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Knowledge Economy Challenges for Post-Developmental State: Tsukuba Science City as an In-Between Place

Abstract

This paper examines the planning history and current planning challenges facing Tsukuba Science City. Drawing on original empirical material, it suggests that Tsukuba can be seen as an in-between place in three respects. Tsukuba began life as an instance of the international garden-campus-suburb orthodoxy surrounding science spaces, and now falls somewhere in-between an independent city and a suburb of greater Tokyo. Tsukuba's predicament in this regard is intimately related to the broader policy challenges facing Japan as it transitions from a developmental to a post-developmental state. Chief among these challenges is effectively inserting a science city like Tsukuba into an increasingly globalized 'New Argonaut' market for skilled labour. I make use of Appadurai (1996)'s notion of 'scapes' to interpret Tsukuba as an in-between place but also to highlight the practical challenges of it securing a central position within the global science landscape of modernity.

Keywords: developmental state; post-developmental state; Tsukuba Science City; knowledge economy; global modernity

INTRODUCTION

Tsukuba Science City in Japan achieved global notoriety as a ‘technopole of the world’ (Castells and Hall 1994). Planned and developed from the 1960s onwards as a specifically science-oriented new town for the de-concentration of national research institutes and Tokyo ‘overspill’ (Dearing, 1995), Tsukuba attracted hundreds of research laboratories of private companies by the early 1990s, including Texas Instruments and Glaxo-Wellcome¹. Despite this, Tsukuba has largely failed to generate the local economic spillover effects envisaged at its inception (Bass, 1998) – though it is hardly alone among other planned concentrations of science and high technology industries (Miao et al. 2015). Recently, it has been further exposed to the changing fortunes of the Japanese economy and shifts in the urban and regional planning orthodoxy surrounding promotion of the knowledge economy.

Drawing upon published sources and original research interviews, this paper discusses the planning history and current features of Tsukuba as an in-between place in three aspects. First, in physical and economic planning terms, Dearing (1995) once predicted that there were two alternative future scenarios for Tsukuba – either the spread of Tokyo’s suburban development would swamp the unique character of this science city, or the strengthening of the Tsukuba economy would see it resist absorption as a suburb of Tokyo. This paper finds that contemporary Tsukuba conforms to neither scenario completely, but is poised somewhere in-between. Second, Tsukuba now also lies in between in respect of Japan’s transition from developmental to post-developmental state strategies. If it was once a prime spot from which to observe the planning and politics of catch-up among developmental states, Tsukuba is now an excellent vantage point from which to examine ideology and strategy in post-developmental states. Third, Tsukuba is ambiguously placed with respect to the New Argonaut (Saxenien, 2007) flows of skilled labour which have been credited with sustained localised economic development.

This in-betweenness of Tsukuba can be understood at an abstract theoretical level in the way new metaphors such as the techno-, ideo- and ethnoscapings of modernity (Appadurai, 1996) are able to capture some of the global interconnectedness of the modern world. For Appadurai (1990), globalisation is composed of a series of cultural flows producing a shifting set of ‘scapes. However, as will be seen in the case of Tsukuba, these ‘scapes also overlay the way in which national and even subnational politics and policy may create important frictions on the global projection of ideas, the mobility of people and ultimately, the innovative record of designated science cities and parks.

I begin this paper by briefly positioning Tsukuba as an in-between place with regard to the literature on science parks and cities, developmental and post-developmental state strategies and ‘New Argonaut’ connections. I note the value of Appadurai’s metaphor of ‘scapes for integrating analytical and policy discussion of the future of Tsukuba and other ‘technopoles of the world’. Next I outline the methods used to collect the secondary and original empirical data on which the paper draws. Then I recall the historical development of Tsukuba until the

¹ <https://www.deepdyve.com/lp/elsevier/tsukuba-science-city-paTE9CZFzP>

2000s, followed by its recent transformations as response to the post-developmentalism agenda. The three dimensions of its in-betweenness are discussed sequentially. In conclusion I note how the transitions of Tsukuba raise wider questions about the promotion of the knowledge economy, and in particular the overlooked complex challenges at the confluence of spatial (i.e., land-use and transportation) planning, real estate development potential, and labour market policy.

TECHNOPOLES OF THE WORLD AS IN BETWEEN PLACES

In this part I introduce how Tsukuba, as a ‘technopole of the world’ (Castells and Hall, 1994) might be understood as an in-between place. Its physical absorption into a greater Tokyo reflects the limits of what was once planning orthodoxy regarding science cities and parks. These limits are exacerbated in the context of Japan’s transition from developmentalism to post-developmentalism. Moreover, challenges in physical formats of land use, transportation and real estate development relate in complex ways to the challenges of catering for significantly internationalised scientific labour markets, which remain poorly understood (Miao, 2016).

Between planned city and anonymous suburb

Castells and Hall (1994) used the term ‘science city blues’ to capture the ‘innovation by design’ nature of Daedeok in South Korea and Tsukuba in Japan, which were born as ‘highlands of innovation’ but with few connections to their hinterland (Oh 2002; Park 1999). Yet by the 1960s, the planned ‘decentralised concentration’ of scientific research in new designated science parks or cities away from existing major urban centres had become a global ‘campus-garden-suburb’ model (Forsyth and Crewe, 2010), which came to be closely associated with the ‘Silicon Valley’ exemplar (Hall and Markusen 1985). The assumption was that relative isolation and critical mass would drive improved performance of, and increased interaction within and among, public and private research institutes to produce the innovations desired to boost national competitiveness, leading ultimately to broader economic spillovers in terms of new firm formation.

