

Housing the knowledge economy in China: An examination of housing provision in support of science parks

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Abstract

Little attention is paid in the extant academic literature to the question of housing knowledge workers despite the potential mismatches between housing supply and demand. This paper provides an initial examination of housing the knowledge economy in China, focusing on three science parks (SPs): Zhongguancun (Z-Park, Beijing), Zhangjiang (Z-SHIP, Shanghai) and Optics Valley of China (OVC, Wuhan). It discusses to what extent, and how these three SPs have factored in the housing dimension in connection with the knowledge economy, paying particular attention to housing affordability, location (inside the SPs or outside in the wider city-region) and the mode of provision (market or state). Insights were drawn from documentary analysis and in-depth interviews in the three chosen case studies. Initial evaluation of policies geared towards housing supply in China suggests that the housing question needs to come to the fore in discussions of structural transformation towards the knowledge economy.

Keywords

affordable housing, China, knowledge economy, knowledge workers, science parks

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Introduction

Since the 1980s, economic development strategies for nations, regions and cities have emphasised the potential importance of science parks (SPs), science cities, technopoles and the like (Castells and Hall, 1994; Miao et al., 2015). Designated zones such as these are seen to be important in raising creativity, innovation and productivity in many national settings. However, scholars and practitioners have emphasised their economic contributions, without much regard for what wider infrastructure is required to have these knowledge facilities function

effectively. Housing provision is just a case in point. Such negligence is problematic as housing is an important ingredient among the collective consumption needs of those employed in SPs and constitutes the quality of place (Florida, 2002) for the wider city-region.

These collective consumption needs of the knowledge economy are the subject of a variable territorial politics and planning

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(Jonas et al., 2010). There are very few extant studies to draw upon but a reasonable assumption is that individual SPs will differ in their planning, provision and integration of housing issues in their parks' development and coordination with the wider city-region. In particular, the potential for a mismatch between housing supply surrounding the SPs and demand generated by such large agglomerations of labour, may 'squeeze out' or 'scare away' a proportion of knowledge workers. This can lead to the expected labour market impacts of SPs failing to materialise when they are deployed as a tool of regeneration (Burfitt and Ferrari, 2008), or to 'overheating' in those cases where SPs have been an ingredient in the emergence of new knowledge hubs (While et al., 2004). These housing-labour dilemmas could be complicated further by policy choices regarding whether and to what extent housing provision is made within the park itself or supplied externally from the wider city-region.

Many of these 'urban contradictions' (Saxenian, 1983a) accompanying the development of knowledge economies, including their constituent SPs, have been discussed in the Western contexts. In East Asia, despite the importance of SPs to the strategies of the developmental states, there is a dearth of research evaluating the ways in which housing provision is planned for and supported by science park authorities. The generalities of the developmental state model from countries such as Japan and the four Asian tigers, refer to the strong government intervention in support of market growth (Johnson, 1995; Wade, 1990; Woo-Cumings, 1999). For the concerns of this paper, this model suggests a prevailing measure of government intervention in meeting the collective consumption needs of the knowledge economy. Nevertheless, Morrison (2014) has noted how some Chinese cities' urban entrepreneurial strategies were confronted with

delivery problems and limited effectiveness, whereas Miao and Maclennan (2014) reported the noticeable capitalisation trend in China's housing system reform, which could undermine its social stability. These findings suggest that a deeper reflection on the interface between housing and the knowledge economy in the world's pre-eminent developmental state economy is much needed. As the housing market in China is still a seller's market – commodity housing by the developers and affordable housing by the state – this paper focuses not on the residential demands emanating from knowledge workers, but instead on evaluating the supply side of housing policy, although an overview of the size of demand will be outlined.

Against this background, this paper presents an examination of housing provision in the development of the knowledge economy centred on SPs in Beijing, Shanghai and Wuhan. The research questions are: (1) to what *extent* are SP authorities aware of the housing needs from the knowledge workers? (2) Where SP authorities and local governments have considered the 'housing question', *how* have they sought to address it in terms of the interrelated aspects of: (a) affordability (b) location (inside the SPs or outside in the wider city-region)? (c) What is the mode of provision (market or state)?

Housing the knowledge economy: Neglected questions

Influential accounts point to the structural transformation of national economies from labour to capital to knowledge-intensive industry sectors (Castells, 2000, 2010, 2011). Although it is less clear whether such structural transformations are adequately captured in the term 'creative class' (Berry, 2005; Markusen, 2006b; Peck, 2005), the related literature is nevertheless important for what it suggests regarding a role of

housing in local economic development. Making use of the 'creative class' idea, scholars argue that 'the old mode of people moving to follow jobs is turned on its head' (Baris, 2003: 42). The strong implication here is that it is the quality of place that functions as a magnet for human capital. Yet, curiously, the role of the housing market in general, and the policies shaping the *supply* of housing in particular, have been marginalised within such discussions. Tangible factors such as infrastructure and housing provision barely figure in Yigitcanlar et al.'s (2007: 22–24) four magnets to the creative class, or in Florida's six factors defining the 'quality of space' so sought after by members of the creative class (Berry, 2005).

Designated science and technology parks are one discrete and widely used policy ingredient seeking to affect economic transformation. Yet in the literature on SPs too, housing has rarely featured prominently. The literature on SPs charts an evolution from what Massey et al. (1992) documented as a rationale based upon the linear model of knowledge transfer, to one based on multi-faceted operational models (Hansson et al., 2005; Lofsten and Lindelof, 2002). It was only when the local institutional environment being brought into the SPs analyses (see for example Scott, 1993; Segal et al., 2000; While et al., 2004), that the literature began to question the *extent* to which political and planning priorities have centred on the collective consumption needs of these new industrial spaces, in forms of transport and communication infrastructure but also housing (Jonas et al., 2010). Thus SPs and their effects on housing markets have been at the heart of localised planning dilemmas of 'unblocking growth' (Valler et al., 2012, 2014; While et al., 2004) or urban regeneration (Burfitt and Ferrari, 2008) in Britain and elsewhere. These concerns lead on to the subsequent question of precisely *how* local

policies have sought to house the knowledge economy. Three dimensions are particularly worth noting.

The first relates to the work–life balance and affordability. Housing is a fundamental need that composes much of the basic urban layout and structure, the quality and dynamic of communities and, ultimately, social reproduction (Castells, 1977). As a consequence, the 'work–life balance' has become a prominent concern not only in the West (Cervero, 1989) but elsewhere too (Liu et al., 2009). This misalignment between housing demand emanating from workers, and the existing or planned housing supply could prove to be even more severe in the case of SPs, regardless of whether they are on greenfield or brownfield sites. SPs in greenfield locations as in the cases of Silicon Valley (Saxenian, 1983b), Cambridge, UK (Segal et al., 2000; While et al., 2004) and Hsinchu in Taiwan (Castells and Hall, 1994) have suffered declines in the *affordability* of housing. When SPs are proposed as part of a regeneration strategy, such as in the case of the Longbridge site in Birmingham (Burfitt and Ferrari, 2008), there can be a mismatch between the housing offered in the neighbourhoods most closely associated with the plant closure and the preferences of incoming knowledge workers.

