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Government intervention in the evolutionary process of innovation districts: a comparison of Tech City in East London and 22@ Barcelona

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MSc Urban Regeneration

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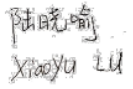

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Abstract

Innovation districts have been emerging and developing rapidly all around the world over the past two decades. Meanwhile, there has been a growing consensus that it is important for the government to take a role in the innovation activities. However, questions remain that who should lead and how to lead different innovation districts to certain development stages. In this case, the research contributes to the existing literature by proposing a comprehensive and comparative analytical framework to understand the multi-dimensional government interventions in the evolution of various innovation districts from emergence to maturation. Using a comparative case study approach, Tech City in London and 22@ Barcelona were selected to explore the government's role and their efforts in shaping the innovation ecosystem. The findings from these two cases indicated that the government's role has been co-evolved with the other actors in the evolution process. In addition, government intervention is a non-linear and dynamic process. On the one hand, government tends to intervene in complicated ways, using both direct and indirect approaches. On the other hand, various intervention dimensions are interrelated and may have spillover effects upon each other. These results can provide referential value for the policymakers and local practitioners of the innovation districts.

Key words: Innovation ecosystem, Government intervention, Tech City, 22@ Barcelona

Chapter 1 Introduction

1.1 Background Overview

Innovation has increasingly been seen as the most critical component for competitiveness and prosperity of cities and regions (Florida 2004), as the paradigm shifts from mass production to the knowledge economy. In this context, there is a global trend of the emergence of innovation districts (Pluijmen 2017), among which the 22@Barcelona is being considered the first ever created. The concept was first defined by Bruce Katz and Julie Wagner at Brookings in 2014, who identified the rise of innovation districts in US cities and urban regions. Globally, more 'innovation districts' have been set up in cities as diverse as London, Toronto and Rotterdam etc., forming the new geography of global innovation (Wagner et al. 2017). Unlike the previous out-of-town science park which uses expansive greenways and parking lots to separate institutions and companies, innovation districts are a new type of space formed by the 'open' innovation ecosystem embedded into the pre-existing urban space. They are therefore been considered as an important tool to reshape the rundown neighbourhood of the city centres. And they also embrace the the attributes of density and proximity to facilitate collaborative and strong social networks (Wagner et al. 2017).

However, there remain questions about how to translate the ambitious ideas into successful innovation districts for the practitioners, for example, who should lead, how to lead and what levers to push (Wagner etc. 2017). Although some authors believe that the market can be better placed than the government to select and support innovations, there has been a growing consensus that it is important for the government to take a role in the innovation activities (Hall 2013; Wagner et al. 2017; Mazzucato 2019; Harris 2019). Nonetheless, encouraging organic evolutionary growth but also driving intentional, deliberate change through government intervention in innovation districts remains a challenge (Wagner et al. 2017). Also, innovation districts are emerging and developing in radically different ways, and thus there is no one-

size-fits-all approach that can be used in all of them. In this case, a systematic and rigorous comparative study of the relationship between various government interventions and innovation districts is crucially important but still very rare in the literature.

Therefore, this dissertation seeks to make up for the research gap. Two globally leading innovation districts- Tech City in East London and 22@ District in Barcelona are purposely selected for research. They represent two distinct development models: Tech City developed from an ecosystem comprised of multiple smaller companies in an organic way with government intervening at the next stage, while 22@ was an intentionally 'planned' district from the beginning. Overall, this comparative study could enhance the understanding of government interventions and the underpinning mechanisms for enabling the innovation ecosystem to evolve, thus providing practical significance and referential value for the policymaking in the future for both the two cases and other districts in the world.

1.2 Research Questions

The main question that this research would like to answer is:

> *"How does government intervention contribute to shaping the innovation ecosystem in the evolutionary process of Tech City and 22@ Barcelona innovation district?"*

Specifically, this research seeks to find answers to the following sub-questions:

- *What is the government's role and how has it changed in the evolution of tech city and 22@ Barcelona?*
- *What efforts have been made by the government in different development stages and how do they transform the innovation ecosystem of the two cases?*

1.3 Structure the Dissertation

This study is structured as follows. Chapter 2 reviews relevant literature about

innovation districts, innovation ecosystems and the main topics on government intervene. Chapter 3 describes the research methods used, including comparative case study, interviews and documentary analysis. Chapter 4 provides an overview of Tech City and 22@Barcelona. Chapter 5 answers the research questions through analyzing and discussing the collected data. It describes the government intervention processes of the two cases from four dimensions within three stages, and then compares the results and reflects the main findings to the literature and theories. Finally, chapter 6 summarizes the findings, highlighting possible further research and the limitations of this paper.

Chapter 2 Literature Review

2.1 Debates on Innovation Districts

The concept of an innovation district derives from territorial innovation models such as regional innovation system (Braczyk et al. 1997), innovation milieu (Aydalot & Keeble 1988), cluster (Porter 1990), and industrial district (Maillat 1998). More recently, Innovation districts are defined by Katz and Wagner (2014) as 'geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators.' They further argue that all these elements are connected 'by transit, powered by clean energy, wired for digital technology, and fueled by caffeine' (Wager et al. 2017).

City governments have tended to welcome and promote innovation districts in the past years, which may attract the creative class (Florida 2004), accelerate the technological innovation process and make places more attractive to investment (Lawrence etc. 2019). However, the development of the innovation district in a poor neighbourhood can be a mixed blessing. One long-lasting critique is gentrification and the potential displacement of local business and residents (Smith 2002; Mirabal 2009). More recently, Florida's work on new urban crisis adds that the concentration of the high-tech companies and creative class has deepened inequality, segregation, and poverty in the superstar cities and leading technology and knowledge hubs (Florida 2017). Similarly, a report from Nesta examines the innovation policy in the UK and argues that although innovation practice is world-leading in many areas, it is only focus on a small handful of places and sectors, benefiting far fewer people and undermining democracy (Farmer & Gabriel 2020). Thus, there is a consensus that more 'inclusive' policies are needed to deal with the fundamental social-economic challenges and make the innovation districts work for everyone (Farmer & Gabriel 2020; Wagner et al. 2017; Sims et al. 2015).

2.2 Fostering Innovation Ecosystem in Innovation Districts

Innovation ecosystem has become popular with a rapidly growing literature in the last 15 years (Gomes et al. 2018). It applies ecological concepts to management and organizational research, which emphasizes the adaption as driving forces of the community and dynamic evolutionary processes, such as variation, selection and retention (Monge et al. 2008). Innovation ecosystem is therefore viewed as a hybrid of different networks and characterized by non-linearity and self-organization (Russell & Smorodinskaya 2018; Mercan & Göktaş2011). Granstrand and Holgersson (2020, pp.3) further defined it as the "the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations". In addition, innovation ecosystem is also a multi-scale concept. Many studies have explored the main elements of innovation ecosystem in cities, as shown in the Table 1. The Brookings Institution (2014; 2017) reduces the scope of innovation ecosystem across a city and focuses on innovation districts. It finds that these three assets are present in all innovation districts: economic assets— the firms, institutions and organisations; physical asset— the public and privately owned spaces such as buildings, open spaces and infrastructure; and social networking asset— the relationships (e.g. strong ties or weak ties) between various individuals, firms and institutions (Fig. 1). The resulting ecosystem is a synergistic relationship between people, firms, and place and the strategies to facilitate convergence of them are highlighted by Brookings. Mulas et al. (2015) critique these assets identified by Brookings ignores the connections generated beyond geography. Besides, although these elements have been widely used to analysis innovation districts, the network between innovation actors and local communities that is critical to build inclusive innovation ecosystem is often overlooked in the studies.

Table 1. Categories related to innovation ecosystems in cities

(Adapted from Mulas et al., 2015)

Winden et. al. (2007)	Schaffers (2011)	Crowley (2011)	European Commision (2013)	Bell (2014)
Human capital / scale /diversity	Citizens	Human capital	People	Talent
Quality of life / amenities (infrastructure)	Utilities	Wider conditions (infrastructure)	Place (infrastructure)	Gathering places / competitive advantage
		Institutions / government	Policymakers	
	Organizations / economic activities	Research centers / businesses / universities / urban entrepreneurs	Private (businesses)	Academic institutions / capital / support services
Industrial science		Networks		Guides / heroes
	Supply of goods and services (markets)	Markets		customers

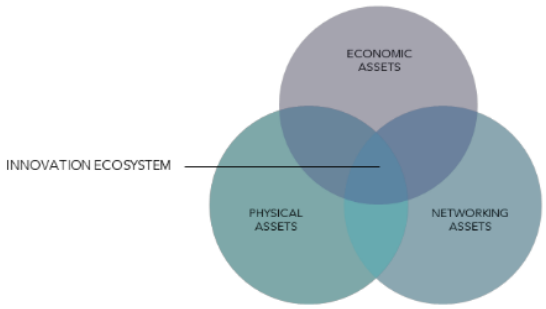

Fig. 1 Three assets of innovation districts (Adapted from Wanger et al., 2017)

2.3 Government Intervention in Innovation Ecosystems

2.3.1 Government's Role and Their Intervention Approaches

Some researchers classify the innovation districts into top-down (public-led) and bottom-up (market-led) approaches. The former is created by different levels of

governments and/or other public organisations and can have certain territorial boundaries, while the latter may arise spontaneously without any formal planning from the government, and often lack of exactly defined spatial boundaries in the structure of existing urban texture (Vershinin 2017). However, these two approaches only depict two opposite ideal types of the role of government in building innovation districts. Things are not always that black and white. Instead, many governments adopt a more hybrid way and their roles may vary from case to case (Yeung 2000). In this case, a growing body of literature highlights the changing nature of government's role. In a non-linear and increasingly 'flat' innovation ecosystem, government may neither be 'a supreme administrator' or a 'night watchman' (Russell & Smorodinskaya 2018). Innovation is actually 'a collective process' that government should fertilize the interactions and linkages of multiple stakeholders (Mazzucato 2019; Farmer & Gabriel 2020; Sun et.al 2019), which challenges the traditional views that see the government as a barrier to entrepreneurial actions. Moreover, some researchers adopt the ideal Triple Helix model to interpret the overlapping interactions of the government, industry and universities in a knowledge-based society (Leydesdorff & Etzkowitz 1996; Daniels et al. 2017; Pique et al.2018). This model has been applied in a number of districts and cities (e.g. 22@ Barcelona) and two additional spheres, namely civil society and environment have been added to this model more recently (Leydesdorff & Fritsch 2006; Carayannis et al. 2018).