The weaknesses of this particular science park model were captured in the specialised enclave roles they occupied within spatial divisions of labour (Massey et al. 1994). They suffered from many of the problems of area-based policies attracting business functions that were non-innovative, contributing to displacement within the local stock of businesses, and seemingly failing to exert an additive effect on performance compared to other possible locations (e.g. Felsenstein, 1994; Westhead and Batstone, 1998). Indeed, Castells and Hall (1994: 11), after reviewing some of the world-famous science spaces, concluded that ‘most of the world’s actual high-technology production and innovation still comes from ... the great metropolitan areas of the industrialized world’. Little wonder, then, that specially designated science cities and parks of the campus-garden-suburb mould have become increasingly exposed to a change in the *zeitgeist* regarding the relationship between science and the city (Addie, 2016; Charles, 2015; Phelps et al., 2014).

Reflecting the possible scenarios suggested by Dearing (1995), and taking into account the more detailed empirical evidence presented later, Tsukuba appears to be caught in physical

planning terms between remaining a specialised independent city and being absorbed as a suburb into one of the great metropolitan areas of the industrialized world. In terms of its economic base, Tsukuba runs the risk of other designated science and high-technology spaces of being neither special nor diverse (Dawood and Phelps, 2015).

Between developmental and post-developmental project

Tsukuba represents one concrete instance of the developmental state model in general (Wade, 1990) and the Japan formula in particular (Johnson, 1982). The strategies pursued by developmental states have been summarised as ones in which ‘the advantages of markets (decentralisation, rivalry, diversity and multiple experiments) have been combined with the advantages of partially insulating producers from the instabilities of free markets and of stimulating investment in certain industries selected by government as important for the economy’s future growth’ (Wade, 1990: 5).²

Tsukuba was perhaps the purest expression of top-down physical and economic planning of the developmental state era in Japan; an experiment that ‘may never happen again’ (Dearing, 1995: 3). In particular, the relocation and concentration of national-level research institutions and the creation of Tsukuba University unveiled specific attempts of Japan to catch up to the West (and the US in particular) in terms of knowledge production (Dearing, 1995; see also Traweek, 1988, 1992 on the case of particle physics). Tsukuba represented a unique physical and economic configuration to support this ambition. The key elements of this orthodoxy were: decongestion of the capital city Tokyo; the concentration of research activity sequestered away from existing centres of economic activity; land use separation within Tsukuba itself (the initial planning sketches for Tsukuba make it clear that research institutes, private enterprises and residences were to be located in distinct parts of the city); the further distinction between basic, public-sector research to be located in Tsukuba and applied and private research to be largely excluded (Dearing, 1995: 79).

The developmental state concept and its applicability to the continued transformations in East Asia have been subject to revision recently, partly as a result of an exogenous policy paradigm shift towards economic (neo)liberalization (Kim, 1999).³ However endogenous forces have also played a role as shown in South Korea, where ‘the state's influence in the economy declined due to historical pressures and the inherent contradictions of autonomy and institution’ (Kim 1993, p228). Indirect incentivising and steering figures prominently as part of ‘post-developmental’ strategies (Yeung, 2016), referring to ‘a democratic facilitative state that establishes synergistic relations with society in the process of co-production’ (Edigheji, 1999). Market forces and civil society are expected to play a more decisive role. Japan is no

² The lessons of developmental state model have been itemised by Wade (1990) as: national policies to promote industry investment within national territories; protection to help competitiveness of industries; export oriented policies (not import-substitution); welcome MNEs – as long as they export; government control of bank-led financial system; carry out trade and financial liberalisation gradually; establish primacy of economic development within national bureaucracies; develop political authority before democratisation; develop corporatist institutions before democracy.

³ In particular, the state-centric, sector-specific, and period-specific limits of the developmental state thesis have been recognised (Yeung, 2016).

exception to this wider trend although it has featured what Schaefer and Grimes (2003: 5-6) refer to as a 'permeable insulation' transformation. Fujita and Hill (2007) suggested that at least symbolically, developmentalism ended in Japan with the Plaza Accord in 1985, and the subsequent crisis and decade's long economic stagnation, characterised and catalysed Japan's transition to post-developmentalism (Fujita 2011). In light of the puzzle presented by its legacies of developmentalism, Tsukuba may represent one of the best vantage points from which to view contemporary challenges facing the post-developmental state of Japan in developing its knowledge economy.

Between the margins and the centre of 'New Argonaut' connections

The international inter-state system in which Tsukuba was conceived as a key project of a developmental state was one that was firmly partitioned into distinct national economies. While it is clearly an overstatement to say that the world has become borderless, the Japanese national politics and economies are significantly more permeable than they were at the height of Japanese developmentalism. Among the many aspects of international economic integration or the emergence of a second global economy has been the return of international migration to levels last seen in the late 1800s (Jones, 2005). In the case of the global knowledge economy, such migration is composed significantly of 'New Argonaut' connections.

The 'New Argonauts' is the term used by Saxenien to refer to foreign-born (from Taiwan in her cases), technically skilled entrepreneurs who travel back and forth between Silicon Valley and their home countries, developing their education and training but also entrepreneurial opportunities (Saxenien, 2007; Saxenien and Hsu, 2000). Taiwan and Silicon Valley emerge as central places in the global knowledge economy in this pioneering research. The term undoubtedly has wider relevance than this US-Taiwan nexus, though few studies have yet explored the breadth and depth of such connections. Some exceptional works such as Sternberg and Muller (2010)'s examined the role of New Argonaut migrants within the Shanghai economy, but the more general significance of these connections as contributors to local and national economic development remains unclear. Moreover, little is known about the specific contribution of designated science parks and cities to such flows of labour, let alone how physical and economic planning might seek to respond to the greatest effect. The dilemma faced by Tsukuba falling in between the margin and the centre of 'New Argonaut' connections, as will be seen later, reflects and results from such ambiguity.

