., 2011). The role of the central government includes the endorsement of special status in development zones besides direct resource allocation. These entitlements help the local government to capture domestic and international resources. In 2011, Zhangjiang became the third national demonstration zone for indigenous innovation (Zhang & Wu, 2012). During the visit of the new Chinese leader, Xi Jinping, to Shanghai in 2014 he stressed that Shanghai should emphasize innovation and subsequently Shanghai announced its ambition to become a ‘global science and technological innovation centre’. The interaction between the science park, the city and the central government can be seen from the transformation of Zhangjiang from a high-tech development zone to an innovation centre to implement innovation policies.

Zhangjiang is not just a physical space where biotech companies cluster, but also an institutional space in which state-allocated resources assemble. In 2006, the State Council renamed ‘Shanghai High-tech Development Zone’ as ‘Shanghai Zhangjiang High-tech Development Zone’, which includes Zhangjiang and six other parks in the metropolitan region. The change could be seen as a branding exercise as well as a policy to spread and replicate the Zhangjiang innovation model (Zhang, 2015). But the assembly of parks expanded quickly afterwards from 6 parks to 12, 18 and then finally 22 parks today in the whole metropolitan area of Shanghai. Without understanding the interplay between different forces from multi-scalar governance, it is difficult to understand the spatial dynamics of innovation. The perspective allows us to understand the agency above the locality, in particular the complex role of the state, shifting away from its direct promotion of science and technological programmes (Wu, 2007; Zhang et al., 2011) to a more decentralized governance of innovation, which involves both market mechanisms and state directives in the city.

#### 4.2. The entrepreneurial local government: building innovation spaces

The local government has been incentivised by the tax-sharing system into an entrepreneurial agent (Wu, 2018) and plays a significant role in building innovation capacities. Specifically, their agencies include the following aspects. First, the local government promotes innovation through public policies. Following the central government's directive to build ‘indigenous innovation capacities’, the municipal government of Shanghai further initiated the policy to ‘Focus on Zhangjiang’ in 1999, which strengthened the biotech sector in Zhangjiang (Zhang & Wu, 2012). Because of this policy initiative, Su and Hung (2009) argue that Zhangjiang High-tech Park is ‘policy-driven’. A high-profile management office is chaired by the mayor of Shanghai.

Second, the local government implements the development of science parks through large development corporations. The policy does not mean that the state now acts like a developmental state taking over all responsibility for funding and development. But rather the development has been driven by a state-owned enterprise. Through the coordination of the management office, the park development has been able to break out of divisions between government departments and bureaucratic constraints. The development of infrastructure resorts to the land market, which not only develops common park facilities and experiment platforms but also provides a new source for venture capital (Zhang, 2015). In post-reform urban governance, the local government uses development corporations to achieve its development vision. Science parks are usually managed by development corporations, for example Zhongguancun Science Park in Beijing (Zhou, 2008) and Zhangjiang high-tech Park (Zhang, 2015; Zhang & Wu, 2012).

Third, the local government fosters links between universities and industries and influences universities to either relocate into the high-tech park or develop joint ventures between universities and industries. For example, Shanghai municipal government managed to persuade the Chinese Human Genome Centre to move from Beijing to Zhangjiang and required the Shanghai Chinese Medical University and its affiliated hospital to relocate from Puxi to Pudong new district. In Zhangjiang High-tech Park, Shanghai Fudan-Zhangjiang Bio-Pharmaceutical Co., Ltd. was established in 1996. Fudan University was interested in developing this branch in Zhangjiang not only because of the access to the industrial base but also due to the status of Zhangjiang as the ‘National Indigenous Innovation Zone’ endorsed by the central government.