Apart from different roles of government discussed above, much of the research on innovation districts has also focused on various intervention approaches. Vandore (2011) identifies three types of intervention approaches in her research on cluster policy, including place branding, cluster strategies and ordinary functions of governments such as licensing and planning regulation. Some writers illustrate that most government intervention in innovation takes on two types: directive intervention through highly interventionist measures such as creating clusters to achieve predetermined results; and facilitative intervention which aims to overcome obstacles for private sectors instead of heavily influencing the innovation behavior (Wang 2018). More broadly, Uhl-Bien et al. (2007) propose the complexity leadership theory and

point out that various intervention methods such as orientating, directing, reframing, fostering and integrating etc. are necessary for managing the complex adaptive innovation system. In addition, Mazzucato (2016) challenges the market failure theory and the limited understanding of intervention ways of public sector as simply 'administrators', 'fixes', 'regulates' and 'facilitates' and 'de-risks' the private sectors, while emphasizes the importance of 'direct' creation of market landscapes that did not exist in the past. Similarly, Farmer and Gabriel (2020) argue that the innovation policy in the UK needs to broaden its remit and change the approach, becoming better able to direct innovation for wider societally important challenges. However, some indirect mechanisms that may bring tangible or intangible spillover effects on innovation activities have been underexplored in these studies.

2.3.2 The Dynamics of Government Intervention

While the issues around government intervention continue to receive considerable attention in both the theoretical and empirical literature, attentions has turned more recently to questions of dynamic agents and related actions in evolutionary process. For instance, the modified cluster adaptive cycle model (Martin & Sunley 2011) maps the phylogenetic evolution trajectory of the cluster (Fig. 2) and points out that the composite entities (e.g. industrial and agents) themselves change over time and may be able to address the potential 'lock-in' in the evolution process. The ability to adapt is also recognized by Harris (2019), who conducts an empirical study based on the cluster life cycle theory. However, his research does not portray the full story since it just examines different institutional configurations between government and business communities that serve as the drivers of the cluster evolution, while ignores other actors and influential factors. Also, to explain the reasons for the changing governance and development paths, some writers identify several external factors (e.g. political, economic and technological) based on case studies (Henkes 2016). Besides, a few researchers argue that the priorities of intervention strategies would also vary according to the objectives and development stages of the targeted cluster (Uyarra & Ramlogan 2012; Bevilacqua et al. 2018)

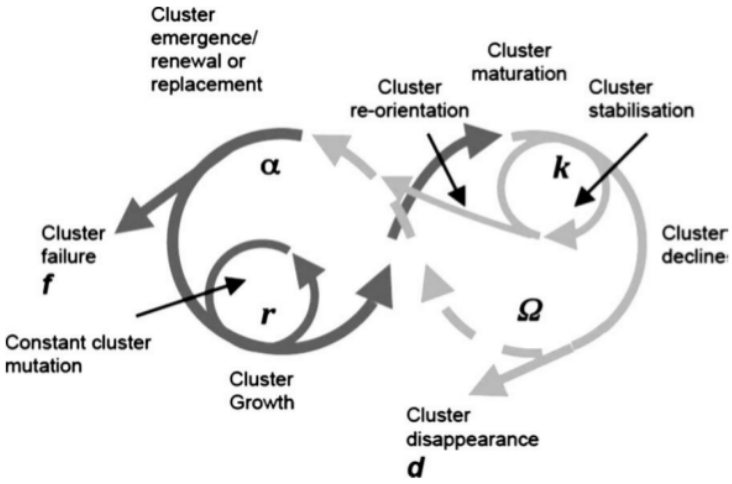

Fig. 2 Modified cluster adaptive cycle model (Martin& Sunley, 2012)

2.3.3 Dimensions of Government Intervention and Research Gap

Although there are ample researches related to the government intervention in different phases, empirical studies testing how government intervention affects different assets of innovation ecosystem are scarce, and relevant comparative studies between different districts are also lacking. Previous studies on public interventions have been mostly restricted to one or two area. For example, several studies have investigated the relationship between physical environment (e.g. workspace, public space) and innovation industries (Martins 2015; Davis 2015). Beyond this, many authors have analyzed and evaluated the cluster policy of a specific innovation district like Tech City (Vandore 2011; Nathan & Vandore 2014; Foord 2013; Nathan et al. 2019). However, it is argued by Nathan and Overman (2013; 2019) that cluster thinking fails to fully think through other issues such as costs and mobility. Non-cluster policy instruments may also have a positive or negative impact on the target cluster (Duranton 2011; Sternberg 2003). Hallsworth et al. (2011) therefore argue that regarding policies as discrete intervention that can achieve a particular goal on their own is actually unhelpful. Policy may be the cumulative impact of many different initiatives that may interact or even conflict with each other (Uyarra & Ramlogan 2012). In the same vein, Wager et al. (2017) claim that devising strategies on different dimensions of the innovation ecosystems may contribute to a successful innovation

district. This means a more comprehensive and systematic perspective which examines various government interventions in the evolution of the innovation ecosystem with a cross-national comparison offers a valuable way to expand the existing literature.

2.4 Analytic Framework

To answer the research questions, the analytic framework has been presented (Fig. 3), which links the different theories and concepts explained in the literature. Firstly, the modified cluster adaptive cycle model is used as a lens to describe the triggering actors and relative actions which affect the innovation districts' evolution at different stages of their life cycle. And three development stages of the two selected cases- Tech City and 22@Barcelona are analyzed, namely emergence, growth and maturation. Secondly, a multi-dimensional approach is utilized to assess how the government intervention affects the three assets of innovation ecosystem. Especially, connections between local community and innovation activities which have been rarely explored in previous literature have be discussed in this paper.

This framework provides a broad view of how government intervene affects areas that have been signaled in the literature as crucial for successful moulding of innovation ecosystem. It should be noted that the four layers of intervention, of course, are not exhaustive. Other layers such as place making may also have impact on the innovation ecosystem. However, due to the lake of physical intervention associated with public space and infrastructure in the past decade in Tech City (ACA1_LDN; ACA2_ LDN; ACA3_LDN; I1_LDN), place making is not considered as a major topic in this research.

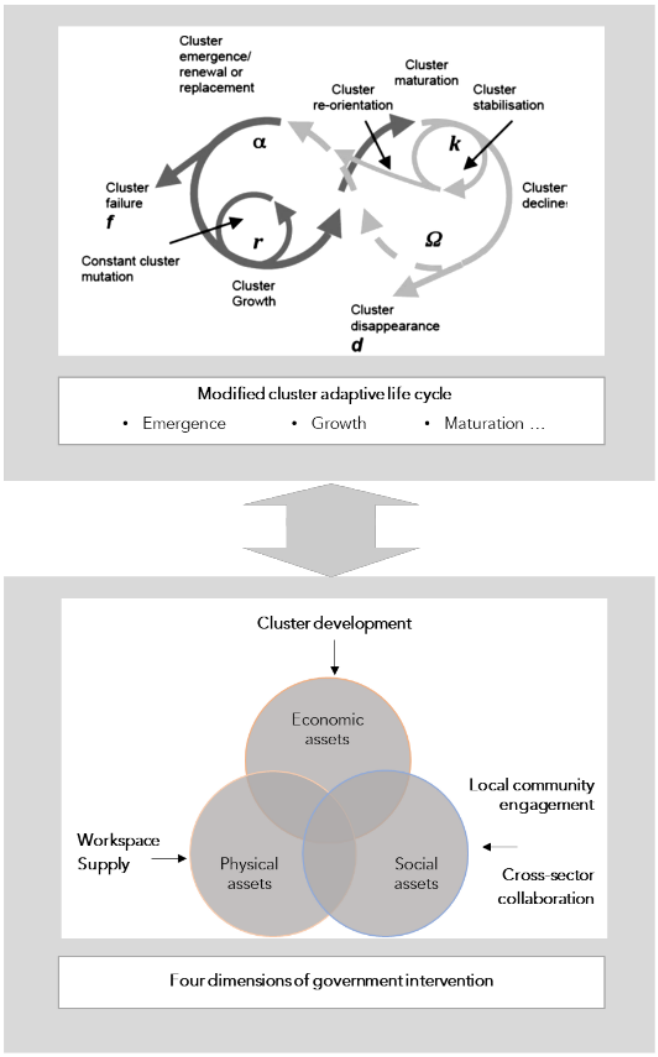

Fig. 3 The framework to analyse the multi-stage and multi-dimensional government interventions

Chapter 3 Methodology

3.1 Research Design

The research follows a qualitative approach to investigate the key issues and collect data based on the research questions, including case studies, interviews and documental analysis. The components of the research design and linkage between them are shown in Fig. 4.

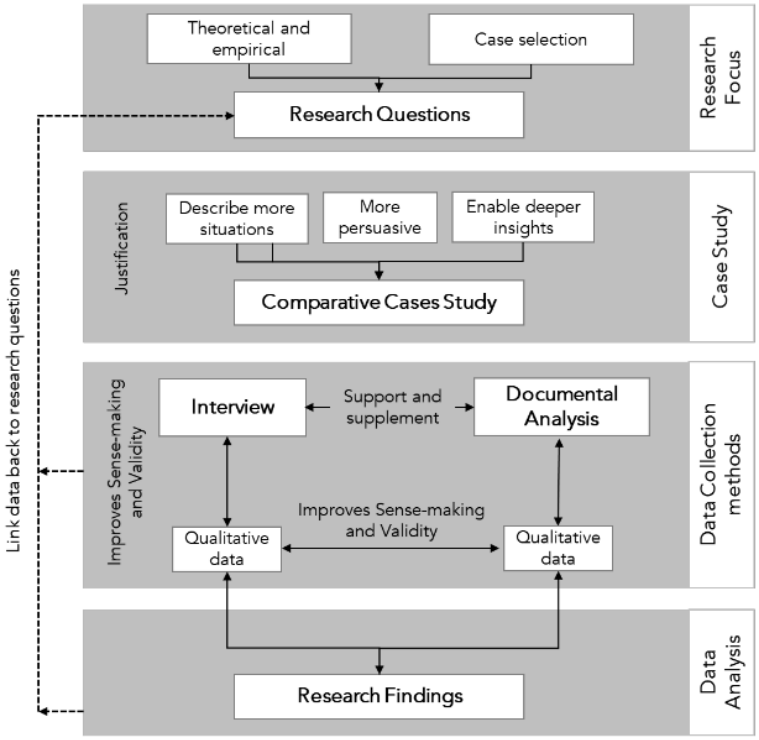

Fig. 4 Representation of research design (Adapted from Yin, 2003 and Jackson, 2014)

3.2 Comparative Case Study

Comparative analysis is defined as the 'collection of data on two or more situations, followed by an attempt to make sense of them by use of one or more explanatory models (Pickvance 1995, pp.36). According to Boschma and Frenken (2009), this

methodology would enhance the robustness of conceptual and theoretical explanations as well as enable deeper insights.