Placing Tsukuba in the global knowledge economy landscape

I place Tsukuba in the global knowledge economy landscape by making reference to Appadurai's (1996) techno-, ideo- and ethnoscapes. Appadurai (1996, 1990) used the term 'scapes' to capture the importance of global cultural flows and perspective to understanding global modernity. For Appadurai (1990, p329), these scapes 'are the building blocks of ... imagined worlds, that is, the multiple worlds which are constituted by the historically situated imaginations of persons and groups spread around the globe'.

Appadurai's (1996) notion of 'scapes of modernity allows for the integration of the differential substance of the fluid landscape of global modernity when distinguishing its 'technoscapes', 'ideoscapes', 'mediascapes', 'ethnoscapes' and 'financescapes'. While he is concerned primarily with a tangible and intangible landscape of global flows, these flows are to a greater or lesser extent contained within the extant territorial organisation of society, notably at the national and subnational scale.

Appadurai's (1996) term 'technoscape' might be equated with the physical properties of individual science spaces, including the infrastructure, spatial planning and the 'machinic termini' (Pickering, 1995) (of large scale experimental equipment investments) found there. Appadurai's term 'ideoscape' refers to the images, meaning, and ideologies associated with the international projection of particular science spaces in a diplomatic act akin to the exertion of soft power⁴. Finally, his term 'ethnoscape' refers to global flows of labour which in the case of science spaces have been most closely associated with 'new Argonaut connections'. Tsukuba's predicament is one of a place-in-between in respect of each of these three 'scapes', and one that will continue to frame important planning challenges going forward.

RESEARCH METHODS

The research interviews are drawn from two related projects undertaken simultaneously in May and June of 2016. The first project sought to understand the recent development of and the planning challenges facing Tsukuba. It consisted of ten interviews with Ibaraki prefectural and central government officers and planners in Tsukuba, Tokyo and Mito (see Figure 1), who were responsible for the original planning of Tsukuba; as well as representatives from the main coordinating institutions such as Tsukuba Centre for Institutes and Tsukuba Center Inc. The interviews lasted around one hour and covered the major spatial and transportation planning developments in Tsukuba, and how these developments had been changing the nature of this city away from being a specialised knowledge production centre. Here I am grateful to the overview and assistance of Tokyo and Tsukuba based planning academics.⁵

Insert figure 1 here

Source: Mito Government (2017)

The second, and related exercise was designed to explore the imaginaries or 'scapes' of Tsukuba (Appadurai, 1996), and in particular the 'new Argonaut' connections (Saxenian, 2007; Saxenien and Hsu, 2000) centred on Tsukuba.⁶ This involved eight interviews with overseas researchers of all ranks at various national research institutes (including the most

⁴ Soft power is a concept developed by Joseph Nye (1990) to describe the ability to shape the preferences of others through appeal and attraction rather than by coercion (hard power). Universal ideology and favourable images have been widely used nowadays to achieve such soft influence.

⁵ The research was funded by the GB Sasakawa Foundation grant number 4947

⁶ The research was conceived as an additional contribution to a Leverhulme Trust funded International Network. See <https://www.globalsciencespaces.org>

prominent ones) and the University of Tsukuba. The interviews were generated as a result of snowballing from initial inquiries with Tsukuba University and Tsukuba Centre Inc, and were conducted both face-to-face and via telephone and skype. Here I focused on perceptions of Tsukuba as a place (including its legibility as part of global techno-, ideo- and ethnoscapes), and how they positioned Tsukuba within the Tokyo metropolitan area and the international science landscape.

Although modest in their scope, the two pieces of exploratory research are complementary in offering an integrated insight relating to the rather separate policy fields on knowledge economy, i.e. spatial and transportation planning, housing and labour markets. In what follows, I draw upon the most relevant insights from a subset of the interviews undertaken to first revisit the birth of Tsukuba, and then update its contemporary development as part of global techno-, ideo- and ethnoscapes.

TSUKUBA: THE MAKING OF A DEVELOPMENTAL STATE ICON

Inspired by other planned cities and science development, such as Brasilia and Akademgorodok (Holston 1989; Josephson 1997), the idea of constructing a self-contained science city emerged during the 1950s (Castells and Hall, 1994). As with other national projects, this lofty idea was to some extent compromised by the practical realities of finding a suitable location – not to be underestimated in Japan, where much of the country is vulnerable to the effects of earthquakes and volcanic activity, and where fragmented patterns of private land ownership create problems of assembling a sufficiently large area of land for a new city. Tsukuba's location reflects both of these realities and originally was conceived more as a government and administrative city (Dearing, 1995: 51)⁷, as well as a suitable location for a new international airport for Tokyo (Vice President, City Planning Institute of Japan, 1 June 2016).

The creation of Tsukuba was given Cabinet approval in 1963 and construction progressed from that point into the 1970s. However, a green light on its construction did not protect Tsukuba from further controversies among local residents and within the Japanese planning (Castells and Hall, 1994: 70) and scientific communities (Traweek, 1992: 455).⁸ Indeed, the original land use plan was reworked several times from a more compact city into a linear layout in order to better reflect the realities of land assembly but also the outcomes of inter-Ministerial battles (Dearing, 1995)⁹. Perhaps as a concession to concerns over concentrating science investment in this way, the designation of Tsukuba was followed by the instigation of the Technopolis Programme, which sought a greater measure of dispersion for research activities, although these later research concentrations were smaller in scale and less significant in comparison to Tsukuba (Bass, 1998).

⁷ Interviewees recounted the story that Tsukuba was planned both in terms of its location and the plots available to national research institutes as a potential place for central government to decamp to in event of an emergency.

⁸ Worried about the loss of research funding to a new university and institutes concentrated in the new city prominent academics also lobbied in opposition to disperse institutes and funding across the established universities across Japan.

⁹ This involved negotiations with around 2500 landowners (Bloom and Asano, 1981) despite the takings concentrating on common lands of the many farms involved (Vice President, City Planning Institute of Japan, 1 June 2016).