The second concern relates to the residential location preference of knowledge workers. If firms increasingly are following the locational preference of talents, then given the latter's high mobility, disposable income and particular locational and residential appetite (Markusen, 2006a), knowledge workers are likely to be pushing the transformation of the urban economic landscape via the *location* of their demand for housing. Musterd (2004) believed that the creative class will be highly urban-oriented, and Lee and Murie (2004: 242) also suggested that the creative class 'appears to reject large

parts of traditional housing markets and especially monotonously designed suburbs built for the conformity of the organizational age'. Yet, many of the assumptions apparent in the literature regarding the urban preference of creative workers may be overdrawn given evidence of creativity in the suburbs (Phelps, 2012). Tomaney and Bradley (2007) found that many creative workers moved from urban areas to Wynyard Park, Newcastle, because of its 'rural feeling'. Moreover, locational preferences of knowledge workers are likely to change along with their life cycle (Burfitt and Ferrari, 2008; Lawton et al., 2013). Therefore, the diverse preferences of creative workers are likely to drive needs across a variety of different segments of a local housing market (Van Oort et al., 2003).

A third dimension relates to the mode of provision. If urban amenity drives economic growth, then the fact that urban amenity is not only tangible but is the subject of collective consumption and provision (Clark et al., 2002; Frug and Barron, 2008) is often overlooked. That is, the *mode* of housing supply is an important tangible and, more or less effectively, planned ingredient in urban amenity. The development of different tenures and mix of housing types is the subject of a more or less effective territorial politics and planning alongside road, rail and communication infrastructure. In the UK, Segal et al., (2000) found that planning controls were loosened partly because major local employers were faced with recruitment difficulties resulting from earlier restrictions in housing supply. The same debates continue to resurface in concern over the 'Greater Cambridge' economy (While et al., 2004). Housing mix and tenure has figured in the desire to promote 'big science' in the UK in a context of severe accessibility and environmental constraints (Valler et al., 2014), but with little such institutional development.

The housing market and the knowledge economy in China

Developmental states have been notable for their altogether more planned approaches to stimulate economic structural change in general (Johnson, 1995; Wade, 1990; Woo-Cumings, 1999) and through specific policy vehicles such as SPs in particular. In China, as in other developmental states, SPs have been at the heart of national science and technology policy since the early 1990s. In particular, the Torch Programme, supervised by the Ministry of Science and Technology and executed through the Torch Centre, was launched in 1988 as the overarching programme to support SPs. Since the acknowledgement of the first national SP (Zhongguancun Science Park) in 1988, there were 114 national-level SPs in total by 2013 scattered in almost every province (except Tibet) (Torch Centre, 2015).

Studies on Chinese SPs have concentrated on their institutional arrangements (Walcott, 2007; Watkins-Mathys and Foster, 2006; Wright et al., 2008). Only a few have touched in a cursory way on the housing question (see for example Li and Kang, 2004; Zhou, 2005). Nonetheless, China's reform in its housing market and its science and technology system arguably further complicates the relationship between housing and SPs. In the housing system, marketisation in China has pushed up its urban private housing ownership to around 87% (China Household Finance Survey, 2014). Yet constrained by land availability, many cities have to exert 'double standards' on *who could buy what*: only those registered as local households could apply for public housing, and in 2010, for commercial housing as well in the hottest cities such as Beijing and Shanghai (State Council, 2010). This means migrant workers could be excluded from the local housing market. In China's science and technology system, the State had abolished its arbitrary

Table 1. R&D and total employment in National SPs against the national average.

Year	R&D employment in NSPs (unit: 10,000)	R&D employment in China	Total employment in NSPs	Total urban employment in China	R&D proportion in NSPs against national (%)
2007	120.3	173.6	650.2	30,953	33.0
2008	134.5	196.5	716.5	32,103	30.7
2009	155.7	229.1	810.5	33,322	27.9
2010	161.1	255.4	960.3	34,687	22.8
2011	174.4	288.3	1073.6	35,914	20.2
2012	223.6	324.7	1269.5	37,102	20.1
2013	258.6	353.3	1460.0	38,240	19.2

Note: there were 54 NSPs in 2007–2008, 56 in 2009, 83 in 2010, 88 in 2011, 105 in 2012, 114 in 2013.

Source: China Science & Technology Statistics (2003–2014); China Statistics Bureau (2002–2014) and Torch Centre (2013–2015).

labour allocation in favour of greater labour mobility since the late 1980s. Universities and research institutions function as talent attractors (Florida et al., 2008; Li and Florida, 2006), and the university-affiliated SPs provide thriving job markets when the Chinese youth graduate (Haibin, 1992). Table 1 summarises the employment figures in the national SPs in China. Their high proportions of R&D personnel against the national average reveal the disproportionately high agglomeration of knowledge workers in these SPs. Conceivably, there are also significant collective consumption needs associated with these large numbers of knowledge workers, within which housing features prominently.

By now this paper has highlighted the likely collective consumption pressures exerted by the agglomeration of knowledge workers in SPs. Yet the strategic responses to such pressures along the dimensions of housing affordability, location and provision mode remain unclear. In China, government control of the key housing inputs, such as land and finance, underlines the importance of examining such pressures from the supply side. The remainder of this paper will examine the awareness and actions of the Chinese SPs towards housing provision, outline the

methodology used in data collection and analysis, and present the case studies.

Methodology

No macro-level data are available on the real estate markets around China's national SPs, so aggregated cross-sector analysis proves to be difficult. Therefore the method of comparative case study was chosen, which is appropriate when the phenomenon under investigation (SPs) is not easily separated from its wider context (the wider urban economy) (Yin, 1994).

Zhongguancun (Z-Park) in Beijing, Zhangjiang (Z-SHIPs) in Shanghai and Optics Valley of China (OVC) in Wuhan are chosen as examples (see Table 2 for their general profiles). These are the three leading SPs in China and are the first 'National Self-Innovation Model Zones'. As such, they are the representative cases to highlight the potential mismatch between housing provision and aggregated housing demand of knowledge workers. Moreover, they are perhaps the most appropriate to compare with the wider literature on knowledge hubs and science park examples internationally. Interestingly also, the three cases offer contrasting city-region contexts and unique

Table 2. Profile of Z-Park, Z-SHIPs and OVC as of 2013.

	Z-Park	Z-SHIPs	OVC
Year designated National Science Park	1988	1991	1991
Year designated Innovation Model Zone	Mar 2009	Mar 2011	Dec 2009
Physical coverage (km ²)	232.52	470.5	518.0
Number of enterprises (unit)	15,455 (1)	2806 (4)	2883 (3)
Year-end employment (0.1 million)	189.9 (1)	72.2 (2)	41.9 (4)
Industrial output (0.1 billion RMB)	7890.3 (1)	6665.8 (2)	5086.2 (4)
Total revenue (0.1 billion RMB)	30,497.4 (1)	11,368.9 (2)	6517.2 (3)
Actual tax turnover (0.1 billion RMB)	1506.6 (1)	595.7 (3)	320.9 (7)
Net profits (0.1 billion RMB)	1908.2 (1)	728.9 (2)	394.7 (6)
Exports (0.1 billion USD)	336.2 (1)	312.8 (2)	104.7 (13)

Note: figures in brackets refer to the ranking of the SP among the 114 NSPs.

Source: Cheng et al. (2014: 59–61).

development pressures. Exploring how these city-regional contexts shape and are shaped by the housing provision policy is therefore meaningful.