Fourth, the local government tries to attract talents and skilled workers through actively participating in the central government programme and developing their own talent programmes. In the literature, tolerant local cultures and rich urbanism are considered important to attract the ‘creative class’ (Florida, 2002). Consequently, the development of social capital through social networks facilitates innovation. Saxenian (2002) highlights the importance in Taiwan of transnational immigrants between Hsingchu in Taiwan and Silicon Valley. Similarly, Chinese returnees play a very important role in building up China's biotech innovation (Prevezer, 2008). Overseas returnees are not only scientists but also entrepreneurs who have experience of working in large Western pharmaceutical companies. The introduction of managerial skills to Chinese enterprises helps to fill a gap in commercializing technologies. We need to investigate the political economic process in order to explain talent concentration. The processes go beyond agglomeration effect. The talent programmes initiated by the central government operate on the basis of competition. Universities and key state-owned enterprises are encouraged to submit strong candidates for their positions. Scientists working in private firms are also allowed to propose themselves through the high-tech park. For the local government, the programme is an additional resource from the central government to boost the local economy, and hence tries to attract qualified candidates for competition. As a result, high-tech parks in large cities such as Shanghai have a better chance of receiving funding from central and local governments' talent programmes.



### 4.3. Global R&D: gaining market access and contract research

Multinationals select large global cities as their bases for R&D centres because these cities have strong science bases and can provide market access (Grimes & Miozzo, 2015) and support through contract research. These cities are able to assemble these diverse resources because they are global cities and economic centres. Here, we emphasize the institutional dynamics besides the knowledge dynamics of innovation. Grimes and Miozzo (2015: 1891) studied big pharma's internationalization of R&D in Shanghai and found that tapping into knowledge sources outside big pharma's home countries was not the main driver. Rather, it is a result of greater offshoring activities of early drug development because China, as a country with a large market, is becoming an important centre for active pharmaceutical ingredients (APIs) and clinical trials. Because large pharmas are facing the so-called 'patent cliff', which means their existing patents will be ending at similar times, they are competing for the development of generic drugs (Grimes & Miozzo, 2015: 1890). The use of the Chinese market to develop new drugs is a key reason. For pharmaceutical production, cost savings and market potential are two major reasons, and the network formed within the industry is secondary – derived from these developments at a later stage. Therefore, the relocation and development of global R&D is more a consideration of firm strategy rather than of agglomeration in the destination city.

In contrast to Glaeser (2011), who views the local buzz of cities and the capacities they offer for frequent and unplanned face-to-face contacts, Zeller (2010) identified the role of global production networks which created the 'pharma-biotech complex' in Boston. Biotech innovation seems to be affected by a set of dynamics that may or may not be necessarily at the scale of the urban (Shearmur, 2012). Important considerations are cost saving and risk reduction. Here, the city represents a particular governance form, which leads to the promotion of innovation. Shearmur (2012: S15, also Yeung 2005) argues that 'cities appear to be loci of innovation because agents with the social and market power to promote [innovation...] tend to reside and work in cities'. As shown here, the high-tech park is located in major cities in China because the local government has the incentive and power under decentralized economic governance. The driver of land development also means the city government has the practical capacity to organize related infrastructure development to support innovation in high-tech parks (Zhang, 2015). To multinational pharmaceutical companies, Shanghai presents a new opportunity as the gateway to the Chinese market. Within the city, various development zones provide concrete support for relocating their R&D centres. In short, the external conditions and agencies for biotech innovation may not be created by agglomeration. These agencies, however, regard the city as an important arena to implement their strategies. Multiple forces across different scales work together to produce the conditions that are attractive to the concentration of biotech firms in the city.

### 4.4. The city as an arena for innovation actors

The city is becoming an arena where all these actors are assembled to play their roles in biotech innovation. This is not to deny that knowledge dynamics between firms are very important. Rather, we argue that these actors in the arena of the city, in particular in this case of Zhangjiang, help to develop the conditions for knowledge dynamics. In the case of Chinese biotech, the central government shifts its governance model of innovation from science programmes to high-tech parks (Wu, 2007). At the same time, the local government is highly incentivized under 'state entrepreneurialism' to pursue economic growth through urban development (Wu, 2018). Global R&D, facing the pressure for new drug development, adopts a cost-saving and risk-reduction strategy and aims at the vast Chinese market to set up their R&D centres in major Chinese cities, in particular Shanghai. These actors have different motivations but all happen to exert their influence on the

development of biotech in Zhangjiang, which leads to a highly concentrated pattern of innovation in Shanghai. The rising importance of innovation and indeed the emergence of new industrial sectors such as biotech in Chinese cities are also changing the trajectory of urban development.