With the fourth plan for Tsukuba in place, national government cajoled as many as 43 national level institutes into relocating to this new science city. The first research facility, a large-scale Earthquake Simulator by the National Research Institute for Earth Science and Disaster Prevention, was constructed in 1970, and the headquarter of this Institute was moved from Tokyo to Tsukuba later in 1978 (NIED, 2016). Today 29 national institutes exist in Tsukuba as a result of subsequent rationalisations and consolidations of national research institutes. Among the existing institutions, the majority covered science and engineering, biological sciences (8); education (7), and construction (6). Some of the most reputable ones included JAXA (Japan Space Agency), KEK (National Institute for High Energy Physics), AIST (Advanced Industrial Science and Technology Institute) and NIMS (National Institute for Materials Science) (Planning Director, Ibaraki Prefectural Government, 10 June, 2016).

Although the detailed land use plan of Tsukuba had to be drafted and redrafted in order to accommodate different interests, its overall planning philosophy (campus-garden-suburb-style) stayed the same. Actually Traweek's (1988: 18) observation that 'almost all of the high energy physics in national laboratories ... have lovely settings' doubtless reflects a similar planning orthodoxy surrounding technopoles at that time. It continues to ring true for one interviewee who suggested that big science research facilities around the world appeared the same in that they were in remote, suburban sites with nothing much else around (Post-doctoral Researcher, KEK 6 June 2016). Actually until very recently, Tsukuba has been enjoying a reputation as a specialised city, which featured physical and cultural remoteness within the Japanese urban system (Vice President, City Planning Institute of Japan, 1 June 2016). Located in rural Ibaraki prefecture, it was a curiosity considered hardly part of the major part of urban industrial Japan. Regardless of the extensive pattern of urban sprawl that has accompanied the failure of greenbelt planning for Tokyo (Sorensen, 2001), for much of its existence to date, Tsukuba has remained separate from Tokyo. Yet, quite unlike its prefectural surrounds, Tsukuba was considered a Tokyo-like island within rural Ibaraki prefecture (Vice President, City Planning Institute of Japan, 1 June 2016). Traweek (1992: 457) drew attention to this uniqueness of Tsukuba when she spoke about the scientific community centred on the KEK institute: 'Underscoring their isolation from the conventional sites of power, the science city is located in Ibaraki, an economically depressed region which has the reputation among sophisticated Tokyoites of being hopelessly declassé'. A significant part of this picture persists with scientists working in the city. One interviewee, a Chinese scientist who had studied and worked in Tsukuba since 1989, recalled the anecdote that there were two types of people in Tsukuba – farmers and doctors (Chief Senior Researcher, AIST, 9 June 2016).

The name of Tsukuba and its development as an independent science city only gathered pace in a booming Japanese economy with the International Science and Technology Exposition held in 1985. From this point on, the presence of national research institutes did indeed begin to attract the research laboratories of major Japanese and foreign companies. Residential and commercial land prices increased abruptly and markedly shortly after the expo (Dearing,

1995: 57).¹⁰ The first industry park was completed in 1982, and Castells and Hall (1994:70) reported a total of over 200 private laboratories located on 8 industrial parks, although they also noted how little or no manufacturing was relocated to Tsukuba by these companies (Castells and Hall, 1994: 74). Dearing (1995: 87) was able to observe over 80 informal networks among researchers in Tsukuba by 1982. But designated as a research park with large national research institutions that were primarily self-contained, Tsukuba was considered much less capable of benefiting from the scale of localised technological spillovers than Silicon Valley (Bass, 1998; Castells and Hall, 1994: 72). Nor had it been able to attract a diverse economic base that underpins a prosperous real estate market (Manager, Orion Partners, 10 June 2016).

Nonetheless, viewed from the economic development perspective, Tsukuba might be said to have played its part in Japan's developmental state policies of catch-up over the past decades, underpinned by absorbing nearly half of this country's public research and development budget. Important scientific breakthroughs include the identification and specification of the molecular structure of superconducting materials, the development of organic optical films, and the creation of extreme low-pressure vacuum chambers (Wiki, 2016)¹¹. Some exceptional examples here include the Public Works and Building Research Institutes, for which Bloom and Asano (1981: 1242) knew of 'no equivalent elsewhere in terms of size, breadth of interest, or quality of facilities'. Its International Centre for Water Hazard and Risk Management is the largest category 2 centre in the world, placing it in a subsidiary position only to a category 1 institute in the Netherlands (Research Specialist in this Centre, Public Works Research Institute, 9 June 2016). KEK is also the second biggest institute after the European Organization for Nuclear Research (CERN) in Switzerland, and in experiments like Belle I and II (with 5000 participants from 23 nations), it represents the low energy physics experiment alternative to the much larger and much better funded high energy physics philosophy of CERN (Post-doctoral researcher, KEK, 6 June 2016).

Taken as a whole, however, and for much of its early history, the research institutes in Tsukuba tended to occupy positions at the margins of global science landscapes (Traweek, 1988, 1992; Hoddeson, 1983). Indeed, at the outset, the Japanese needed foreign researchers to gain credibility in international high energy physics community. Traweek (1992:450), for example, had noted how researchers in KEK had selected names that represented the marginality of this global science location, and to an extent the global marginality of the experiments being conducted.

ASPECTS OF TSUKUBA'S IN- BETWEENNESS

Over the half-century or so it has taken to fully develop Tsukuba, Japanese economy and society has changed markedly. Noticeably a booming economy has stagnated, a growing population started to age and decline in numbers (Sorensen, 2011), and some of the unanticipated consequences and limits of developmentalism itself have come to light (Yeung,

¹⁰ Indeed Dearing (1995: 58) notes that land value inflation meant that the national government had effectively recouped its initial outlay on land purchase and development of Tsukuba.