The first research question is concerned with evaluating the *extent* to which local governments have factored in housing into their strategic plans. To answer this question, a review of relevant academic and policy documentation, as well as collecting official data on land use and housing provisions in these parks was undertaken. The techniques followed were content analysis suggested by Weber (1990) and Krippendorff (1980). ATLAS.TI was used to conduct the analysis. In the first step, the two most relevant strategic documents available for each park were selected, which were (1) the most recent five-years plan of the SPs and (2) their longer term development strategy. Second, given that the focus of this paper is on housing supply to knowledge workers, all those sections or paragraphs where human capital and housing were mentioned were chosen as the unit of analysis, which were big enough to give the contexts and small enough for effective analysis (Graneheim and Lundman, 2004). From there, an inductive approach in coding and abstracting was followed, and a key-word-

in-context list was established for each document. The result of this open-coding, following Cavanagh (1997), was then grouped into six categories that best capture the foci of this paper, including: (1) Housing; (2) Residential land; (3) Planning (urban and infrastructure focused); (4) Price; (5) Coordination; and (6) Human capital. The classification process was re-run twice in order to increase the reliability of the result (Stemler, 2001). Interviews with housing experts and SP managers helped triangulate the content analysis, and thus increased its validity (Shapiro and Markoff, 1997).

The second research question is *how* these SPs have sought to address the housing issue surrounding the attraction and retention of knowledge workers, including affordability, location and mode of provision. Here the average housing prices in the districts covering the three SPs were first drawn upon, in order to infer the issue of housing affordability. Data were collected by Xitai National Real Estate Data Centre and Soufang Database. Both are among the largest real estate transaction service websites, which record monthly and annual housing prices in different districts of the top 100 Chinese metropolitan cities. So they provided a geographical reference to the housing markets

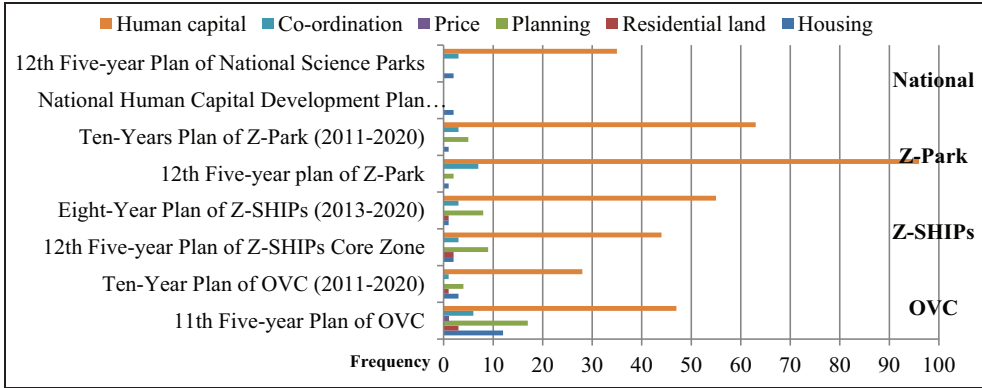


Figure 1. Frequency of the key dimensions appeared in the three SPs and national regulations.
 Source: the author.

around the three SPs. Emerging patterns from these secondary data were explored further through 25 face-to-face interviews undertaken between 2010 and 2014, which allow comments on the location and mode of housing provision. Interviews were organised in a semi-structured manner, in which participants were guided to articulate their understandings of the housing-knowledge economy dilemmas. Interviewees included professional planners (three in total), academic staff (five), property development companies (three), science park administration committees (six), local civil servants (three) and local residents (five).

Housing the knowledge economy in the three cities

National background

Figure 1 summarises the result of content analyses in each of the main documents pertaining at the national and local levels. The frequencies of the key dimensions appearing in these documents offer a direct reflection on the policy awareness of the housing issues.

To start, the national benchmark documents examined were *National Mid-to-Long Term Science and Technology Human*

Capital Development Plan (2010–2020) and *12th-Five Year Plan of National High-Tech Development Zones*. These documents were chosen because of their relevance and comparability with local-level policies. In the former, young knowledge workers’ housing needs were addressed lightly in one sentence, where their priority in affordable housing allocation was declared. Nevertheless, a distinction needs to be made between the different types of affordable housing in China (see Chen et al., 2014 for a summary). Currently it is only the Public Rental Housing (PRH), legislated in 2010, that is available to interregional migrants (Maclennan et al., 2014). In the 12th-Five Year Plan of National Science Parks, ‘housing’ was mentioned twice: first, the government acknowledged that the urban facilities in these SPs, such as commercial, leisure, hospital and culture infrastructures, had been improved significantly. The second time housing was emphasised in the context of attracting international talents, including leading scientists, entrepreneurs, foreign managers, and business and financial professionals, which indicated a policy recognition of what Saxenian (2006) described as ‘new Argonaut’ returnee flows.

Housing awareness in the three SPs

Benchmarked against the national-level documents, the same content analyses of the local development strategies were conducted. For Z-Park, it is clear in Figure 1 that concerns for housing-related issues were not prominent. Instead industrial development was its exclusive focus and the limited land available in Z-Park was allocated mainly to its priority sectors. In the *Ten-Year Plan of Z-Park*, there was a dedicated section on spatial planning, but what was highlighted there was the industrial specialisation and complementarity of different sub-parks. The only time housing was mentioned was in its *12th Five-year Plan* (Z-Park, 2011b), where the provision of PRH for entrepreneurial human capital was suggested, which basically followed the tone of the national government.

Comparatively, the documents pertaining to Z-SHIPs were more explicit on housing provision. In the *12th Five-Year Plan of Z-SHIPs Core Zone*, the necessity to quicken the construction of business ancillaries, leisure facilities and housing was highlighted as one of its six main tasks (Pudong Academy of Reform and Development, 2010). The *Eight-Year Plan of Z-SHIPs*, although more industrial focused, devoted a whole section to the construction of an innovation-friendly environment. It was emphasised in this section that industrial development and urban amenities had to be developed together. The necessity of improving basic auxiliary and living facilities, including employee dormitories, was noted. The intention was to provide a relatively self-contained living and working environment (Sina Housing, 2008).

Public awareness of housing issues was most noticeable in OVC (Wuhan), though this presents an interesting challenge in how to interpret the overall objectives and likely future achievements of this SP (Miao and Hall, 2014). According to OVC's *11th Five-Year Plan*, industrial land covered 10 km², and residential usage, which mainly referred

to private housing development, had a planned area of 8 km², plus a further 4 km² for public facilities (OVC, 2010). In the *Ten-Year Planning Outline of OVC* (2011–2020), the issue of housing was downplayed somewhat (Wuhan Land Resources and Planning Bureau, 2011). Nevertheless, there was a section on cultivating a good environment for innovation activities, in which the social-welfare system, including affordable housing, was highlighted as one of the government foci. In comparison with the other two cases, however, there were no explicit preferential policies for top-level talents (although these were articulated in other, city-wide talent attraction plans), which is noteworthy against the fact that OVC, and Wuhan in general, was much less attractive to elites. Similar contradictions could be found in the dimension related to 'human capital', which was least mentioned by OVC compared with the other two SPs (Figure 1). This leads to the speculation that OVC's approach to housing, and to the SP's development in general, might be more oriented towards revenue growth, which emerged as a common theme during the author's field work. Some interviewees had made especially harsh comments on the shift from industrial to real estate development in OVC, saying that the spatial expansion of OVC was driven by selling land, as this approach was quicker in raising revenue and faster in leveraging political achievements (Interview: Wuhan Planning Bureau, 10 July 2010).

Contrasts in provision for housing: Affordability, location and mode of provision

Affordability. Contra to the different levels of public awareness openly expressed, the housing supply and demand gap was most severe around Z-Park and least so at OVC.

Housing prices in Beijing are always the highest within China. The average housing

price in this city in October 2013 was 36,299 Yuan/m², an increase of 27.4% compared with the previous year, and 10,000 yuan/m² more than the second highest city, Shanghai (Center of National Real Estate Market, 2013b). Among the 18 districts in Beijing, the average housing price of Haidian District, where the core of Z-Park is based, was the fifth highest, falling only behind the four inner districts (Center of National Real Estate Market, 2013b). A survey among the young employees in Zhongguancun revealed that high property costs and rental costs were the top concern for their living (Communist Youth League of Haidian District, 2007), which has increasingly become a burden for local companies as well (Zhou, 2010). Leaving aside the speculation

factor, such high property cost has partly resulted from the land shortage around Z-Park's Haidian core area (Z-Park, 2011a).