Picking the right cases to compare is a key step for conducting the research. Abu-Lughod (2007) suggests that the combined method of differences and similarities is essentially the logic of comparative case studies. Based on this, two comparable cases- Tech City and 22@Barcelona were selected for research. On the one hand, they are generally considered to be distinct in terms of governance approaches and ways of intervening. Tech City is famous for its light-touch intervention that minimizes the power of government in influencing the cluster while 22@ is often known for strongly top-down intervention. On the other hand, they are both embedded in the similar neighbourhoods which used to be the old industrial areas in the inner city (Smith 2014; Vandore 2011). And their emergence can both be tracked to roughly late 1990s and both move towards mature world-leading innovation districts today. Thus, they share similar spatial patterns and comparable evolution trajectories in which I can understand how the government intervention affects the innovation ecosystem in a similar temporality. In addition to empirically observable patterns, a deeper understanding of the causal mechanisms that bring these empirics into being could also be gained during such process (Sayer 1984).

3.3 Interview Design

Interviews were considered as one of the most appropriate methodologies for this research, as they directly target the case-study topics and focus on causal inference (Yin 2003). The first-hand interviews conducted were semi-structured and informal interviews, each guided by the interviewees' role and aimed to collect their views on the work of their organization and how they respond to the public interventions within the development process. The interviews were based around an interview guide (Appendix 2), which remain openness that allowed for follow up questions to explore new themes emerging throughout the conversation. Admittedly, the recruitment of members especially in public bodies was challenging. As shown in Table 2, 7 key

informants who are familiar with government intervention at various stages of the development process were interviewed Jun-September 2020. They represent a range of individuals such as leaders from the public sector, senior managers from social enterprises and academics. Beyond this, informal interviews were also undertaken. For example, a normal conversation was conducted with a tour guide in a two-hour tour of 'Silicon Roundabout and Tech City'. The quotes from informal interviews have not been used without permission.

Along with first-hand interviews, the secondary interviews extracted from online audio and video documentaries were also used. A coding was then employed to reference quotations or information provided by the interviewees, which can maintain the confidentiality of the participants (Table 2).

Table 2. Interview participants (primary and second data)

Case	Organization	Code/ Name	Type of Interview
Tech City	Academic	ACA1_LDN	Online interview
	Academic	ACA2_ LDN	Online interview
	Academic	ACA3_LDN	Online interview
	NGO	NGO1_LDN	Online interview
	NGO	NGO2_LDN	Online interview
	Informal	I1_LDN	Face to face
	Academic	Max Nathan	Secondary data (audio)
22@ Barcelona	Public Official	PO1_BCN	Online interview
	Public Official	PO2_BCN	Online interview
	Informal	I1_BCN	Ask questions via email
	Barcelona City Council	Marc Pérez-Batlle	Secondary data (video)

3.4 Documental Analysis

This research used documents as important sources of data, including online blogs, policy statements, project files such as planning reports, newspaper, consultation materials, monitoring and evaluation materials in different phases to analyze the

selected cases and wider context. These documents may provide information about the policy initiatives, projects and various stakeholders involved in and help to understand how the government intervention changed in the evolutionary process of the two cases.

Chapter 4 Background of Case Study

According to the modified cluster adaptive cycle mode, the trajectory of the evolution of two cases can be divided into three stages- emergence, growth and maturation. The criteria for assessing phases is based on 1) cluster's development (e.g. scale and density) (Nathan 2019); 2) involved actors (Harris 2019); 3) changing external circumstances (e.g. political, economic and technological factors) (Henkes 2016). Then, a brief description of the two cases is given and the timeline of the phases with key events of each district is shown in Fig. 6 and Fig. 8.

4.1 The Evolution of Tech City

Before officially named as Tech City, the digital cluster in East London emerged from the depressed ex-industrial neighbourhood around Shoreditch and Old Street. The area was filled with a history of creativity and entrepreneurship which can date back to 1980s due to the cheap rents of warehouse spaces and industrial vibe (Pratt 2009). During the DotCom bubble of 1999-2001, hundreds of software startups located near the Old Street (Nathan & Vandore 2014). And this came to prominence in 2008 with a wave of media attention about 'Silicon Roundabout', a term coined by Matt Biddulph on Tweet as a joke. (Butcher 2013; Foord 2013). Then, approximately 70 new startups had been attracted to the area at the end of 2009. In July 2010, Prime Minister's senior policy advisor Rohan Silva heard the speech at a meeting held in India. It was made by a CEO from Silicon Roundabout, who mentioned his frustrations but also optimism about the cluster's potential. Cameron and his policy team therefore decided to promote the tech industry that was still achieving growth after the global financial crisis (Harris 2019; ACA1_LDN).

Four months later in November 2010, David Cameron launched the 'East London Tech City' initiative, aiming to grow the cluster, attract FDI and create economic linkages between Shoreditch and a post-Games Olympic Park (Nathan et al. 2016). It

sits at the boundary of Islington, Hackney and Tower Hamlets with Old St roundabout and Shoreditch at its physical core, but no specific boundary was defined (Fig. 5). The Tech City Investment Organisation (TCIO) was established in 2011 to support the area, which was relabeled as 'Tech City UK' in late 2014 since the policy support went London-wide (Nathan 2019). By then, the number of firms and technology workers had been largely improved and Tech City was ranked as the world's third-largest technology cluster behind New York and San Francisco. (Davis 2015).

However, the localized policy which targeted only in the Tech City cluster was ended after 2014. 'Tech city UK' was then rebranded as 'Tech Nation' since spring 2018, confirming its UK-wide remit (Tech Nation 2017). The cluster is generally perceived as heading for maturation since 2014 (ACA1_LDN; ACA3_LDN). As a former Number 10 staffer argued that, Silicon Roundabout had served its purpose, which did not need as much encouragement from the central government as before (Volpicelli 2020).

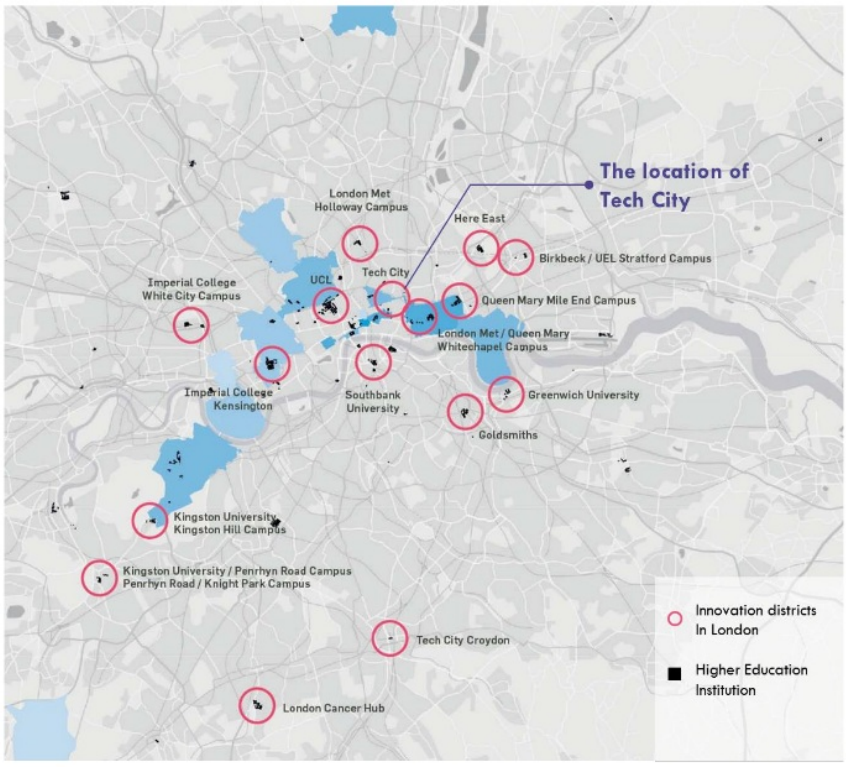

Fig. 5 Location Map of Tech City in London (Adapted from Hanna, 2016)

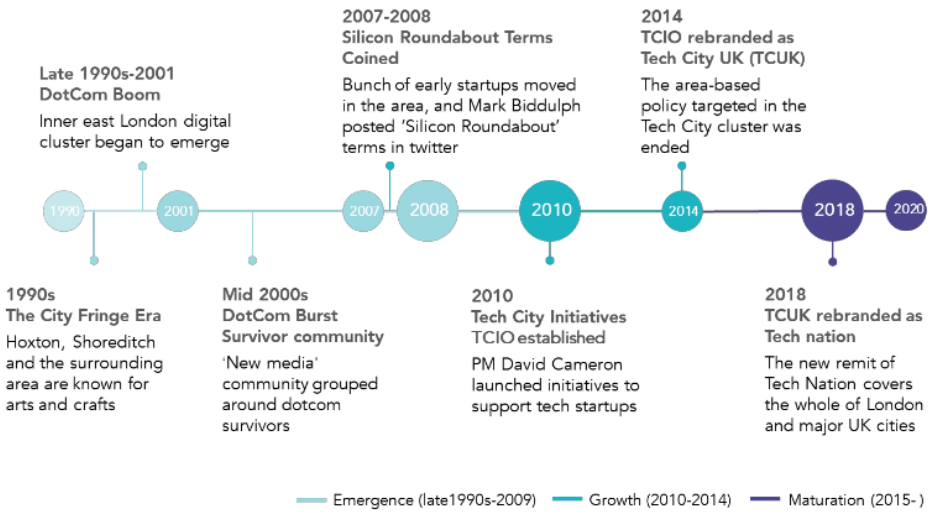

Fig. 6 The timeline of Tech City evolution (Based on Nathan et al., 2019; Harris, 2019)

4.2 The Evolution of 22@ Barcelona

22@ located in Poblenou, a previously industrial hub of Barcelona and was known as the 'Manchester of Catalonia' (Morisson 2014). Following the staging of the Olympics in 1992, Mayor Joan Clos wanted to rethink the development of Barcelona and drew aspiration from both experiences of Silicon Valley and Richard Florida's "Creative Class" as the new economic vision for the city (Smith 2014). The 22@Barcelona project was then launched in 2000, which had a 20-year time frame and aimed to transform the 200 hectares (about 115 city blocks) of the decline area into a mixed-use (e.g. working, working and learning) innovation district. The targeted sections are shown in Fig. 7, in which the planning department further identified six areas for special public-sector intervention (around 100 hectares) (Casellas& Pallares-Barbera 2009). At the same time, the municipal company 22@bcn, a multidisciplinary team of economists, urban planners and business and urban leaders was established to pilot the regeneration process until 2011, the year of its dissolution (Pareja-Eastaway 2016). In the first five years, the main infrastructures and buildings were developed, and the Council started to develop a strategy to attract innovation clusters to the district (Pareja-Eastaway& Miquel 2010). The second stage started in 2006, when the Council

mainly focused on the attraction of companies and talents to the area. Hundreds of new businesses installed each year, although the intense economic promotion process experienced a relative disruption due to the 2008 crisis. Nevertheless, it is one of the districts that has best withstood the crisis across the city (Pareja-Eastaway 2016). Besides, it had also become an international benchmark of innovation district at this stage, which started to export the experience to other cities such as Boston, Medellin and Montréal (Morisson 2014).