¹¹ https://en.wikipedia.org/wiki/Tsukuba,_Ibaraki

2016). Yet by now the process of scientific catch-up that Tsukuba embodies could in large measure be said to have been achieved. Viewed as a global ethnoscape of modernity, however, the picture of Tsukuba is still coloured by marginality, albeit in subtle ways.

Science City or suburb of Greater Tokyo?

The physical (technoscape) transition in Tsukuba - as a result of increased accessibility, infrastructure and housing development in the vicinity - is a hard one to read. At first glance, these developments promise to undermine the uniqueness, and indeed some of the attraction of this new town to a rather self-selecting set of Japanese and foreign researchers. Yet, they may also provide the means by which this relatively marginal science space might move nearer to the international and commercial mainstream by virtue of its ability to leverage the urban scale and amenities of an 'alpha' world city.¹²

The original discussions that led to the development of Tsukuba Science City envisaged a new settlement around 100km away from Tokyo, since this was 'far enough away so that the relocation effort would be taken seriously, and it was a sufficient distance so as to not be subsequently engulfed by the advancing suburbanization of Tokyo' (Dearing, 1995: 49-50). Against this intention, it would be ironic if much of Tsukuba's future and its record in promoting economic transition towards a knowledge economy would hinge on its incorporation into the capital city region. Moreover, the implications of this potential absorption as a suburb of Tokyo are ambiguous; instead of leveraging the sort of 'related variety' seen to be the hallmark of large diverse urban economies, Tsukuba may end up being neither special nor diverse, a consequence that is not uncommon among experiments in the campus-garden-suburb mould (Dawood and Phelps, 2015).

In attempts to avoid such ambiguity, different central, prefectural and local authorities now imagine Tsukuba as something more than a campus-garden-suburb. There is the increasingly untenable image of Tsukuba as a separate rural science city, a view to which the Ibaraki prefectural government to a certain extent continues to hold. Moreover, there is some evidence to suggest that the Ibaraki Prefectural Government located in Mito is concerned with the growth and increasing independence of Tsukuba (General Manager, Department of planning Promotion, Tsukuba City 8 June 2016) from the rest of the largely rural prefectural economy. Nevertheless, as Tsukuba goes, so goes Ibaraki Prefecture, and the latter has actively sought to re-image itself, as shown by changing its slogan from 'Standing on Industry' to 'Standing on Innovation' (Director, International Affairs Division, Ibaraki Prefectural Government, 10 June 2016). Second, evidence suggests that the image of a Greater Tsukuba¹³ has been significantly enriched beyond a garden-campus high-tech island towards a new town that could leverage the metropolitan economies of Tokyo (Tsukuba

¹² Tokyo invariably ranks alongside London and New York as an alpha world city in analyses based on the stock of business and financial services industry (Beaverstock et al., 1999).

¹³ The promotion of integrated urban management around Tsukuba happened since the late 1980s. Six neighbouring municipalities were merged into Tsukuba Science City in 1987, 1988 and 2002, extending its total land coverage to 28,400 hectares (equal to about half the area of Tokyo's ward sections). It composes of a central research and education district and suburban district, making Tsukuba a complex urban configuration as well (Tsukuba Science City Network, 2013).

Science City Network 2013). If the 1985 Expo was an event that catalysed the development of Tsukuba, the completion of the Tsukuba Express (TX) railway line in 2005 has had a more profound effect twenty years later. This line connects Akihabara city, Tokyo Prefecture and Tsukuba city, Ibaraki Prefecture, within a total journey time of 45 minutes, almost half of that taken by the Joban line and highway bus (Kawada et al. 2010). In a similar trend seen almost everywhere else across the greater Tokyo area, the major stops *en route* to Tsukuba have been the subject of significant new residential development, creating new outer suburban dormitories for Tokyo.¹⁴ One of our interviewees in Tsukuba described how

‘We are stop 20 on the TX - the last stop. When I first arrived, stops 17, 18 and 19 were just rice paddies. All of those are fully developed now ... various shopping centres and building communities have popped up for at least three or four stops going into Tokyo. So rather than being perceived as a rural teaching area, I think now a lot of people from Tokyo are actually moving out to Tsukuba, where they can have bigger homes and greener space and commute into Tokyo’ (Professor, Tsukuba University, 6 June 2016).

Stimulated by this growing demand and speculation for future property price increase, the average land price near the TX stations increased significantly compared to those further away, especially at the two ends of the TX line (Morito Tsutsumi and Seya 2008). Kenkyu-Gakuen station (the station before Tsukuba), built on a former car test track, for example, has become the focal point for much recent real estate development in Tsukuba, including new local government offices, a retail mall, commercial offices and residences, to be developed within a total of 484.7 hectares of land, the largest among the 20 stations (Sugiura 2010). Indeed one interviewee recognised that the planning of Kenkyu-Gakuen was originally envisaged as a subcentre of Tsukuba, but now it has grown sufficiently to effectively become a twin-core to Tsukuba (General Manager, Planning Promotion, Tsukuba Science City, 8 June 2016). Interestingly, although the Special Measures Law for Coordinated Development of Residential Areas and Railways in Metropolitan Areas had enabled simultaneous construction of railways and housing projects along the TX line (Yamada 2005), Tsukuba, as a National project, did not benefit as significantly as other stations in real estate development (Sugiura 2010).