Since 1994, Z-Park has been actively seeking new development space through the so-called 'One District, Multiple Sub-parks' model (see Figure 2). Now, among its 16 sub-parks, 11 were located outside the fourth-ring road (which divides the core and peripheral districts of Beijing), and it is in these remote locations that housing, especially affordable housing, has been built. Yizhuang New Town, 16.5 km south of Beijing's CBD (see Wu and Phelps, 2011), in particular, had constructed 5000 units PRH by 2011, which were ten times those supplied in Haidian Districts (Beijing E-Town, 2011).

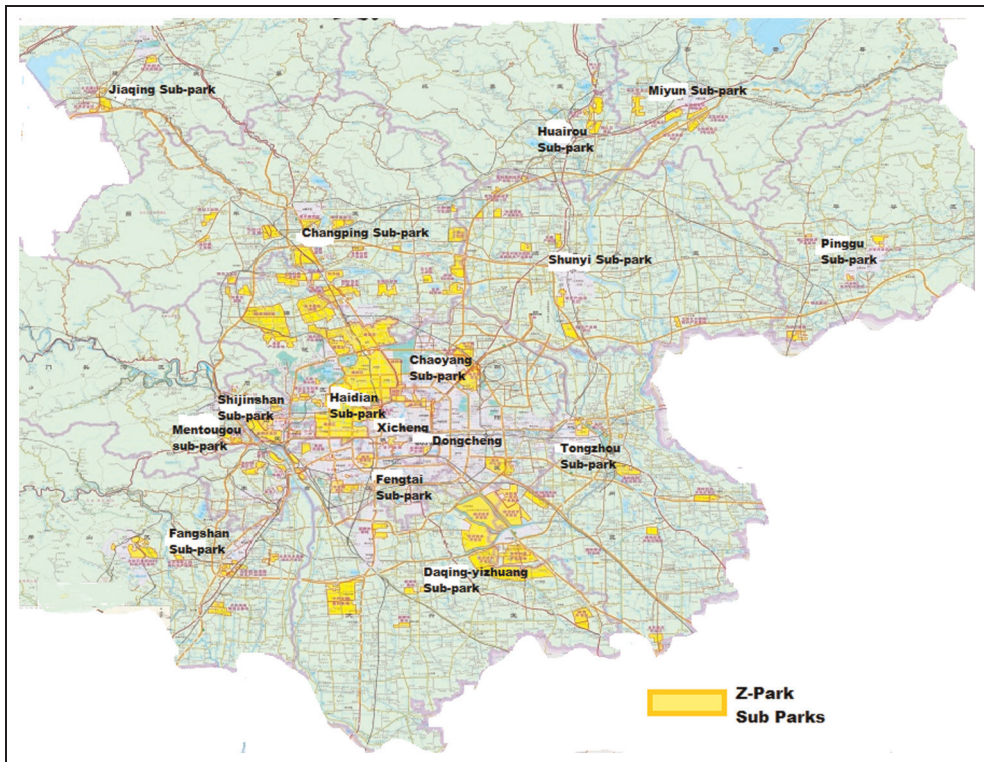


Figure 2. Location of Z-Park sites.

Source: Z-Park official website: <http://www.zgc.gov.cn/sfqgk/gyj>.



Figure 3. Location of Z-SHIPs sites in Shanghai.

Source: Z-SHIPS official website. Available at: <http://www.zjsfq.gov.cn/zh-CN/94580d83c3794de890b7fdec42390ebe>.

The housing market of Shanghai is the second hottest in China. In October 2013, the average housing price was 26,818 yuan/m², an increase of 12.73% compared with the previous year. Geographically, it had been the central districts where the housing market grew most strongly between 2009 and 2013 (Center of National Real Estate Market, 2013c). For Pudong New Zone, where Z-SHIPS is located (see Figure 3), the average housing price was 28,771 yuan/m² in October 2013, ranking tenth among the

18 districts of Shanghai (Center of National Real Estate Market, 2013b). This relatively affordable price might have resulted from the fact that, on the one hand, Pudong is located on the edge of the built-up area of Shanghai with easy access to greenfield and on the other, from the fact that urban amenities here are still being developed, which impairs its attractiveness for households.

Wuhan is a second-tier city; therefore its housing price is much lower compared with Beijing and Shanghai, and was only ranked

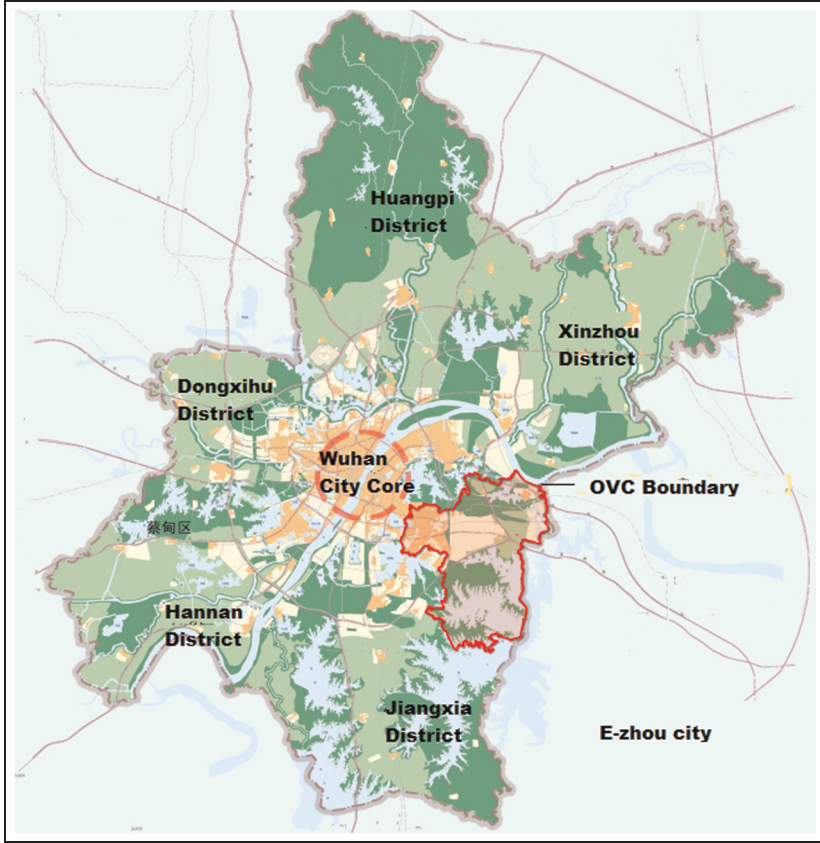


Figure 4. Location of OVC in Wuhan.

Source: Wuhan Land Resources and Planning Bureau. Available at: <http://www.wpl.gov.cn/pc-7-48662.html>.

27th among the 100 largest cities in China (Center of National Real Estate Market, 2013b). In October 2013, the average housing price in this city was 8663 yuan/m², an annual rise of 1.7%, and only accounted for 23.9% of that in Beijing, and 32.3% of that in Shanghai. Furthermore, all three districts comprising OVC (Figure 4) had a lower-than-average housing price in Wuhan, which had not improved noticeably since 2009 (Center of National Real Estate Market, 2013a). According to an engineer interviewed in OVC, the most competitive advantage of this SP was its low housing price. His family relocated from overseas to Wuhan

was mainly attracted by the housing affordability here (interview: 12 August 2010).