The election of Mayor Colau in 2015 has brought the 22@ into the next development stage. In 2017, a new municipal body, 22@ Coordination Commission was created to coordinate different actors. Meanwhile, a participation process, 'Rethink the 22@' was promoted to modify the strategy of the 22@ regarding the new needs and challenges (Gianoli & Henkes 2020).

Fig. 7 Map of the 22@ Barcelona (Henkes, 2016)

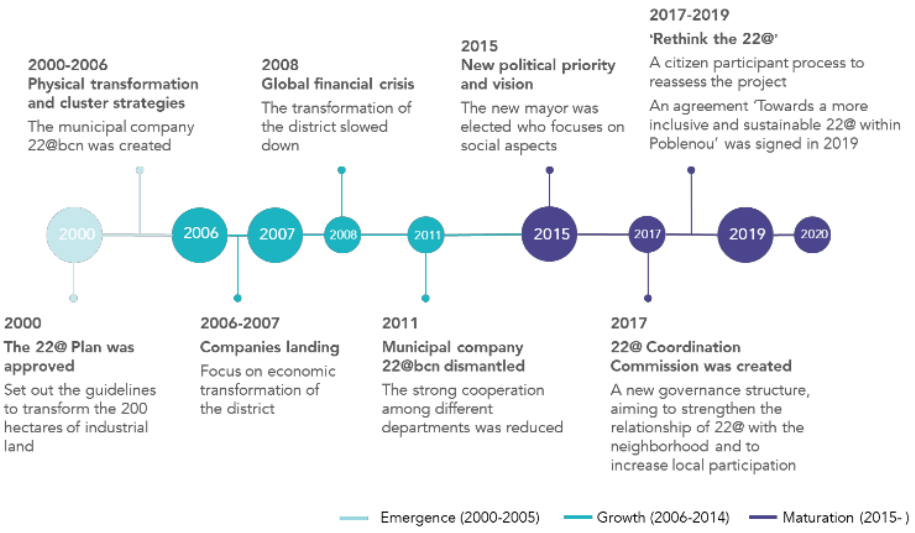

Fig. 8 The timeline of 22@ Barcenola evolution (Based on Gianoli & Henkes, 2020; Ajuntament de Barcelona 2019)

Chapter 5 Comparative Case Study Analysis & Discussion

Based on the results from interviews and documental analysis of Tech City and 22@, this chapter first presents the results of each case in terms of the four dimensions and three stages of government intervention described in the analytical framework. In the last part of this chapter, it compares these two cases and proposes some explanations and implications associated with the research questions.

5.1 Tech City

5.1.1 Cluster Development

There was no specific policy regarding a clustering of small technology firms before 2010. Nevertheless, it is argued that the efforts made by the successive governments at regenerating the deprived area and fostering the creative industries create an environment where a digital cluster could prosper (Jackson 2014). For example, the City Fringe Partnership established in 1996 and the New Deal for Communities (NDC) regeneration programmes carried out between 2001-2010 played an important role to promote physical environment and economic growth in the inner- city boroughs (NGO2_LDN). In addition, The City Growth Strategies (CGS) developed by government's Small Business Service in 2003 brought new resources and enabling policies to tech complementary industries such as publishing and hospitality (Nathan et al. 2016). In such circumstances, the tech cluster grew substantially and quietly and then peaked around 2008 when the 'Silicon Roundabout' band was coined.

By the end of 2010, the cluster was seemingly ready to move into a new stage of development that needs a more supportive policy environment (Jackson 2014). It is argued that government's decision to intervene in this area seems to be 'a haphazard process' (Hallsworth et al. 2011) without 'much research and evidence gathering beforehand' (ACA3_LDN). In Cameron's opening speech in November 2010, he claimed that the best way a government could help to support a cluster is to "go with

the grain of what is already there. Don't interfere so much that you smother." (HM Government 2012). In other words, it is actually a 'vision' where place branding was central, but without a 'grand centralised plan'. Specific policies such as the Enterprise Investment Scheme (EIS), Seed Enterprise Investment Scheme (SEIS), and the Entrepreneur Visa were made to help the cluster growth. These policies enacted by central government have directly contributed to creating a more favorable institutional environment, which helps to address some constraints faced by the cluster such as funding and talents as well as create new opportunities (Harris 2019). Meanwhile, the introduction of internationally renowned accelerator programs such as Tech Stars greatly boosted the cluster, providing financial and knowledge-based resources that had not been in the cluster previously (Jackson 2014). Although the central government was the most important actor that facilitated the development of the cluster at this stage, local governments such as Hackney Council have also championed the cluster at the local level and integrated its development into higher authority plans and private sector objectives (ACA3_LDN; Jackson 2014).

Fig. 9 Maps of scaleups around Tech City and the rest in London (Adapted from Harris, 2019)

While the number of startups were growing year by year, some startups had achieved sufficient growth to be labelled as 'scaleups', which were heavily concentrated around the Tech City by 2016 (Fig. 9). More unicorns (startups values over $1bn) emerged in the last 5 years, such as Monzo and Checkout.com in the fintech sector (Tech Nation

2018). At this stage, the spatial focused cluster strategy by the central government has ended. The new policies were more focused on those high-growth and high-productivity potential scaleup firms in major UK cities, since 'a more maturing and more confident ecosystem leads to a larger, older and more developed companies raising later rounds of investment' (Tech Nation 2020). The main example was the UpScale programme launched in 2016, which aims to accelerate the growth of scaleups 'through workshops, socials and meetups, with access to leading scale coaches' (Tech Nation 2018c).

Overall, the UK government has adopted a light touch intervention approach in the Tech City cluster. According to the recent research by Nathan (2019), the policy had indeed increased the size and density of the cluster from 2010 to 2017 (Fig.10). However, the character of the cluster was changed by the policy and distributional impacts are highly uneven, with only certain type of firms getting more productive. As one interviewee pointed out: "Because clusters are very complicated things, it's not always clear what the big issues are and what the sort of second order effects of intervention are" (ACA3_LDN). Therefore, even the light touch cluster programmes require cautious implementation (Nathan 2019).

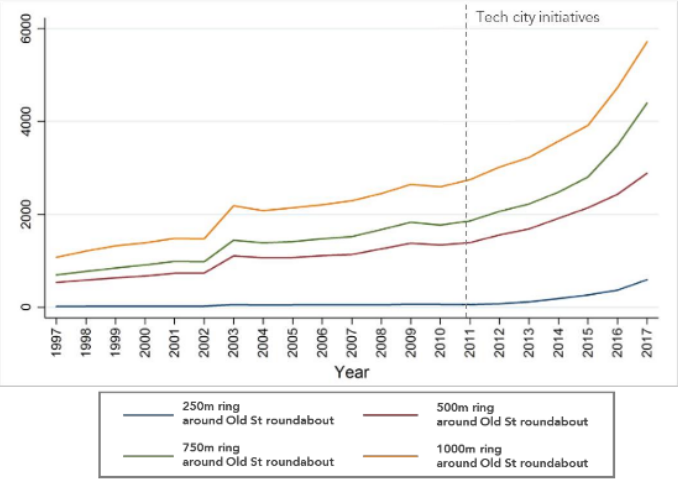

Fig. 10 Digital economy firm counts in the Tech City Zone

(Adapted from Nathan, 2019)

5.1.2 Cross-sector Collaboration

Business communities' activities to create events and spaces that enabled informal networking are highlighted as the most important factors to the cluster formation in the Shoreditch and Old Street area (Biddulph 2012). Although these activities emerged spontaneously and unplanned, Hackney Council's night economy policy, and Inner East London's relaxed policing of live-work rules historically played an indirect but important role in allowing tech businesses to take root in the area (Pratt 2009). Plenty of bars/pubs, local coffee shops, restaurants have promoted social interactions after working such as meetings and chance encounters. The shared working environment also leads to informal socializing events between co-located firms such as MiniBar and Last FM parties (Biddulph 2012; Foord 2013). Towards the end of the 2000s, firms also began to make connections with angle investors, larger VC firms, government agencies and other clusters through further events held by White Bear Yard and SeedCamp etc. (Foord 2013; PRWeb 2013).

The vision for a 'Tech City' seems to have coalesced various fragments for the cluster and brought into more actors in the area. A serious of actions were undertaken by the governments to promote social networking of the cluster. First, a new government sector- Tech City Investment Organisation (TCIO) was launched as the coordinator which created 'a central voice for the disparate parts of the cluster'. Besides, Monthly breakfast meetings at No.10 Downing St including 50-60 key figures in the local businesses, universities, government officials, property owners and service providers have been an important mechanism that allows bottom-up feedback to occur (Jackson 2014). Second, the central government attempted to pursue partnerships with big firms. It was successful in convincing Google to set up Google Campus in Shoreditch, which provides free space for the firms to organize events and find network etc. (Harris 2019). Additionally, the Greater London Authority (GLA) and local authorities have also worked in partnership with central government to connect the companies and institutions within a cluster. The Mayor of London announced a London Tech Ambassadors Group in 2014 consisting of a number of actors from the cluster (London & Partners, 2014). Hackney Council itself built the Hackney Business Network to bring

different clusters (e.g. tech and local fashion industry) together and boost business (Tech Nation 2016).