## 5. Conclusion

This paper attempts to extend the scope of existing economic geographic studies on the knowledge dynamics of innovation to political economic analyses of how the knowledge dynamics are materialized, especially during the process of urban development. The paradigmatic explanations of agglomeration and diversity are mainly derived from developed economies in the West. Rather than applying existing theories to the Chinese case, we follow the spirit of comparative urban studies where new understandings can be generated from 'elsewhere' outside the North (Robinson, 2016). Our question is quite intuitively simple: can these theories help to explain why China's biotech innovations emerge and concentrate in major cities such as Shanghai? This specific question about the city and innovation requires going beyond knowledge dynamics, because although knowledge dynamics are universally observed the intrinsic conditions of knowledge generation are 'necessary but not sufficient' (Lovering, 1999) for understanding the relation between the city and innovation.

We argue that the city is an arena where various agencies impact innovation capacities. Together they form variegated institutional dynamics of capturing resources and innovation capacities. In China, the city has become a substantive scale to organize economic development and provides the state-market interface (Wu, 2018). The ubiquitous landscape of high-tech parks in Chinese cities has led to the geographical concentration of innovation. The concentration is not a result of inter-firm linkages because firm-level interactions are still weak though being strengthened by emerging opportunities (Prevezer, 2008; Zhang, 2015).

Understanding the city as an arena where multi-scalar forces interweave helps to reveal the development process of innovation. In China, it is insufficient to attribute the concentration of innovation to being 'policy-driven' or 'state-led' or 'state-sponsored' (Prevezer & Tang, 2006; Su & Hung, 2009; Zhang et al., 2011), because the Chinese innovation system is no longer state-centred and enterprises have become major actors (Liu & White, 2001). Rather, the state agency plays its role through concrete geographical space and territorial dynamics. In the post-reform political economic landscape of China, the city government becomes a major actor in urban development. While agglomeration and diversity help to explain knowledge generation, the arrival of big pharmas in Pudong Pharmaceutical Valley is a response to political economic conditions created by the urban development process. Clustering is the result of rather than the cause of enhanced innovation capacities.

Instead of thinking of biotech in Shanghai as an idiosyncratic case, we should rethink the connection between the city and innovation. The case shows that the city provides an arena for various actors across geographical scales. For that purpose, we need to understand the peculiar institutional setting that creates the city as a place for concentration, for example in the UK a 'new regionalism' in the 1990s was advocated for upgrading old industrial areas (Lovering, 1999). Phelps (2008) argues that the concentration of regional innovation is not the effect of 'cluster' but rather the 'capture' of local state policies. The formulations of 'platform policies' (Asheim et al., 2011) and 'triple helix clusters' (Etzkowitz & Leydesdorff, 2000) imply more institutional complexity than has been hinted at as a spatial manifestation of agglomeration. Indeed, the association of innovation with the city may not be purely driven by knowledge dynamics, as 'only innovators who require intense and frequent interactions will pay the cost of locating in metropolitan areas' (Shearmur, 2012: s13). More recently there has been continuing interest in 'knowledge-based urban development' and

‘science cities’ (see Benneworth & Ratinho, 2014, for its practice in the Netherlands; Forsyth, 2014 for high-tech corridors and other forms). China’s biotech suggests that a more political economic understanding is needed. Concurring with the appeal from Agnew (2012) for a fuller understanding of politics in economic geography, we highlight the need for a political economic analysis in economic geographical studies of innovation.

## Acknowledgement

We would like to acknowledge the funding support from UK Economic and Social Research Council (ESRC) (ES/P003435/1) and the British Academy project award (No. SG113182).

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