Location. In-depth interviews with policy-makers in the three cities revealed that, although articulated differently in the official documents, there were certain degrees of public awareness on the housing gap and the problem of affordability. However, there are also substantial differences in the extent to which the three SPs have been able, and have wanted, to plan and provide for housing within their own jurisdictions.

Z-Park, as introduced earlier, adopted a dispersed spatial development strategy

because of the land constraints. Most housing supplies therefore were planned at its peripheral new extensions and labelled as the High-tech New Towns, which contrasts with many urban regeneration projects found in the West (Marquardt et al., 2013). The 'not in my backyard' dilemma could be found in those more centrally located sub-parks. One Manager of a Bio-sub Park revealed that:

Our sub-park only caters for industrial development, no residential usage at all. I don't think it is necessary [to include residential in the land usage plan] because now people buy houses on the free market. Some time ago there was a document from the municipal government, requiring us to build public rental housing, which was strongly resisted by the district authority and left in the air ... this was because the district authority was not happy for its land to be used for affordable housing projects, which need a large amount of public subsidy on one hand, and have no revenue generating capability on the other ... Young employees might find it hard to rent nearby, let alone buy a property, but it is similar everywhere in Beijing, not just us. (Interview: 10 June 2013)

Some of these issues may be ameliorated in particular extensions of Z-Park such as in Yizhuang. The officer from the Beijing Housing Security Bureau confirmed that the PRH policy was implemented there most dutifully (interview: 5 August 2014). But as commented by a member of staff from Zhongguancun Development Group, 'by no means I will live there. It is too far, and nothing happens there' (interview: 25 August 2014).

Z-SHIPs comprises of 'one zone and nineteen sub-parks' with a planned coverage of 470.5 km² (Zhangjiang Science Park, 2013), the bulk of which is greenfield and offers the possibility of mixed land use. Coupled with a more supportive housing development policy, the disparity between housing supply and demand in Z-SHIPs

area is not as severe as that in Z-Park. One local real estate agency revealed that:

Zhangjiang is still a rising real estate market in Shanghai, especially after it became the Self-innovation Zone. Its core area has already shown a steady price rise; but this area [a recent extension of the core] is still under development, and therefore lacks living facilities and has poor transport linkage ... The properties here are mainly large-size, high-end flats [over 100 m²], and the average price is around 20,000 yuan/m². (Interview: 12 June 2013)

Thus, while housing provision within the park has become more of a priority in recent years (as discussed above), Z-SHIPs has also been content to a great extent by housing supply around the park given its reasonable price.

In OVC, the plentiful supply of greenfield land has contributed to the affordability and ease of housing supply within the SP. Since established in 1988, OVC had undergone at least six expansions. The latest one happened in 2010, which almost doubled the coverage of OVC from 224 km² to 518 km² (Miao and Hall, 2014). For some observers, this large amount of commercially available land is the most competitive advantage of OVC compared with Z-Park and Z-SHIPs (North Youth Net, 2012). The park authorities were also very open about their support to the real estate sector. The philosophy of the Management Committee, according to a Manager of the Economic Development Bureau of OVC, was to build a 'valley' instead of just 'Optics', and it requires a 'two-leg' development strategy of industries and urban amenities (interview: 13 August 2010). This high awareness and direct engagement therefore contrasts clearly with the practices in Z-Park and Z-SHIPs.

Mode of public provision. Z-Park included the provision of PRH in its strategic development plan, along with its strong emphasis on



Figure 5. Z-Park PRH example.

Source: the author.

human capital. This type of affordable housing was introduced by the Beijing municipal government in 2009, and Z-Park was suggested as the main beneficiary. Between 2011 and 2015, half a million units of affordable housing will be constructed, among which no less than 60% should be PRH (Beijing Commission of Housing and Urban-rural Development, 2012). Following this policy, Z-Park initialized its PRH Construction Plan in 2010, with the aim to provide at least 0.1 million units of PRH within three years (Z-Park, 2011c). The price for these talent flats was supposed to be 10–20% lower than the market price in a similar location (Feng and Zhang, 2011). Furthermore, imported talents and top returnees would enjoy priorities in buying or renting houses (Z-Park, 2010). Some of the PRHs are shown in Figure 5 – a zone of new housing construction 25 km from the core of Z-Park.

Z-SHIPs, comparatively, relied on the market mechanism to meet the housing needs of knowledge workers. Zhangjiang Science Park Development Corporation, an affiliate to the Management Committee of Pudong New Zone, was responsible for capitalising Z-SHIPs' real estate assets. Initially, this company acted mainly as the

representative of the government by renting land to other developers. Since 2000, it adjusted strategy to directly involve in real estate development. Now its businesses cover offices, factories, housing, hotels and leisure facilities. By 2009, real estate had become the main income generator for this company, with its Real Estate Development Subsidiary contributing almost 2 billion, or 97% of the company's profit (Kuang, 2011).

Nonetheless, Z-SHIPs also had a similar subsidised PRH to that in Z-Park, which first appeared in 2006 (Zhangjiang Science Park, 2006). By 2009, there were eight sites, 3168 units on the market, housing totally 9596 employees, a much smaller scale compared with that in Z-Park. Moreover, the operation of PRH was run by a subsidiary of Zhangjiang Corporation, which raised doubts that there might be conflicts of interest between the company's revenue maximisation motivation and the government's public welfare protection. Partly confirming this suspicion, it was found that besides the 200 yuan monthly rebate by this company, tenants in these PRHs were actually paying the market price (Xu, 2008). To attract high-end elites, Z-SHIPs published 'Innovative Ten Articles', which included explicit

Table 3. Summary comparison of the three SPs.

Items	Z-Park	Z-SHIP	OVC
1. Awareness	Least specified, which leaves more operational space	Explicit	Most explicit
2. Public actions			
2.1 Affordability	Least affordable; but extensions at urban fringes provide space; urban amenity in these Science New Towns however is questionable	Relatively affordable but risk of overheating; market plays the strongest role	Most affordable; large green space for extension
2.2 Location	Dispersed housing supply, not directly related to SPs	Nearby and within the SP, with both public and private housing available	Agglomerated supply within the SP
2.3 Modes	Largest scale PRH Plan; but most in remote locations	Smallest scale PRH; but not significant price difference between subsidized and open market housing	Medium scale PRH supply; real estate sector is supported by the SP
3. Potential sustainability	High living pressure, at the junction of industrial upgrading	Most dynamic SP; further growth might push up living and business costs	Attractive to middle-level human capital; but risks in changing development priorities

Source: the author.

incentives on housing and healthcare for imported talents. Regional competition for top human capital could be inferred here.

In OVC, a similar PRH policy was also in place. According to the social housing construction plan of Wuhan, there would be 12,000 units of PRH under construction in OVC since October 2011, which accounted for around 40% of the total number in the city. This promised amount therefore stands in between that of Z-Park and Z-SHIPs. Six out of the eight projects were, however, reserved for specific industrial parks or companies, such as for the Foxconn employees (Hubei Government, 2011). In order to attract talents, the Management Committee of OVC published its '3551 Talent Plan' in 2009, with the aim to import and cultivate around 50 industrial leaders and around 1000 innovative talents. This is the largest, yet the least selective of the targets among the three SPs.