The government's intervention has fostered more cooperation between the actors in the period after 2010 due to the potential they saw that government could add. Social interaction during this period transformed from after-work BBQs to bigger and more formalized networking events such as Digital Shoreditch Festival and Silicon Drinkabout (Jackson 2014), bringing in a more diverse range of interested actors with shared but also competing interests (Martins 2004). More international corporations, venture capital investment and oversea entrepreneurs flew into the area, generating both spillover and competition that Porter considers as the key elements in the cluster (Porter 1990; 2008). Besides, some companies began to build partnerships with the university. One example is IDEA London, an innovation focused start-up incubator run by Cisco, DC Thomson and University College London (UCL 2013). However, the strategic 'Triple Helix' activities are absent in the London case (ACA1_LDN; ACA3_LDN).

As the 'Tech City' brand expanded to the UK-wide after 2014, agents in the cluster also began to establish links nationally and internationally to form a more connected and developed ecosystem. For example, in 2017, the Tech City UK organisation partnered with WSGR on an 'Expansion to the US' advice series to help scaleups go global (Tech Nation 2017). A policy evaluation conducted by Nathan (2019) confirmed the effectiveness of these efforts to fix coordination problems. On the other side, competition among companies within the cluster intensifies at this stage. The government's policy such as Future 50 seems to pick winners and raise their productivity, while the 'losers' shed revenue and staff or exit (ACA3_LDN).

5.1.3 Local Community Engagement

Tech City is developed in one of the poorest and most diverse areas of London. There has been a significant 'divide' between East London's young people and the tech cluster (Sims et al. 2015; NGO1_LDN). Around 2011, several social organizations

recognized this problem and attempted to create opportunities for young people around Shoreditch through the apprenticeship scheme. However, it was a difficult task at the beginning because of the limited funding support in the austerity context and little effective policy from the mayor of London and local government (NGO1_LDN).

Before long, GLA and local government began to initiate some programmes such as Tech City Stars, Tech City Apprentices in partnership with businesses and education providers, as well as identify 'Bedroom coders' from the school to aid disadvantaged East London youth access opportunities in the cluster (LBH 2014; NGO2_LDN). The government's actions seem to play a catalytic role. More Digital Learning Programmes (at least 60 in 2015) have born from the digital cluster and have a sense of 'being part of it'. In fact, they tend to have a social purpose but also entrepreneurial character (Sims et al. 2015). As the interviewee mentioned:

> *"I think the solution lies really, again, with some kind of intervention from the public sector into the market… They (local governments) should create a good partnership and use that local connections in order to make those things work."*

After years of development, Hackney Council's Apprenticeship Programme tripled the number of London Living Wage apprentices in the Council from 2016 to 2019. And early indications from the research shows that it is starting to make a real impact on people's working lives as well as how they feel about their own access to the employment market (CLES 2019). In the latest plan- 'Future Shoreditch (2019)', the Council made planning policies to deliver inclusive growth and genuinely affordable homes, aiming to address the challenges such as high cost of living and a growing gap between those who feel the benefits of a growing economy and those that don't (LBH 2019).

5.1.4 Workspace Supply

Shoreditch had been the home of the digital cluster since the DotCom boom with an abundance of office space with the cheap rents. After the dotcom crash, there was a

kind of survivor community, who began to persuade their friends to locate in the area and share an office with them (Harris 2019). Towards the end of the 2000s, the co-working spaces had transformed from adhoc arrangements to specific businesses with associated support services. For example, The Trampery that launched in 2009 led to a connection between businesses and resources such as finance, talent (Harris 2019). However, this does not mean that government adopted a 'do nothing' approach, as there were clearly some institutional factors at play. For example, the planning authority declared a Conservation Area in Shoreditch in 1986, avoiding mass demolition in the area. And the Hackney Council had made efforts to maintain the flexible creative spaces for creative industry which could also benefit the digital cluster (Ferm 2016).

After the Tech City initiative, the government persuaded 'google Campus' to move in. The seven- story site was redeveloped into a start-up factory that offers a variety of working space, event space and accelerators. The central government also initiated a proposal for the Old St Roundabout redevelopment to build a 'Europe's largest indoor civic space' for the startups and the local community. However, this top-down attempt to transform the area was strongly opposed by the local technology firms and failed eventually (Nathan et al. 2016).

The brand of Tech City also acts as a signal to real estate industries to locate in the area (Nathan 2019). On the one hand, the redevelopment helps to provide diverse workspace of the area, ranging from small business workspaces (e.g. studio units and coworking spaces) to larger corporate office floorplates for professional service companies (LBH 2019). On the other, the office rents have increased significantly since the area becomes a hot spot for real estate development. By 2019, it had grown to around £60/ sqft, although still lag behind office rents in the prime City of London market (Volpicelli 2020; LBH 2019). The coworking spaces continue to thrive in the area, but also need to deal with the soaring prices. The rising rents and growing firms count are driving the clusters to relocate in other areas of London. According to the research by UHY, the Shoreditch/ Old Street area has seen a major decrease in

business start-ups, reducing by 70% from March 2015 to March 2016 (LBH 2019).

To address the increasing level of unaffordability for businesses in Tech City, the Hackney Council introduced an Affordable Workspace policy in the Development Management Local Plan. However, the delivery of affordable workspace is a big challenge, which largely relies on private-led development and often locked into a 'growth-dependent' model (Rydin 2013). Another challenge is the competition for space of different uses including housing. The GLA and local authority have dedicated to the on-going exemption from national rules that allow landlords to change use from commercial to residential premises without the need for planning permission. This was regarded as 'the most effective measure to protect the heathy of Tech City' (ACA1_LDN). In addition, accommodating growth while protecting its traditional character is also highlighted in the recent planning policy (LBH 2019).

5.2 22@ Barcelona

5.2.1 Cluster Development

22@ is an example of designing and implementing clusters with a top-down method. By 2004, once the physical transformation had been achieved, four clusters were identified by the municipal company (Fig. 11), including media, ICT, medical technologies, and energy (Morrison 2014). It is hoped that the economic activity would be promoted by creating synergies among the clusters. However, these clusters were selected based on their role in the future of area and the potential growth of certain large companies to settle in (Pareja-Eastaway & Miquel 2010), while neglecting the pre-existing artistic activities since the 1990s, small retail businesses and workshops. The artistic community lost their artists' studios in the regeneration process and therefore gradually disappeared between 2000-2007 (Martí-Costa & Miquel 2012).

Fig. 11 The location of the four clusters in the 22@ Barcelona

(Ajuntament de Barcelona 2008)

Until 2007, 1041 companies were attracted to the area, although around 75% of the newly located companies were in fact relocations from the city center itself (Charnock et al. 2014). The following financial crisis slowed down the evolution of the process. However, the impact of the knowledge-based activities was not as strong as the other sectors, demonstrating their higher resilience (PO2_BCN). During the crisis, a new design cluster was created in 2008 to reinforce the adaption of the project. The economic uncertainty decreased the investment plans but created new opportunities for small firms in the creative economy, with artists' workshops and art galleries moving into the unreformed factories now available for rent (Pradel-Miquel 2020). In addition, the 22@PLUS was initiated in 2008 to strengthen the support to companies that wanted to move in the district (Pique & Miralles 2019). Other programmes and many incentives were also launched to foster entrepreneurship, such as Barcelona Activa- the largest public business incubator in Europe and the MediaTic building- a collaborative space for accelerators, consultants etc. According to the business census (2015), around 4500 businesses had located in the district since 2000. Of these approximately 30% are knowledge-based companies, and approximately 40% of the companies are related to clusters (Pareja-Eastaway 2016).

After the district began to revive from the crisis since 2013, the city government felt

like it had to relaunch the district and adopted measures to support the cluster, especially help the firms to scale up. As Pérez-Batlle (2018), an official in Barcelona City Council mentioned:

> *"In 2017, we have 100 projects applied to the land… Bacelona (council) is financing the 80%. This is Specific for digital publication and open software."*

> *"Ok, you are doing that, let's scale up, let's scale the application… this is what is happening in Barcelona, we are multiplying the impact by mixing all the players, and putting in money there."*

5.2.2 Cross-sector Collaboration

The 22@ Barcelona has followed a "Triple Helix" model, and the role of the Triple Helix agents evolves over time (Pique & Miralles 2019). The 22@ municipal company played a strong role in seeking the collaboration of the companies and institutions at the preliminary stage. It moved some public companies and universities to the district as innovation catalysts to the industrial clustering. Each of the four clusters was supported by specific public institutions and a university (Ajuntament de Barcelona 2019). In 2004, the 22@ Network was created by the president of the 22@bcn, representing a network of businesses and institutions of the district. It was headed by the City Council of Barcelona at first and operated under the leadership of the businesses themselves later on (Pareja-Eastaway 2016). Events such as 22@ Breakfast were organized by the 22@ Network to facilitate the spread of new ideas.

At the second stage since 2006, the main objective of 22@ was to consolidate and strengthen the connectivity and synergy of companies and local institutions such as universities and research centres (Pareja-Eastaway & Miquel 2010), although Battaglia and Tremblay (2011) highlighted the difficulties during such process. Supportive programmers including corporate conferences and forums such as 22@ Synergys and 22@Agora were set up to promote collaboration and interaction between diverse actors. The leading companies such as Telefónica also developed open innovation

and entrepreneurship programmes such as Wayra to promote the interrelation with the new technology-based companies. Together, these efforts had contributed to the economic growth, especially for fledgling firms (Barber & Pareja- Eastaway 2010). Besides, various activities (e.g. exhibitions, festivals, concerts) were held by the 22@Network to bring citizens nearer to the 'new creative realities.' However, some artists in the area felt they had less power in such top-down process and criticized that: 'One of the things that they took away from us is spontaneity.' (Martí-Costa & Miquel 2012, pp.105)

With the election of the new mayor Xavier Trias in June 2011 and the impacts of the financial crisis, more focus was on the Smart City strategy, relegating the 22@ in another level (Henkes 2016). 22@bcn has also been dismantled since then, with its functions being integrated back into the municipality (PO2_BCN). The 22@ Network was then responsible for some tasks of cluster development of the area. Although the public institution the 22@ Coordination Commission was created in 2017, it appears to be a coordination sector without strong leadership as the previous municipal company (PO1_BCN).