Signs of the new dormitory function of Tsukuba are reflected in two distinctly different types of zoning and administration. The built-up core area was thoroughly planned and developed in a garden city/new town morphology by the national Urban Renaissance Agency but much of it remains in the hands of individual central government ministries. The surrounding area - which has taken on the appearance of low density, spreading development morphology typically found in the outer suburbs of the United States - was regulated by Ibaraki Prefectural Government (Director, Urban Renaissance Agency, 8 June 2016). New high-rise residential towers have been developed in or adjacent to the commercial centre of Tsukuba privately (figure 2). Yet elsewhere in the central area of the city, there is ‘planning blight’ in

¹⁴ Indeed, while the development of the TX line was something of an act of faith given the sparse population along the proposed route, legend has it that as a result of the residential development it has promoted, TX line is now one of the most profitable private railway lines in Japan (Vice President, City Planning Institute of Japan, 1 June 2016).

an otherwise prosperous and generally well-tended and well-planned new town, as residential apartments intended for civil servants and foreign workers now stand largely or entirely empty. These residential complexes were built in the 1970s, and occupy the very centre location of Tsukuba close to amenities and the railway station, and consequently have a new value in terms of residential development. These facilities have now passed into the hands of the Ministry of Finance, which is charged with their disposal presumably at highest value. Consequently, as they await disposal to the highest bidder, weeds grow among these boarded up houses and apartments (figure 3). It is ironic, but not surprising that in a post-developmental state of Japan, Tsukuba is becoming a compact city, housing a population of 225,000 by 2015, a scenario far from how it was conceived at the beginning (General Manager, Planning and promotion, Tsukuba Science City, 8 June 2016).

Insert figures 2 and 3 here

Source: the author

For one interviewee, the brand of Tsukuba is valuable and by now quite established, the comparison being drawn was the priceless image conferred by Mount Fuji (General Manager, Department of Planning Promotion, Tsukuba City, 8 June 2016). However, the sensitivities over the further growth of Tsukuba and the nature of that growth have magnified as a result of its increased connectivity and the associated land development potential. According to one interviewee, the Mayor of Tsukuba is ambitious for expansion. The *Grand Design for New Tsukuba* of 2010 has its priorities to create ‘A global city leading world’s innovations’ and ‘A culturally creative, vital city surrounded by lush greenery and relaxed atmosphere (Tsukuba City Planning Record, 2010, p 5). Whereas the ‘Tsukuba style’ of living has been continuously leveraged by the local authority (Director, International Affairs Division, Ibaraki Prefectural Government, 10 June 2016), its integration with the greater Tokyo might also have been reinforced. Kawada et al. (2010) for example, has found a positive impact of the TX line on the number of trips to Tokyo when different travel modes and distances to TX stations were accounted for.

Developmental state icon or post-developmental state puzzle?

Under the developmental state era, there was a long-held central government expectation for Tsukuba to become a high-tech suburb or ‘Silicon Valley’ adjunct to greater Tokyo (Holroyd and Coates, 2007). Indeed, ‘Silicon Valley’ has provided a hopeful point of reference for the outer western suburbs of Tokyo. However, against the context of economic slowdown and urban renaissance, the Japanese central government has abandoned aspirations for balanced national development seeking to strengthen its international competitiveness by refocusing planning attention on a greater Tokyo and its inner suburban centres in particular (Fujita 2011; Tsukamoto, 2012). Tsukuba appears likely to lose some of its distinctiveness as part of the booming TX suburban corridor. Previously Tsukuba was self-sufficient as a result of research institutes providing housing for staff and the proximity of residence to work, but as this subsidised housing has been terminated and as asset management come into play, many employees in Tsukuba have moved out to its outskirts or along the TX line (Executive

Managing Director, Tsukuba Centre Inc, 6 June 2016). 20,000 people now commute *into* Tsukuba every day (General Manager, City Planning promotion Department, Tsukuba City, 8 June 2016). With a renewed focus of national government on the inner suburban cores of Tokyo, rather than its explicit recognition of and planning for the outer suburbs seen in previous decades, Tsukuba faces the prospect of relative anonymity. While the research and education weight of Tsukuba means that its residential base could be regenerated, it might also be the case that students who in the past came from all over Japan now come increasingly from the Tokyo region, and have the option of commuting to Tsukuba (Senior Researcher, National Institute of Land Infrastructure Management, 9 June 2016). In 2010 the daily commuters on TX line had reached 283,000, among which nearly ten percent had Tsukuba as their final destination (Sugiura 2010).

Among the other challenges facing Tsukuba (and a post-developmental Japan in general) is to overcome the separation between science and commercialisation that was rooted in the campus-garden-suburb model embraced as part of developmentalism. For a researcher and CEO of a private company who has been living in Tsukuba since 1993, the culture of Tsukuba was one of pure research with commercialisation taking place in Tokyo. Indeed, he likened the culture in Tsukuba to that in China in the 1980s with a lack of commercial focus (President and CEO, Tsukuba Technology Co. Ltd., 7 June 2016). Amplifying this point, he went on to describe how his company decided to set up a branch in Tokyo as Tsukuba was regarded a good location for research but not for business. This lack of commercialisation desire was also sensed by a post-doctoral researcher, who remarked that in Tsukuba, 'publishing papers in international peer-reviewed journals, ideally in English, is the key driver for the bulk of people working here' (Post-doctoral Researcher, Chemistry Laboratory, Tsukuba University, 7 June 2016). Nonetheless, the changing philosophy towards a post-developmental state requires a greater role for the market. Consequently, efforts to commercialise the results of pure research are increasing in Tsukuba, which have also coincided with the greater accessibility to Tokyo afforded by the TX line. The Tsukuba Science City Network was created in 2004 was precisely for the purpose of speeding up commercialisation as was the creation of Tsukuba International Strategic Zone in 2011, led by Tsukuba Global Innovation Promotion Agency (TISZ, 2013). Now there are over 100 venture capital businesses operating in this science city (Holroyd and Coates, 2007). The research institutes and universities in Tsukuba have also undergone changes. Many research institutes in Tsukuba have introduced incentives in their employment contracts and funding regimes, with a view to stimulate more applied research and encourage more interactions with the private sector, though this transformation will take time to generate significant effects, as one interviewee acknowledged (Senior Researcher AIST, 9 June 2016).