Sustainability of the science park-based knowledge economy

Drawing together the available evidence, I now evaluate the likely impact of housing provision on the overall sustainability of the three SPs. Table 3 summarises the features of the interfaces between housing and SPs in the three cases. Overall, it seems the potential mismatch between housing supply and demand in China is as strong as in Western countries. Comparing the three cases, Z-Park faces multiple disadvantages such as land shortage and tangled relationships with the city planning bureau. Both Z-SHIPs and OVC have, to a greater extent, been able to factor-in the housing-related issues to their overall planning and development.

A tentative suggestion regarding the sustainability of parks as a result of the interactions between housing policy and recruitment could be made here. Although

Z-Park paid the least attention to housing and Z-SHIPs allowed market forces to set the price, they were still by far the most attractive sites for talents. However, a word of caution is that the rising living cost, especially the soaring housing prices, has pushed up the business cost in these two cities. It is therefore interesting to monitor the progress of these two SPs in order to check whether knowledge workers are following the jobs and relocate themselves, or other industrial formats on the upper value chain would emerge or be attracted to these sites.

For OVC, the question is quite different: on the one hand, it seems knowledge workers in China still prefer a cosmopolitan environment and better urban endowment, which OVC was still building up; on the other, the strategy of the local government was arguably pursuing some kind of quick-gains spilling over from urbanisation. In this regard, OVC's sustainability lies in positioning itself with a better balance between industry development, urban expansion and amenity improvement. Gaining a strong top-down government support in its role as a major component in the emerging Wuhan city-region (Yu, 2014), is the last but not the least desirable precondition for OVC's longer term competitiveness.

Conclusions

This paper provides a preliminary examination of housing supply policies in support of knowledge economy development in China around the three SPs. Implications for both practical and theoretical advances could be drawn here.

The empirical findings revealed that, one common feature between the three SPs was the public awareness of housing needs from the knowledge workers, albeit to different degrees. However, the three SPs also presented diverse approaches towards housing

provision. Strong government support was found in Z-Park and OVC. Conversely Z-SHIPs had been relying on the market mechanism in meeting knowledge workers' housing needs. In this regard, although the urbanisation in China as a whole might have entered the globalisation era profiled by Gu et al. (2014), its interregional divergence is still profound, with Wuhan, and to a lesser degree Beijing, still better posited on the socialist market-led era. Moreover, the land constraints in the immediate vicinity of Z-Park, and to some degree in Z-SHIPs, has pushed the PRH to the outskirts of the cities, and thus increased the travel costs of employees. The current planning practice in all three SPs is to build 'high-tech towns' instead of 'high-tech zones', with the intention of balancing work-life patterns spatially. The importance of 'proximity to work' in the creative class's residential choice has also been identified by Lawton et al. (2013), but in China it is still too early to tell the effect of 'high-tech towns' in this regard. Regarding talent recruitment, polarised housing policies featured in Z-Park and Z-SHIPs, where PRH specifically targeted lower-income knowledge workers, while elites could enjoy more bargaining power with the governments. Furthermore, although housing affordability in the two cities was most severe, they retained their allure to talents. In comparison, OVC held an advantage in a much lower housing price, which had proved to be highly attractive to middle-level employees and employees planning start a family. Therefore the results here seem to confirm the finding of Frenkela et al. (2013) regarding the significant impact of municipal socioeconomic level on knowledge workers' residential choice, and to that of Lawton et al. (2013) on the influence of employees' life-cycle change. Following quantitative studies are very much desired to ascertain the impact of these factors.

Beyond these specific empirical findings, this paper raises some important theoretical

topics for future research. At the most abstract level of analysis, the Chinese cases studied here reveal aspects of the broader national macro-economic contradictions that may be emerging in China between what Peck and Zhang (2013) refer to as its 'techno-economic system' and its 'social-welfare system'. China's techno-economic system is marketised to such a great extent that human capital could now be mobilised across the whole country and even overseas. Conversely, this country's social-welfare system is still tied to the household registration system, which resembles an internal 'passport' towards various public services, such as subsidised housing. At lesser level of abstraction, this study highlights the value of placing housing supply at the centre of analysis in localised 'urban contradictions' raised by the knowledge economy. One curiosity emerging here is that, on the local level, the relationship between the knowledge economy and collective responses is far from a simple reflection of the generalities of the national contexts. Notable in this respect are the localised institutional power struggles in which even national self-innovation model zones – such as Z-Park – can be implicated, with consequent implications not just for housing gaps, but also for the longer term sustainability of these SPs. Although contested, the sorts of collective efforts called forth in places such as Silicon Valley in the USA and Cambridge in the UK compare favourably with the sort of coordination feasible (in theory at least) in developmental state settings including the case of China considered here.

The limitations of this paper, however, mean that the above findings should be treated with some caution. The first and foremost problem relates to data quality. Official documents in China need to be interpreted carefully as they could be too general to reveal the governments' true intentions. Public statistics are sometimes manipulated in order to meet the official

targets (Watkins-Mathys and Foster, 2006). However, the focus in document analysis was on the tone, attitudes and actions taken by the local governments, which was easier to extract by reading between the lines and comparing across cases. Contrasting these declared targets with those really delivered could also shed light on the studied cases. Nevertheless, it is still worth broadening the collection of strategic documents, policy reviews and critics, in order to check the consistency of policy statements in the future. For interviews, the general problems of accessing and relying upon elite interviews (Hertz and Imber, 1995) are exacerbated in China and have now been widely appreciated in the social science literature (Brand and Slater, 2003; Walcott, 2003). In particular, interviewees from government circles rarely deviate from the official policy line in a way which allows fulsome critical interrogation of the issues at hand. This is one reason why the research questions posed have been framed as ones of policy evaluation rather than critical reflection. Following studies could benefit from surveying knowledge workers to seek their views on housing constraints. Lastly, direct comparison of the three SPs with diverse industrial structures, economic performances and planning approaches was not ideal. Controlling for the industrial bases and/or regional backgrounds of SPs in future studies might help mitigate the influences of their environment.

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References

- Baris M (2003) Review of Richard Florida: The rise of the creative class: And how it's transforming work, leisure, community, and everyday life. *The Next American City* 1: 42–45.