More recently, the City Council has been trying to mobilize the business community and integrate them into the decision-making process with a more collaborative approach.

> *"We are not going to organise these events from a top-down approach, we are trying to do that from bottom-up… Barcelona City Council is going to organise and meet up with you. we are going to make a coordination table, where all of you can participate…the Barcelona City Council are just another player among this community." (Pérez-Batlle 2018)*

However, unlike the London case, the Barcelona council found it challenging to make the business figures actively involved in such process:

"It is easy to say no top-down approaches anymore, just bottom-up … that is a good hypothesis, but it is really difficult to implement it, if you want that things move quick. It is difficult to engage people to perform… it is difficult to find the roles, let's say the specific entities to say there is a need of the community … now we are trying to think how to make the interaction continue." (Pérez-Batlle 2018)

5.2.3 Local Community Engagement

From the very beginning, the development of the 22@ met the opposition of the residents, who were unsatisfied and disappointed by the proposals and lack of participation. The outcome of the 22@ was therefore influenced to a certain extent with the citizen's mobilization. For example, the City Council agreed to construct 4000 social housing, of which one- third was exclusively reserved for the existing community (Pareja- Eastaway 2016). Additionally, the council extended the catalogue of industrial heritage of the district (Henkes 2016) which did not consider adequately in 2000.

Considering the previous lessons, the Barcelona council launched the 22@ District Digital programmes such as Virtual Memory of the Sant Marti District's elders, new multimedia classrooms etc. to create social benefits for the communities at the growth stage. Just as in London, it also launched the digital learning project- 22@ Projecte Educatiu, in order to 'foster the training of all local secondary school students offering diverse educational opportunities related to the activities' (Ajuntament de Barcelona 2012, pp.24).

In 2011, the financial crisis and the imposition of austerity measures contribute to the rise of the indignados movement demanding more social justice and fuller exercise of political rights in Barcelona and other large cities in Spain. In this scenario, the municipal elections of Barcelona in 2015 brought in the new mayor Ada Colau who promised to support citizens' initiatives and to reinforce their role in policymaking (Pradel-Miquel 2020). The so-called Quadruple Helix was then convened, in the shape of 22@ Coordination Commission made up of the public sector, community residents, business network (22@ Network and the creative association) and universities and

research institutions in March 2017 (Ajuntament de Barcelona 2019). As such, the neighbourhood was incorporated in the governing body of the project for the first time. The Ca l'Alier Agreement signed in November 2019 shifted the orientation towards sustainable and inclusive values. A collaborative economy will be promoted, not only to maintain and attract innovative business but also to create opportunities for local commercial activities which was largely ignored in the past (Ajuntament de Barcelona 2019). More importantly, the percentage of social housing will be increased from 10% to 30% in the area to fight against gentrification and enhance the vitality of the community which was inadequate before. One interviewee pointed out the challenge of putting this into practice (PO1_BCN), while Wager (2019) argued that:

> *"Affordable housing–integrated into market rate housing–is a core piece of this story as innovation districts are as much about inclusive, open neighbourhoods as they are engines of innovative growth."*

In addition to this, the City Council also set up a programme in 2017 to make citizens gain greater access to and influence over the digital initiatives and its results. The communities can choose the projects to invest in and help them to grow. As Pérez-Batlle (2018) argues that:

> *"it is the citizen they know what they need. So it is only say I (the Council) love this project, the citizens are putting money there. I think it is the best way to say their interests…it is another way of digital participation."*

5.2.4 Workspace Supply

When the 22@ project was launched in 2000, the Barcelona Council could not purchase private land for public use under a period of fiscal austerity due to the development of the Olympic Games (Pareja-Eastaway & Miquel 2010). The key issue of the council was therefore to provide incentives for real estate agents and private owners. It changed the zoning rule of the area from a strictly industrial to a mixed-use zoning (Morrison 2014) and increased the construction rights to build per square

meter of land. Also, public investment on the underground infrastructure and urban realm has been essential to preparing the conditions for private investment (Barber & Pareja- Eastaway 2010). Progress in real estate development was significant under the context of the last Spanish property boom (1998-2007). Nevertheless, the bulk of real estate developments have eschewed the original intentions of the 22@bcn to install knowledge-based SME incubators with smaller units, but in favor of making rental profit-maximizing turnkey properties available to larger pre-established firms and tourism-related businesses (Charnock et al. 2014). It is estimated that only 30% of the newly located firms belonged to new technologies and ICT by 2006.

Due to the market failure to establish adequate floor space for SMEs in 22@, public subsidies were a major part of the project designed to create adequate floor space for SMEs (Charnock et al. 2014). And many projects have been launched to make affordable workspace available for them. For example, the "22@ Landing Platforms" offered spaces where startups could rent offices or desks on a weekly or monthly basis (Morrison 2020).

Many companies therefore have been attracted to the area because of the newer offices with lower rents. When the area began to recover from the crisis after 2013, the high demand for the office space has contributed to the rising rents. According to a report from the real estate services company Cushman & Wakefield, the price per m^2 in some areas of the 22@ reached the ones of the prime zone of Barcelona, thus expulsing small and medium-sized firms (Henkes 2016). Meanwhile, the availability of top-quality office space was under 5% in 2017 (Fuster 2017). As a managing member of Cushman & Wakefield argues that, "We run the risk of not being able to welcome the large companies that want to come while seeing those who cannot pay the large rise in prices leaving." In this case, the revised plan recently proposes to activate new spaces for the innovation activities, aiming to halt the rise in the most developed area of 22@. Additionally, due to the discontinuity within the area caused by the construction of the higher new buildings, a set of benchmark planning criteria for the new development has been established to ensure the high-rise buildings do not make

a negative impact on the neighbourhood and heritage around them (Ajuntament de Barcelona 2019).

5.3 Case Comparison and Discussion

This section provides a reflective interpretation of the results by comparing the two cases and linking the empirical findings to the academic literature. It discusses issues around the research questions- the government's role and their interventions in transforming the innovation ecosystem. Also, the effects of the pandemic are also discussed briefly to highlight the broader implications of this research.

5.3.1 Evolution of the Government's Role

The two districts both seem to have gone through three evolution phases suggested by the modified cluster adaptive cycle model, from emergence through growth to maturation. In line with some recent literature, the study finds that the previous 'top-down' or 'bottom-up' leadership models are not appropriate for explaining the innovation district, since the government's role has changed in the complex and dynamic process (Fig. 12). Also, the study echoes the modified adaptive cycle theory (Martin & Sunley 2011) that the changing behavior of the actors may drive the cluster evolution across its various stages. But this could present in a more complicated way in reality, as shown at the growth stage of 22@ in the evolutionary trajectories.

For Tech City, it emerges organically and grows quickly due to the government's support for businesses until the cluster matures. 22@, on the other hand, demonstrated a quite different journey. My finding in 22@ corroborates with Gianoli and Henkes's (2020) analysis of the adaptive governance and challenges the main ideas in previous literature that regard it as a simple top-down intervention process. Evidently, the leadership has changed during the evolution of the district over nearly 20 years, which were influenced mainly by variations in political priorities and financial crisis. Apart from these external factors, my research on the two cases highlights that urban governance dynamics also emerge from internal interactions between actors

such as the calling for strengthening social citizenship rights from local communities and the bottom-up demands from private sectors for the development.

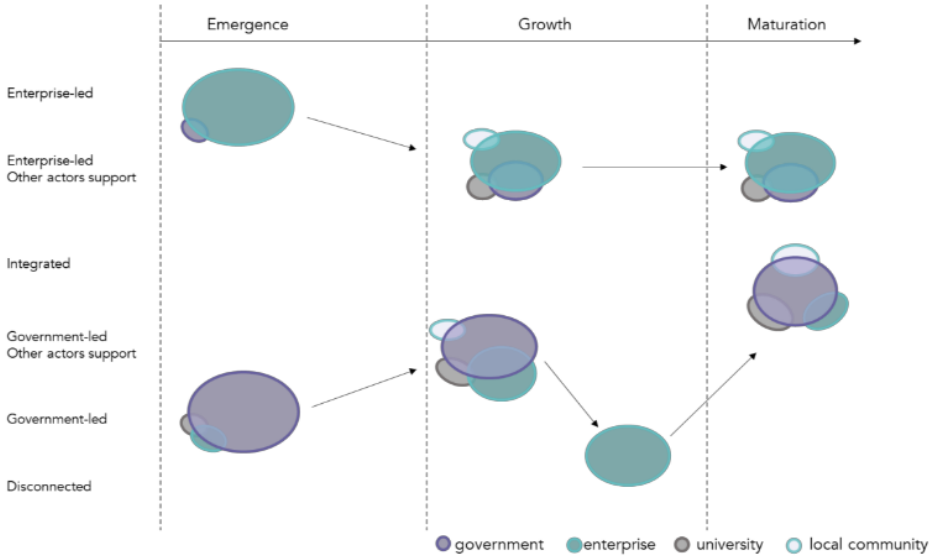

Fig. 12 The evolutionary trajectories of the government's role

Moreover, 22@ seems to be moving toward a more collaborative governance approach (Quadruple Helix' model) at the maturation stage, which integrates the goals of a variety of actors, especially the local community. While such integrated institutional configuration can be thought as the ideal type for fostering innovation and driving cluster evolution in the recent literature (Mazzucato 2019; Harris 2019), evidence from Tech City suggests that other types might also be viable and are likely to stimulate evolution.

5.3.2 Government Intervention in Transforming the Innovation Ecosystem

Through comparing the two cases, the study managed to identify various intervention approaches (Table 3) along with the related actions in different phases (Table 4).