In this regard, the closer connection between Tsukuba and greater Tokyo might imply that Tsukuba will be able to leverage the global connections that operate in and through Tokyo. Perhaps following this logic, one could argue for the likelihood of greater synergies between Tsukuba and the Greater Tokyo economies, since on one side, the former has the space for research and production activities that the latter lacks; on the other, companies based in

Tsukuba could access the greater degree of commercial focus and market information of Tokyo (Director, Tsukuba Science City Network, 9 June 2016).

However, if anything, the opposite may be true. Originally, there were 43 institutes moved to Tsukuba, the remaining 29 seems to tell a story of rationalisation and merger of individual institutes into fewer larger ones (Director, Urban Renaissance Agency, 8 June 2016). Several national research institutes have effectively engaged in a small measure of re-centralisation back to Tokyo. While they are unable to relocate wholesale, some such as AIST and NIMMS have nevertheless opened Tokyo branch offices (Director, International Affairs Division, Ibaraki Prefectural Government, 10 June 2016). Of the private companies that opened or relocated R&D labs to Tsukuba, around a quarter have now retrenched given the greater physical and virtual accessibility to the research conducted at Tsukuba institutes (Executive Managing Director, Tsukuba Centre Inc., 6 June 2016). In contrast to the over 200 private labs identified by Castells and Hall (1994), there are 150 today (Ibaraki Prefectural Government, 2016). One interviewee even argued that the research institutes themselves are effectively branches responsible to their ‘head offices’ (the Ministries) in Tokyo (Professor, Department of Social Systems and Management, University of Tsukuba, 6 June 2016). Therefore although Tsukuba’s growing physical integration into Greater Tokyo provides better social opportunities for the existing Tsukuba population (Post-doctoral Researcher, Nano Electronics Research Institute, AIST, 9 September 2016), it might offer little in terms of research collaborations or commercialisation, which further obscures the future urban system in this part of Japan.

From the margins to the centre of new Argonaut connections?

A potentially fruitful way to peak into the mist of Tsukuba’s in-betweenness, both conceptually and methodologically, is through examining the internal dynamics of this city and its articulation with communities of internationally mobile scientists – what Saxenien (2007) refers to as ‘New Argonaut’ connections and which are part of Appadurai’s (1996) ethoscapes of modernity.

The original marginality of Tsukuba’s science community has gradually changed. Among the research institutes I spoke to, several (such as KEK, AIST, NIMS and IPW) now enjoy reputations as being among the world’s leading centres in their fields or in particular sub-fields. The reputation of the Public Works Institute and KEK was noted earlier. Similarly, the Electrotechnical Laboratory (ETL) and semiconductor research in particular housed within AIST was regarded by one of my interviewees as being one of the very best in the world (Chief Senior Researcher, AIST, 9 June 2016). This persistent science & technology achievement was to a great extent laid down by Japan’s developmental state as discussed earlier, but it also implies a selective strategy to internationalise its human capital in a place like Tsukuba, whose labour pool is:

‘Entirely unique within Japan ... the majority of people living in Tsukuba came to do research or to teach from another country, or they are Japanese who relocated ... In a

sense the Japanese people living in Tsukuba are also foreigners' (Professor, Tsukuba University, 6 June 2016).

This observation was echoed by another interviewee who noted: 'A lot of people coming to Tsukuba would say it is more like Europe within Japan' (Post-Doc, NIMS, 26 September 2016). Traweek (1992:457) had earlier noted how Japanese physicists who worked in Tsukuba and at KEK at that time were aware of the fact that KEK, and Tsukuba in general, were somewhat outside the control of Japanese physics community, which provided a consequent attraction to a loyal band of returnees to Tsukuba and KEK. Today Tsukuba continues to compare favourably with its domestic peers in terms of its research culture (Chief Senior Researcher, AIST, 9 June 2016). This may be a reflection of the specific institutional environment established at the outset in Tsukuba, which, despite its marginality, also is unlike elsewhere in Japan. The University of Tsukuba, for example, has not been organised in the same hierarchy as the traditional Japanese universities, and recruited at the outset in a more open way (Professor, Tsukuba University, 6 June 2016).

Arguably, however, the innovation potential of such a diverse and international labour pool, is handicapped by two institutional shortcomings of Tsukuba as a legacy of its planned nature as a science city. On the one hand, despite the undoubted and unique mixing of nationalities in Tsukuba, the gaps in communication, previously noted by Castells and Hall (1994: 72) among research institutes and among different groups of students and scientists, appear to remain. A recent survey (Ibaraki Prefectural Government, 2016: 5) indicated that, among the 1,781 foreign researchers, by far the largest group in Tsukuba were Chinese (33.7%) and the majority were from East Asia including China, Taiwan, South Korea, Vietnam, and Thailand (53.5%). Researchers from the UK and USA accounted for only 4.8%. This suggests that Tsukuba may play more of a regional than a global role. Moreover, foreign researchers tended to network with peers from their home countries, and rarely blended into the Japanese community on a more informal/personal level (Post-doctoral researcher, NIMS, 26 September 2016). As the largest group, it was little surprise to find that the Chinese contingent in Tsukuba forms the most cohesive community, though organisation there remains informal (Tsukuba Center Inc., 6 June 2016).

Arguably, the process of economic and scientific catch-up represented by Tsukuba pursued under developmental state policies has gone some way to redressing the marginality of science to Japanese society. Less clear is whether post-developmental policies might narrow any gaps further, especially given some of the wider constraints on the evolution of the individual and organisational culture surrounding research. Publishing in English language journals and presenting in international conferences are highly encouraged in order for researchers at Tsukuba to align themselves with the mainstream research in the world (Post-doc, NIMS, 26 September 2016). However, chief among the potential obstacles are the ways in which Japanese language and work culture have played their part in the context of what remains a relatively closed national economy. Here, the difficulty of forming cross-ethnic and cross-discipline networks might have something to do with the legacies of a city so thoroughly planned by a developmental state. For one interviewee, at least 90 per cent of the

stereotypes surrounding Japan are true (Research Specialist, International centre for Water Hazard and Risk Management, Public Works Research Institute, 9 June 2016).