- Beijing Commission of Housing and Urban-rural Development, China (2012) Beijing 12th Five-Year Plan Soical Housing Plan. Official website of Beijing Commission of Housing and Urban-rural Development. Available at: <http://www.bjjs.gov.cn/tabid/3565/default.aspx>.
- Beijing E-Town, Beijing (2011) The first group of Talets Rental Housing put in use in Zhongguancun. *Daxin News*. Available at: <http://www.bda.gov.cn/cms/dxxw/31814.htm>.
- Berry M (2005) Melbourne – Is there life after Florida? *Urban Policy and Research* 23(4): 381–392.
- Brand V and Slater A (2003) Using a qualitative approach to gain insights into the business ethics experiences of Australian managers in China. *Journal of Business Ethics* 45(3): 167–182.
- Burfitt A and Ferrari E (2008) The housing and neighbourhood impacts of knowledge-based economic development following industrial closure. *Policy Studies* 29: 293–304.
- Castells M (1977) *The Urban Question*. London: Edward Arnold.
- Castells M (2000) *The Rise of The Network Society: The Information Age: Economy, Society and Culture*. Volume 1, Oxford: Wiley-Blackwell.
- Castells M (2010) *End of Millennium: The Information Age: Economy, Society, and Culture*. Volume III, 2nd edition. Chichester: John Wiley & Sons.
- Castells M (2011) *The Power of Identity: The Information Age: Economy, Society, and Culture*. Volume II, 2nd edition. Chichester: John Wiley & Sons.
- Castells M and Hall P (1994), *Technopoles of the World: The Making of Twenty-first-century Industrial Complexes*. London: Routledge.
- Cavanagh S (1997) Content analysis: Concepts, methods and applications. *Nurse Researcher* 4: 5–16.
- Center of National Real Estate Market (2013a) *Second hand housing price distribution in Wuhan 2009–2013*. Available at: <http://data.cityhouse.cn/historymap/wuhan/1.html> (2013, accessed 18 January 2016).
- Center of National Real Estate Market (2013b) *Ranking of Chinese cities' housing price in October 2013*. Available at: http://www.cityhouse.cn/default/forsaler_ank.html (2013, accessed 18 January 2016).
- Center of National Real Estate Market (2013c) *Second hand housing price distribution in Shanghai 2009–2013*. Available at: <http://data.cityhouse.cn/historymap/shanghai/1.html> (2013, accessed 18 January 2016).
- Cervero R (1989) Jobs-housing balancing and regional mobility. *Journal of the American Planning Association* 55(2): 136–150.
- Chen J, Yang Z and Wang YP (2014) The new Chinese model of public housing: A step forward or backward? *Housing Studies* 29(4): 534–550.
- Cheng L, et al. (2014) 2013 China National High New Development Zones Comprehensive Development and Data Analysis Report. *China Technology Industries* 9: 43–61.
- China Household Finance Survey (2014) Urban housing vacancy rate and trends in the housing market. *China Urban Housing Development Trend*. Official website of China Household Finance Survey: West Financial Univerity. Available at: <http://chfs.swufe.edu.cn/ListPage/Detail?Detailid=308> (accessed 23 May 2015).
- China Science & Technology Statistics (2003–2014) China High-tech Industry Database. Available at: <http://www.sts.org.cn/sjkl/gjscopy/index.htm> (accessed 04 June 2015).
- China Statistics Bureau (2002–2014) China Statistical Yearbook. Available at: <http://www.stats.gov.cn/tjsj/ndsj/> (accessed 04 June 2015).
- Clark TN, Lloyd R, Wang KK, et al. (2002) Amenities drive urban growth. *Journal of Urban Affairs* 24(5): 493–515.
- Communist Youth League of Haidian District, Beijing (2007) Survey of young workers in Zhongguancun Science Park. Official website of Communist Youth League of Haidian District. Available at: <http://www.bjyouth.gov.cn/gzyj/dcyj/129458.shtml>.
- Feng X and Zhang X (2011) 5000 units talent flats in Zhongguancun ready for use. *Beijing Business*. Available at: <http://news.dichan.sina.com.cn/bj/2011/01/24/268688.html> (2011, accessed 18 January 2016).
- Florida R (2002) *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. New York: Basic Books, 434 pp.
- Florida R, Mellander C and Qian H (2008) Creative China? The University, Human Capital

- and the Creative Class in Chinese Regional Development. CESIS Working paper series No. 145 pp. 1–36. Available at: <https://static.sys.kth.se/itm/wp/cesis/cesiswp145.pdf> (2008, accessed 8 November 2013).
- Frenkela A, Bendita E and Kaplan S (2013) Residential location choice of knowledge-workers: The role of amenities, workplace and lifestyle. *Cities* 35: 33–41.
- Frug GE and Barron DJ (2008) *City Bound: How States Stifle Urban Innovation*. New York: Cornell University Press.
- Graneheim UH and Lundman B (2004) Qualitative content analysis in nursing research: Concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today* 24(2): 105–112.
- Gu C, Kesteloot C and Cook IG (2014) Theorising Chinese urbanisation: A multi-layered perspective. *Urban Studies* 22: 1–17.
- Haibin L (1992) The trend of researchers – Part-time jobs. *Hubei Daily*, third section, 08 June 1992 (accessed 07 September 2011).
- Hansson F, Husted K and Vestergaard J (2005) Second generation science parks: From structural holes jockeys to social capital catalysts of the knowledge society. *Technovation* 25: 1039–1049.
- Hertz R and Imber JB (1995) *Studying Elites Using Qualitative Methods*. 3rd edition. Thousand Oaks, CA; London and New Delhi: SAGE Publications.
- Hubei Government, China (2011) Wuhan published its social housing construction plan. Hubei Government. Available at: http://www.hubei.gov.cn/mzgj/gjcgk/201108/t20110805_142977.shtml.
- Johnson CA (1995) *Japan, Who Governs? The Rise of the Developmental State*. New York, London: WW Norton & Company.
- Jonas AEG, While AH and Gibbs DC (2010) Managing infrastructural and service demands in new economic spaces: The new territorial politics of collective provision. *Regional Studies* 44: 183–200.
- Krippendorff K (1980) *Content Analysis: An Introduction to its Methodology*. Newbury Park, CA: Sage.
- Kuang Y (2011) Real estate accompanies high-tech. *Beijing Business*, 21 February 2011.
- Lawton P, Murphy E and Redmond D (2013) Residential preferences of the ‘creative class’? *Cities* 31(2): 47–56.
- Lee P and Murie A (2004) The role of housing in delivering a knowledge economy. *Built Environment* 30(3): 235–245.
- Li H and Kang R (2004) Flow of talent at Zhongguancun. *Chinese Education & Society* 37(2): 23–28.
- Li T and Florida R (2006) Talent, technological innovation, and economic growth in China. pp. 1–16. Available at: http://www.creative-class.com/rfcgdb/articles/Talent_Technological_Innovation_and_Economic_Growth_in_China.pdf (2006, accessed 08 November 2013).
- Liu Z, Zhang Y and Chai Y (2009) Home–work separation in the context of institutional and spatial transformation in urban China: Evidence from Beijing Household Survey data. *Urban Studies* 9: 23.
- Lofsten H and Lindelof P (2002) Science parks and the growth of new technology-based firms–academic–industry links, innovation and markets. *Research Policy* 31: 859–876.
- Maclennan D, et al. (2014) *Global Affordable Housing Report: BRICS Plus Mortar*. London: Royal Institution of Chartered Surveyors, 84 pp.
- Markusen A (2006a) The artistic dividend: Urban artistic specialisation and economic development implications. *Urban Studies* 43(10): 1661–1686.
- Markusen A (2006b) Urban development and the politics of a creative class: Evidence from a study of artists. *Environment and Planning A* 38: 1921–1940.
- Marquardt N, Fuller H, Putz G, et al. (2013) Shaping the urban renaissance: New-build luxury developments in Berlin. *Urban Studies* 50(8): 1540–1556.
- Massey D, Quintas P and Wield D (1992) *High Tech Fantasies: Science Parks in Society, Science and Space*. London: Routledge.
- Miao JT and Hall P (2014) Optical illusion? The growth and development of the Optics Valley of China. *Environment and Planning C: Government and Policy* 32(5): 863–879.
- Miao JT and Maclennan D (2014) The Long March to Reform: Housing Outcomes and Policies in China after Three Decades of