Table 3. The government intervention approaches (Based on Uhl-Bien et.al, 2007; Jackson, 2014)

Indirect approaches		Generate spillover effects such as creation of new skills, technologies, markets etc. (Mazzucato, 2014)
Direct approaches	**Orienting**	Urban Planning Vision building
	Directive	Pick directions for new market landscape Establish policies and procedures Allocate tasks
	Facilitative	Stimulate actions of other actors (e.g. tax and funding incentives)
	Reactive	Respond to bottom-up feedbacks

During the emergence phase, the intervention strategies such as loosing land-use restrictions and/or re-zoning that providing the flexible live and workspace as well as creating formal and/or informal networking are fundamental for triggering innovation activity. As for Tech City, direct policy interventions on the digital cluster was avoided, but certain policies and efforts to regenerate the area and support the creative industry had generated spillover effects on the emergence of the tech cluster. Meanwhile, entrepreneurs' choices to create co-working space and events that enabled a level of interaction between agents (e.g. entrepreneurs and investors) and pressured them to develop and share knowledge and idea are highlighted as being crucially important to foster innovation ecosystem (Jackson 2014). 22@, then, differed from Tech City that it has been characterized by a high degree of certainty and integration across various domains of intervention, such as large-scale physical transformation, setting up ambitions economic goals and relocation of universities and public institutions (Barber & Pareja- Eastaway 2010). But the priority on the interests of certain actors (e.g. real estate actor and new media industries) over others (e.g. local residents and pre-existing businesses) also hindered social cohesion and economic diversity in 22@ (Ajuntament de Barcelona 2019). Overall, it should be noted that innovation districts may emerge in diverse ways. Although some may seem to occur organically like Tech City, some indirect interventions by the public sectors

may have an effect that should not be ignored.

The growth phase mainly focused on attracting businesses and investors as well as promoting business clustering and networking. Since the late 2000s, innovation policy in the UK has gradually but markedly moved away from the former laissez-fair view. In this context, governments have become increasingly involved in the innovation activities (Farmer & Gabriel 2020). However, compared to 22@, the public sector in Tech City appears to intervene in a more facilitative and reactive way, rather than being too directive (Jackson 2014; Harris 2019). It successfully enabled the business actors to produce knowledge spillovers and networking externalities as well as tackled the immediate problems that are potential lock-ins in the cluster (Harris 2019). Despite this, some authors criticize that the interventions destroy the cluster's original identity by favoring bigger companies over start-ups (Doctorow 2014). In 22@, the public sector intervened in a more directive way. The business actors were often not so forthcoming with their desire to create new groups or organisations as they were in London. The public organization continued to set up new cluster strategies and partnerships to drive the cluster until the municipal company was dismantled in 2011.

Meanwhile, the public sector's intervention on the clusters also provided incentives for real estate development. In Tech City, the private sector is the driver of workspace supply and the local authority is reactive due to a discretionary nature in the English planning system, in which negotiation needs to take place between interested parties (Cullingworth & Nadin 2006). In 22@, the municipal institution was at the heart of the development process, with more power and resources than the local governments in London. It adopted active planning rules and tools with clear and concise guidance to control the development process. For example, the strict restriction of the development of private housing to avoid any speculative strategy (Henkes 2016).

In this phase, both cases started to launch education programms to link local community and future workforce to the innovation economy. However, it is slightly different from 22@ that, local governments in Tech City do not just try to implement

these programmes themselves. Through providing funding incentives, the apprenticeship programmes in Tech City also thrived from business communities and became part of the Tech City cluster.

As innovation districts become mature, the developed cluster with high competition and density stoke greater tensions and new challenges arise between the cluster growth and the other dimensions in the innovation ecosystem. Both cases encounter negative externalities including crowding, expensive milieu that gradually displaces activity to other areas, and social challenges such as inequity and exclusion. According to Arzaghi and Henderson (2008), firms always trade off between access to network benefits and costs of location. More small businesses move out from the 'overheated' area of Tech City, which supports the argument of the decentralization of the cluster in the maturation stage (DETR 2000). The regional and local governments thus tried to make a larger planning framework to facilitate the geographic dispersion and manage some of the constrains as mentioned above (GLA 2015; LBH 2019). The planning-based interventions from GLA and local authorities appear to play a more prominent role than the previous cluster-based policy tool by the central government (Nathan et al. 2019). While for 22@, a revised plan was initiated to update the project in line with the current challenges of the area. The priority of the project has shifted from the economic competitiveness to the social dimension (e.g. affordability of housing and community participation), orienting towards inclusive and sustainable values (Henkes 2016). In addition, there is a common trend in both cases that public sectors started to promote the power of innovation for addressing the world's major social issues (e.g. Tech for social good in the UK), which provides the new directions for the companies in the cluster.

Evidently, through analyzing and comparing the two cases, it can be suggested that government intervention is a multi-stage, multi-dimensional and multi-instrumental process, informed by a mix of rationales. Thus, there is no one-size-fits-all way to intervene in the innovation ecosystem that is applicable to all districts (Barber & Pareja- Eastaway 2010). Different intervention types are a product of not only different

objectives, instrument choice and implementation styles, but also context specific institutional configuration, planning culture and policy path dependencies. Most importantly, the findings appear to support Mazzucato's (2016) description of 'market-creating', which challenges the view that government just need to fix markets or systems. In fact, innovation-led 'sustainable' growth also requires public sectors that use tools and means to 'create and shape new markets'- making things happen that otherwise would not (e.g. producing solutions for societal problems) (Mazzucato 2014). Yet, a 'delicate balance to strike' is also needed, which means picking directions but also allowing bottom-up exploration, discovery and learning to happen at the same time (NGO1_LDN; Mazzucato 2016).

Table 4. Main actions of the government and the other actors in different stages of innovation district development

Stage	Main Actions	Tech city	22@
Emergence	Relaxed planning regulations	●	●
	Rezoning and large- scale physical transformation	○	●
	Informal networking of entrepreneurs	●	○
	Identify innovation clusters	○	●
	Build strategic linking with business and institutions	○	●
	Negotiation with local communities	○	●
Growth	Create new cluster from top-down	○	●
	Devise strategies for attracting businesses and investors	●	●
	Government's support to reinforce social networking	●	●
	Strong set of private initiatives	●	○
	Public funding support for establishing affordable space	○	●
	Set up programmes for local communities	●	●
	Real estate development	●	●
Maturation	More focus on potential scale-up firms	●	●
	Take a new direction based on more social and sustainable values	○	●
	Local polices for affordable workspaces	●	○
	Deal with broader social challenges through innovation	●	●
	New spatial framework for business growth	●	●
	Seek the balance between residential and commercial development	●	●

Chapter 6 Conclusion

Through comparing Tech City and 22@Barcelona, this research set out to explore the government's role and their efforts in shaping the innovation ecosystem. This research has followed the recent trend in the literature and adopted the modified cluster adaptive cycle model as an appropriate lens for analyzing the actors and their efforts that trigger the evolution of the innovation districts (emergence, growth and maturation). In addition, a multilayer framework including cluster development, cross-sector collaboration, community engagement and workspace supply was used to conduct an inter-related analysis between the elements, contributing towards a more systematic understanding of the cumulative influence of various interventions. In general, the analytical framework used for this research may be applied to other innovation districts elsewhere in the world. And the insights gained from this comparative study may be of assistant for the policymakers and local practitioners to understand 'who' should lead and 'how' to lead the innovation district to certain stages, as well as the causal mechanisms responsible for such changes.

The main findings of this research therefore could be summarized as follows: firstly, this dissertation showed that the government's role has been co-evolved with the other actors in different phases of a life- cycle. Although the innovation district may emerge either through bottom-up or top-down manner, a more collaborative approach whereby various actors integrating their goals is best for ensuring successful evolution of the innovation districts (Harris 2019; Russell & Smorodinskaya 2018). Secondly, this study highlighted the need to attend to the complexities of government intervention in the innovation ecosystem. Admittedly, the complexity of innovation activities in the real world make it hard for the governments to identify appropriate actions. Rather than presenting in logical and linear patterns in theory, governments tend to intervene in complicated ways, including both direct approaches to create, direct, catalyse or reactive to the markets, as well as indirect mechanisms such as deregulation, supporting for the complementary industry,

information and service support that could bring spillover effects unintentionally. Thirdly, the case studies provided clear evidence that different layers of the government interventions discussed in this dissertation interact with each other, creating both positive and negative feedback loops that affect the area's innovative capacity. Thus, despite the priorities of interventions might vary at different phases in practice, the multilayer public interventions which make the economic, physical and social assets work in unison to create synergies are crucial to sustain a symbiotic and inclusive innovation ecosystem.

6.1 Limitations and Further Research

Admittedly, there are some limitations to this study. Although four key dimensions of government interventions were identified to conduct a comparative study, there are certainly some other aspects. However, due to the constraints of time and resources, those elements that may not be present in the whole phases were not discussed in this dissertation. Moreover, on reflection, the sample size for data collection was relatively small, especially for the case of 22@, although two key actors from the former municipal company 22@ have been interviewed. And the respondents might be unwilling to tell the truth during the interviews, thus the results of the investigation may contain a certain degree of bias.

Finally, some topics have been raised in the process of this research which could be explored further. For instance, it would be interesting to investigate the two cases in this study over a longer timescale to analyse future changes. Specifically, how the pandemic will affect the evolutionary trajectory of them and how should the policymakers deal with the unpredictable economic outlook. Also, theoretical research is required to explore how will the key issues in cluster theories such as physical proximity, spatial preference, life- cycle models and ways of social interactions be challenged in the post-pandemic period. In addition, more research should be undertaken to address the increasingly societal challenges in innovation districts, for example, how innovation policies can better measure and deliver social

outcomes and more effectively widen opportunities to innovate (Nesta 2019). As a research report from Nesta (2020, pp.37) notes: "Innovation is now more important than ever, both in building societal and economic resilience to future shocks and disruptions."

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Appendix 1: List of interviewees

Case	Organization	Code/ Name	Type of Interview	Duration	Relevant Stages
Tech City	Academic	ACA1_LDN	Online interview	30 mins	Growth
	Academic	ACA2_ LDN	Online interview	50 mins	Growth
	Academic	ACA3_LDN	Online interview	40 mins	All stages
	NGO	NGO1_LDN	Online interview	40 mins	Emergence to Growth
	NGO	NGO2_LDN	Online interview	20 mins	Emergence
	Informal	I1_LDN	Face to face	120 mins	All stages
	Academic	Max Nathan	Secondary data (audio)	55 mins	All stages
22@ Barcelona	Public Official	PO1_BCN	Online interview	60 mins	Emergence
	Public Official	PO2_BCN	Online interview	60 mins	Growth
	Informal	I1_BCN	Ask questions via email	--	Maturation
	Barcelona City Council	Marc Pérez-Batlle	Secondary data (video)	50 mins	Maturation

Appendix 2: Interview Guidelines

2.1 Tech City

General instructions:

- I am studying government intervention in the evolutionary process of innovation districts. My focus is on government's role in such process and how do the government's actions contribute to shaping the innovation ecosystem. I have been looking at cases of Tech City in London and 22@ District in Barcelona and conducting a comparative study. Since you have an experience in the_____, this interview will help me understand the work of your (previous) organization, and your view on the Tech City policies and how you think the government intervention might best be able to support the development of Tech City in the future.