One example mentioned was the very hierarchical organisation of research compared to her home country (the Netherlands), which extended into a lack of communication about what research leaders and line managers were doing, and the need to cultivate relationships within the workplace in order to get things done. More specifically,

‘The culture is completely different. In the Netherlands it is much more direct. If you have an idea, it doesn’t matter who you are, you can just say your idea to anyone, and discuss it and improve it and maybe manage it. But here it is more like a pyramid, hierarchy. ... Relationships are the key to getting any project started. If you need funding or if you need to consult with an expert, you never go directly to the person in charge. You have to go to someone you know who knows someone that they know ... you can’t go directly’ (ibid, 9 June 2016).

For others, though, the hierarchical organisation of research into specific tasks also generated a degree of freedom and autonomy for individual teams, which was appreciated even if it displaced broader opportunities to discuss the overall findings from research (Post-doc, KEK, Belle II Experiment, 6 June 2016; Post-Doc, NIMS, 26 September 2016; Senior Researcher AIST, 9 June 2016). It can be problematic to draw generalisations across the many different institutes found in Tsukuba. However, my other interviewees noted how research culture often depends on the director of each specific institute. Directors are drawn from two different pools – government ministries or academia. For one interviewee, the former are poorer managers of researchers and the research process compared to the latter (Post-doc, Public Works Research Institute, 9 June 2016). Moreover, the orientation of academic directors themselves can differ significantly depending upon their international experience as one interviewee noted regarding recent changes in the work culture of his institute (Post-doc, NIMS, 26 September 2016).

While ‘Tsukuba Science City has moved from government-focused research to collaborative initiatives with industry, from Japan-specific projects to international partnerships, with a particular emphasis on Asia’ (Holroyd and Coates, 2007: 132), for Basurto (2007: 15) ‘Tsukuba Science City has gained international prestige for what it is best known, a mirror image of the omnipresence of the Japanese national state’. Despite the gradual changes in its complexion as a settlement and community, Tsukuba remains quite firmly associated with nationally-oriented development goals in a way which conceivably prevents its projection within the global ethnoscapings of modernity (Appadurai, 1986). Here at least there remain continuities between Japan’s developmental and post-developmental state aim of catch-up. I end on a quotation from one interviewee that neatly sums up the dilemma in this regard.

‘The problem is that they attract people from outside of Japan but not long term. ... if they want to make a silicon valley of Tsukuba they will have to change their politics, to open it more and let foreigners come in the leading positions... as long as they don’t do that it is not going to happen. The potential is there, the money is there, it is

just that culturally they are too protectionist' (Post-doctoral Researcher, NIMS, 26 September 2016).

CONCLUSION

This paper examines the history and recent planning of Tsukuba, an icon of Japan's developmental state of the 1960s. I have noted how Tsukuba is now an in-between place in three respects. In physical and economic planning terms, it is evolving away from the international garden-campus-suburb (Forsyth and Crewe, 2010) model that dovetailed with the developmental state policy of the day. However, to what extent it is evolving and with what effects on local and national economic development is less clear. Its ambiguity as neither quite a separate city nor suburb of Tokyo and challenges relating to its institutional configuration, also reflect the second in-betweenness, which is to do with the broader strategic challenges facing the post-developmental state of Japan as it transitions from a distinctive political economic path carved out of strong interventionist tools and precedents (Schaede and Grimes 2003). Indeed, the 'strategic ambiguity' that was said to characterise the early development of Tsukuba (Dearing, 1995: 159) appears set to continue. Finally, Tsukuba might be regarded as somewhere between marginal and central within the international flows of 'New Argonaut' (Saxenien, 2007; Saxenien and Hsu, 2002) labour that increasingly weave disparate science cities and places into the global knowledge economy landscape. Great science and technology achievements have been recorded in Tsukuba. However, this science city is yet to position itself centrally within the global knowledge economy landscape as a destination or point of return for international skilled migrants.

Academic discussions on the geography of and urban planning for the knowledge economy have tended to be fractured into separate bodies of literatures that are rarely brought into dialogue. Here I used Appadurai's (1996) notion of different global 'scapes of modernity' as a means of integrating otherwise separate discussions found across the fields of economic and cultural geography, urban planning and even the sociology of science. Much early research focused on the economic development record of designated science parks and cities as distinct *technoscapes* (Braun and McHone 1992). Their study can hardly be separated from the transportation and housing market contradictions of the wider urban economies in which they are located (e.g. Saxenien, 1983; While et al., 2004; Valler et al., 2012). A small but distinct literature has focused on designated science parks, cities and corridors as *ideoscapes* (e.g. Bunnell 2004), through which states seek to project senses of national economic modernity, and strengthen their international influence as shown by Singapore's extraterritorial investments (Phelps 2007). Contemporary research further highlights the centrality of 'new Argonauts' or *ethnoscape* connections (e.g. Saxenien, 2007; Saxenien and Hsu, 2000; Sternberg and Muller, 2010) that underpin the development of knowledge spaces.

However, Appadurai's (1996) scheme is also useful in highlighting some of the practical planning challenges facing places like Tsukuba as 'technopoles of the world'. If the international campus-garden-suburb model is now the past of planning for the knowledge economy, then new models that plan beyond 'simple' separations of settlements, land-uses and functions with reference to new spatial imaginaries (Healey, 2006) are called for. These

will need to integrate policies bearing upon some of the spatial fixities of land-use and housing but also the flows addressed by transportation and infrastructure planning as well as labour market policy in ways which have rarely been in evidence even in developmental states (Miao, 2016).

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