- Change. In: Maclennan D et al. (ed.) *Global Affordable Housing Report: BRICS Plus Mortar*. London: The Royal Institution of Chartered Surveyors, pp. 35–55.
- Miao JT, Benneworth P and Phelps NA (2015) *Making 21st Century Knowledge Complexes: Technopoles of the World Revisited*. Abingdon and New York: Routledge.
- Morrison N (2014) Building talented worker housing in Shenzhen, China, to sustain place competitiveness. *Urban Studies* 51(8): 1539–1558.
- Musterd S (2004) Amsterdam as a creative cultural knowledge city: Some conditions. *Built Environment* 30(3): 225–234.
- North Youth Net (2012) Fight with Beijing and Shanghai, Wuhan OVC sprints towards 500 million industrial income based on land. Fenghong Net. Available at: www.house.ifeng.com.
- OVC China (2010) OVC 11th Five-Year Plan for Urban Development. Available at: <http://www.wehdz.gov.cn/jsp/zwgk/browser/content.jsp?id=70>.
- Peck J (2005) Struggling with the creative class. *International Journal of Urban and Regional Research* 29(4): 740–770.
- Peck J and Zhang J (2013) A variety of capitalism ... With Chinese characteristics?. *Journal of Economic Geography* 13: 357–396.
- Phelps NA (2012) The sub-creative economy of the suburbs in question. *International Journal of Cultural Studies* 15(3): 259–271.
- Pudong Academy of Reform and Development (2010) 12th Five-Year Plan of Zhangjiang Science Park. MBAlib. Available at: <http://doc.mbalib.com/view/e8d57e9517189cc0856137d58beb3252.html> (2010, accessed 18 January 2016).
- Saxenian A (1983a) The urban contradictions of Silicon Valley: Regional growth and the restructuring of the semiconductor industry. *International Journal of Urban and Regional Research* 7(2): 237–262.
- Saxenian A (1983b) The genesis of Silicon Valley. *Built Environment* 9(1): 7–17.
- Saxenian A (2006) *The New Argonauts: Regional Advantage in a Global Economy*. Cambridge, MA: Harvard University Press.
- Scott AJ (1993) *Technopolis: High-technology Industry and Regional Development in Southern California*. Berkeley, Los Angeles, CA; Oxford: University of California Press.
- Segal, Quince and Wicksteed (2000) *The Cambridge Phenomenon Revisited*. Cambridge: Segal, Quince and Wicksteed.
- Shapiro G and Markoff J (1997) A matter of definition. In: Roberts CW (ed.) *Text Analysis for the Social Sciences: Methods for Drawing Statistical Inferences from Texts and Transcripts*. Mahwah, NJ: Lawrence Erlbaum Associates, pp. 9–32.
- Sina Housing, China (2008) Planning retrospective of Zhangjiang Science Park. Sina Housing. Available at: <http://sh.house.sina.com.cn/news/2008-03-18/130461100.html>.
- State Council, China (2010) Notice on Firmly Suppressing the Rapid Increase of Housing Price in Some Cities. The Central People's Government of the People's Republic of China. Available at: http://www.gov.cn/zwgk/2010-04/17/content_1584927.htm.
- Stemler S (2001) An overview of content analysis. *Practical Assessment, Research & Evaluation* 7(17). Available at: <http://PAREonline.net/getvn.asp?v=7&n=17> (accessed 2 December 2014).
- Tomaney J and Bradley D (2007) The economic role of mobile professional and creative workers and their housing and residential preferences: Evidence from North East England. *Town Planning Review* 78(4): 511–530.
- Torch Centre, China (2013–2015) *Key Economic Indicators of National High-tech Zones*. Available at: http://www.chinatorch.gov.cn/kjb/tjnb/list_3.shtml (accessed 04 June 2015).
- Torch Centre, China (2015) Brief introduction of National High-Tech Zones. Available at: <http://www.chinatorch.gov.cn/gxq/gaikuang/gaikuang.shtml> (accessed 04 March 2015).
- Valler DC, Phelps NA and Radford J (2014) Soft space, hard bargaining: Planning for high-tech growth in Science Vale UK. *Environment & Planning C* 32: 824–842.
- Valler DC, Phelps NA and Wood AM (2012) Planning for growth? The implications of localism for 'Science Vale', Oxfordshire, UK. *Town Planning Review* 83(4): 457–488.

- Van Oort F, Weterings A and Verlinde H (2003) Residential amenities of knowledge workers and the location of ICT-firms in the Netherlands. *Tijdschrift voor Economische en Sociale Geografie* 94(4): 516–523.
- Wade RH (1990) *Governing the Market*. Princeton, NJ: Princeton University Press.
- Walcott SM (2003) Xi'an as an Inner China Development Model. *Eurasian Geography and Economics* 44(8): 623–640.
- Walcott SM (2007) The dragon's tail: Utilizing Chengdu and Chongqing technology development zones to anchor west China economic advancement. *Journal of Chinese Economic and Business Studies* 5(2): 131–145.
- Watkins-Mathys L and Foster MJ (2006) Entrepreneurship: The missing ingredient in China's STIPs? *Entrepreneurship & Regional Development* 18(3): 249–274.
- Weber RP (1990) *Basic Content Analysis*. Quantitative Applications in the Social Sciences. California, CA; London; and New Delhi: Sage.
- While A, Jonas AEG and Gibbs DC (2004) Unblocking the city? Growth pressures, collective provision, and the search for new spaces of governance in Greater Cambridge, England. *Environment and Planning A* 36: 279–304.
- Woo-Cumings M (ed.) (1999) *The Developmental State*. New York: Cornell University Press.
- Wright M, Liu X, Buck T, et al. (2008) Returnee entrepreneurs, science park location choice and performance: An analysis of high technology SMEs in China. *Entrepreneurship Theory and Practice* 131: 155.
- Wu F and Phelps NA (2011) (Post)suburban development and state entrepreneurialism in Beijing's outer suburbs. *Environment and Planning A* 43: 410–430.
- Wuhan Land Resources and Planning Bureau (2011) Ten-Year Planning Outline of OVC (2011–2020). Available at: <http://www.wpl.gov.cn/pc-30899-78-0.html> (2011, accessed 22 March 2013).
- Xu J (2008) Shanghai Pudong is building cheap talents apartments in large scale. *Shanghai Business*, 09 April 2008.
- Yigitcanlar T, Baum S and Horton S (2007) Attracting and retaining knowledge workers in knowledge cities. *Journal of Knowledge Management* 11(5): 6–17.
- Yin RK (1994) *Case Study Research: Design and Methods*. Applied Social Research Methods. Thousand Oaks, CA: Sage Publications.
- Yu G (2014) Revitalize the 'Big Wuhan': From city's actions to national expectations. *Daily Economic News*. Available at: http://finance.ifeng.com/a/20141030/13230648_0.shtml.
- Z-Park, China (2010) Regulation of Zhongguancun National Self-innovation Model Zone. Management Committee of Z-Park. Available at: <http://www.investsjs.gov.cn/a/sjs/9193.html>.
- Z-Park, China (2011a) Z-Park spatial layout and land usage research. In: China Z-Park (ed.) Z-Park website. Available at: <http://www.zgc.gov.cn/fzbg/yjkt/70112.htm>.
- Z-Park, China (2011b) Development and construction plan of Z-Park during the 12th Five-year Plan of Beijing. Beijing government. Available at: <http://zhengwu.beijing.gov.cn/ghxx/sewgh/t1202385.htm>.
- Z-Park, China (2011c) Several ideas on talent rental housing construction in Zhongguancun Science Park. Management Committee of Z-Park. Available at: <http://www.investsjs.gov.cn/a/sjs/9192.html>.
- Zhangjiang Science Park, China (2006) Temporary management regulation on Talents Apartments of Zhangjiang Science Park. Zhangjiang High-tech Park. Available at: <http://www.zjpark.com/InfoShow.aspx?id=7809>.
- Zhangjiang Science Park, China (2013) Introduction of Shanghai Zhangjiang High-tech Industrial Development Zone. Official website of Zhangjiang Science Park. Available at: <http://www.sh-hitech.gov.cn/website/introduction/content.html>.
- Zhou X (2010) The price of talents under the pressure of housing costs. *Science Times*, 26 August 2010.
- Zhou Y (2005) The making of an innovative region from a centrally planned economy: Institutional evolution in Zhongguancun Science Park in Beijing. *Environment and Planning A* 37: 1113–1134.