Remind interviewee of confidentiality rights:

- Your identity will not be disclosed in the dissertation to maintain your confidentiality. The information you provide will only be used for the purposes of this study. And you may decline to respond to any question or portion of a question.

Questions:

A. Basic questions

1. What is the role of your organisation in Tech City?
2. How do you think about the geographic boundary of Tech City?
3. In your opinion, what is the current development stage of Tech City?

B. Government interventions and their impacts

1. How do you understand 'East London Tech City' policy launched by the central government in 2010?
    a) Why did the government initiate this policy in 2010?

b) What is the aim of this policy? Is it a regeneration strategy aiming to revitalize the deprived neighbourhood in East London?

c) Is there any gap between the promise of Tech City policy and realities on the ground?

2. Are there any other policies or programmes initiated by the Central government on Tech City after 2010? Did they change the priority of the project?

3. How does GLA support the development of Tech City?

a) Is 'City Fringe Opportunity Area Planning Framework' a policy for Tech City?

b) How is this policy implemented?

4. What is the role of Hackney Local Council in the development of Tech City?

5. What are the key factors contributed to the cluster growth?

a) Are there any challenges of cluster development currently?

6. Do policymakers make some efforts to generate benefits for surrounding neighbourhoods?

a) Are there any policies to protect residents from gentrification and displacement?

7. How do the policymakers manage the supply of workspace for entrepreneurs?

a) How do they work with developers?

b) How does the real estate market affect the transformation of workspace?

c) How does the government ensure the affordability of the workspaces?

C. Involvement

1. What are the main reasons for institutional changes in the past decade (e.g. from the Tech City Investment Organisation in 2011 to Tech City UK in 2014 to Tech Nation in 2018) and their impact on Tech City development?

2. How do different levels of government (e.g. GLA, local authority and central government) collaborate with each other to develop Tech City? Are there any conflicts between them?

3. How do the public sectors collaborate with firms, universities and other organizations?

4. How has been the relationship between the start-ups with large companies and universities?

4. Do the local communities participate in the development process? How?

5. What are the pros and cons of the governance approach? In your understanding, what would an ideal leadership for supporting the future development of the Tech City be like?

D. Challenge and Follow Up

1. Are there any issues or circumstances that have been particularly challenging with Tech City development in the past years?

2. How about the impact of coronavirus? Will the Tech City change the development path after the pandemic?

3. Do you have any recommendations for the government intervention of Tech City in the future?

4. Is there anything else you wish to tell me?

2.2 22@ Barcelona

General instructions:

- I am studying government intervention in the evolutionary process of innovation district. My focus is on government's role in such process and how do the government actions contribute to shaping the innovation ecosystem. I have been looking at cases of Tech City in London and 22@ District in Barcelona and will conduct a comparative study. Since you have an experience in the_____, this interview will help me understand the work of your (previous) organization, and your view on the 22@ policies and how you think the government intervention might best be able to support the development of 22@ district in the future.

Remind interviewee of confidentiality rights:

- Your identity will not be disclosed in the dissertation to maintain your confidentiality. The information you provide will only be used for the purposes of this study. And you may decline to respond to any question or portion of a question.

Questions:

A. Basic questions

1.Could you please let me know in which period you have been involved in the project?

2. What is the role of your organisation in 22@ innovation district?

3. In your opinion, how to divide the development stage of 22@ District, from emergence to growth to mature?

B. Government interventions and their impacts

1. Why did the government initiate 22@ Barcelona project in 2000?

2. What was the reason for the dismantlement of the Municipal Company 22@ bcn in 2011?

a) What effect did it have on 22@ project?

b) How did the 22@ Network manage the project after that?

3. The 22@ Coordination Commission has got to work since 2017, why was it set up and what kind of policies or programmes has been initiated?

a) What is the aim of the 'rethinking 22@' project initiated recently?

4. Over the last 20 years of the project, there have been different mayors in Barcelona with different ideas about the 22@. How has it changed the priority of the project of each major?

5. What are the key factors contributed to the cluster growth in the past decades? Are there any failure stories?

a) Considering the different clusters that have been promoted and the time that has passed, could we say that the cluster can support by themselves and generate synergies between them?

6. The project tries to regenerate and transform the area, how does the government generate benefits for local communities?

a) How to balance the innovation and regeneration?

b) Are there any policies to protect residents from gentrification?

7. How does the government manage the supply of workspace for entrepreneurs?

a) How do they engage with real estate market?

b) How does the real estate market affect the transformation of workspace?

c) How could the government ensure the affordability of the workspaces?

C. Involvement

1. The public sector has been the main promoter of the project, are there any other organizations play a key role in 22@?

2. What is the relationship between the public sectors, private sector and the research institutions?

3. Do the local communities participate in the development process? How?

4. How did the company 22@bcn manage resolve conflicts with other actors, especially with the local community?

5. How has been the relationship between the start-ups with large companies and universities?

6. How do you define the governance approach of 22@? Top-down?

a) What are the pros and cons of this approach?

D. Challenge and Follow Up

1. Are there any issues or circumstances that have been particularly challenging with 22@ in the past years?

2. How about the impact of coronavirus? Will the 22@ change the development path after the pandemic?

3. Do you have any recommendations for the government intervention of 22@ in the future?

4. Is there anything else you wish to tell me?

Appendix 3: Risk Assessment Form

RISK ASSESSMENT FORM
FIELD / LOCATION WORK

UCL

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form
http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

DEPARTMENT/SECTION THE BARTLETT SCHOOL OF PLANNING
LOCATION(S) LONDON, UK AND BARCELONA , SPAIN
PERSONS COVERED BY THE RISK ASSESSMENT Xiaoyu LU

BRIEF DESCRIPTION OF FIELDWORK
This research will conduct online semi-structure interviews with the Greater London Authority, the boroughs, private sector and financial institutions, and also a one-day site visit in London.

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low? Low

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	work abroad incorporates Foreign Office advice
	participants have been trained and given all necessary information
	only accredited centres are used for rural field work
√	participants will wear appropriate clothing and footwear for the specified environment
	trained leaders accompany the trip
	refuge is available
	work in outside organisations is subject to their having satisfactory H&S procedures in place
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EMERGENCIES	**Where emergencies may arise use space below to identify and assess any risks**
e.g. fire, accidents	Examples of risk: loss of property, loss of life

Loss of property, or get coronavirus

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
	fire fighting equipment is carried on the trip and participants know how to use it
√	contact numbers for emergency services are known to all participants
	participants have means of contacting emergency services
	participants have been trained and given all necessary information
	a plan for rescue has been formulated, all parties understand the procedure
	the plan for rescue /emergency has a reciprocal element
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

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EQUIPMENT	Is equipment used?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	the departmental written Arrangement for equipment is followed
	participants have been provided with any necessary equipment appropriate for the work
	all equipment has been inspected, before issue, by a competent person
	all users have been advised of correct use
	special equipment is only issued to persons trained in its use by a competent person
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	Is lone working a possibility?	YES	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. alone or in isolation lone interviews.	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

Low

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	the departmental written Arrangement for lone/out of hours working for field work is followed
	lone or isolated working is not allowed
√	location, route and expected time of return of lone workers is logged daily before work commences
√	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
√	all workers are fully familiar with emergency procedures
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

ILL HEALTH	The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.
e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low? Low Coronavirus, high risk

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	an appropriate number of trained first-aiders and first aid kits are present on the field trip
	all participants have had the necessary inoculations/ carry appropriate prophylactics
√	participants have been advised of the physical demands of the trip and are deemed to be physically suited
	participants have been adequate advice on harmful plants, animals and substances they may encounter
	participants who require medication have advised the leader of this and carry sufficient medication for their needs
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

TRANSPORT	Will transport be required	NO		Move to next hazard
		YES	√	Use space below to identify and assess any risks
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training Is the risk high / medium / low?			

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
√	only public transport will be used
	the vehicle will be hired from a reputable supplier
	transport must be properly maintained in compliance with relevant national regulations
	drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
	drivers have been trained and hold the appropriate licence
	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
	sufficient spare parts carried to meet foreseeable emergencies
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC	Will people be dealing with public	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	all participants are trained in interviewing techniques
	interviews are contracted out to a third party
	advice and support from local groups has been sought
	participants do not wear clothes that might cause offence or attract unwanted attention
	interviews are conducted at neutral locations or where neither party could be at risk
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

WORKING ON OR NEAR WATER	Will people work on or near water?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. rivers, marshland, sea.	Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?		

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ lone working on or near water will not be allowed
- ☐ coastguard information is understood; all work takes place outside those times when tides could prove a threat
- ☐ all participants are competent swimmers
- ☐ participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
- ☐ boat is operated by a competent person
- ☐ all boats are equipped with an alternative means of propulsion e.g. oars
- ☐ participants have received any appropriate inoculations
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	Do MH activities take place?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?		

CONTROL MEASURES **Indicate which procedures are in place to control the identified risk**

- ☐ the departmental written Arrangement for MH is followed
- ☐ the supervisor has attended a MH risk assessment course
- ☐ all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
- ☐ all persons performing MH tasks are adequately trained
- ☐ equipment components will be assembled on site
- ☐ any MH task outside the competence of staff will be done by contractors
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	Will participants work with substances	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?		
CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**		

	the departmental written Arrangements for dealing with hazardous substances and waste are followed
	all participants are given information, training and protective equipment for hazardous substances they may encounter
	participants who have allergies have advised the leader of this and carry sufficient medication for their needs
	waste is disposed of in a responsible manner
	suitable containers are provided for hazardous waste
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	Have you identified any other hazards?	NO	If 'No' move to next section If 'Yes' use space below to identify and assess any risks
i.e. any other hazards must be noted and assessed here.	Hazard: Risk: is the risk		
CONTROL MEASURES	**Give details of control measures in place to control the identified risks**		

Have you identified any risks that are not adequately controlled?	**NO**	√	**Move to Declaration**
	YES		**Use space below to identify the risk and what action was taken**

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research? NO

If yes, please state your Project ID Number

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

DECLARATION	The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

√	I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk
√	I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR Fitzpatrick, Daniel